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A HYBRID MODEL FOR MINING MULTI DIMENSIONAL DATA SETS

Santhosh kumar
Government College for Women (A),
PRIST University, Kumbakonam,
Tamil Nadu, India

E.Ramaraj
School of Computing
Alagappa University, Karaikudi,
Tamil Nadu, India

Abstract: This paper presents a hybrid data mining approach based on supervised learning and unsupervised learning to identify the closest data patterns in the data base. This technique enables to achieve the maximum accuracy rate with minimal complexity. The proposed algorithm is compared with traditional clustering and classification algorithm and it is also implemented with multidimensional datasets. The implementation results show better prediction accuracy and reliability.

Keywords: Classification, Clustering, C4.5, k-means Algorithm.

1. INTRODUCTION

Clustering and classification are the two familiar data mining techniques used for similar and dissimilar grouping of objects respectively. Although, due to efficient use of data mining techniques, clustering and classification techniques are used as pre-process activities. The clustering technique categories the data and reduces the number of features, removes irrelevant, redundant, or noisy data, and forms the sub groups of the given data based on its relativity. The classification is used as secondary process which further divides the similar (clustered) groups in to two discrete sub groups based on the attribute value. From our research work, especially for large data bases, the prior classification is required to minimize multiple features of data so that it can be mined easily. In this paper we proposed a combined approach of classification and clustering for gene sub type prediction.

2. PRELIMINARIES

2.1 C4.5 Algorithm

It is used to generate a decision tree developed by Ross Quinlan and it is an extension of ID3 algorithm. The decision trees generated by C4.5 can be used for classification, anC4.5 builds decision trees from a set of training data in the same way as ID3, using the concept of information entropy. The training data is a set of already classified samples. Each sample consists of a p-dimensional vector, where they represent attributes or features of the sample, as well as the class in which falls. At each node of the tree, C4.5 chooses the attribute of the data that most effectively splits its set of samples into subsets enriched in one class or the other. The splitting criterion is the normalized information gain. The attribute with the highest normalized information gain is chosen to make the decision. The C4.5 algorithm then recurses on the smaller sub lists.

2.2 K-means Algorithm

The k-means algorithm was developed by Mac Queen based on standard algorithm. It is one of the most widely used hard clustering techniques. This is an iterative method where the specified number of clusters should initialise earlier. One must specify the number of clusters beforehand. The algorithm can be specified as a given set of observations ($\mathbf{x}_1$, $\mathbf{x}_2$, …, $\mathbf{x}_n$), where each observation is a *d*-dimensional real vector, *k*-means clustering aims to partition the *n* observations into *k* sets ($k \leq n$) $\mathbf{S} = \{S_1, S_2, \ldots, S_k\}$ so as to minimize the within-cluster sum of squares

$$\arg\min_{\mathbf{S}} \sum_{i=1}^{k} \sum_{\mathbf{x}_j \in S_i} \|\mathbf{x}_j - \boldsymbol{\mu}_i\|^2$$

Where μi is the mean of points in S_i
The algorithm works as follows:

- The k (number of clusters) value number of clusters must be initialised
- Randomly select k cluster centres (centroids) in the data space
- Assign data points to clusters based on the shortest Euclidean distance to the cluster centers
- Re-compute new cluster centers by averaging the observations assigned to a cluster
- Repeat above two steps until convergence criterion is satisfied

The advantage of this approach is its efficiency to handle large data sets and can work with compact clusters. The major limitation of this technique is the requirement to specify the number of clusters beforehand and its assumption that clusters are spherical.

3. RELATED STUDIES

In the year 2009 CSVM [1], Clustering based classification technique is proposed by Juanying Xie, Chunxia Wang, Yan Zhang, Shuai Jiang for unlabelled data prediction. They combined different kinds of k-means algorithm with SVM classifier to achieve better results. In order to avoid the major drawback of k-means algorithm; k-value initialisation, the CSVM is proposed. In 2010 [2], Pritha Mahata proposed a new hierarchical clustering technique called ECHC (exploratory consensus of hierarchical clustering's) which is used to sub group the various types of melanoma cancer. This work reveals that, k-means algorithm gives better results for biological subtype with proper sub tree. In 2010 [3], Taysir Hassan A. Soliman, proposed a clustering and classification as a combined approach to classify the different types of diseases based on gene selection method. The results had shown improved accuracy in data prediction. In 2011[4], Reuben Evans, Bernhard Pfahringer, Geoffrey Holmes, proposed a technique called statistical based clustering technique for large datasets. They used k-means algorithm as initial step for centroid prediction and classification as secondary step. In march 2013[5] Claudio Gentile, Fabio Vitale, Giovanni Zappella, implemented the combined technique (clustering and classification) in networks using signed graphs (classification) and correlation based grouping (clustering). In

this work we proposed that for very larger multi dimensional data base needs discrete classification as a primary process and its results classified samples that are grouped with the use of clustering methods. For classification the C4.5 classifier is used and k-means clustering is used as a secondary process.

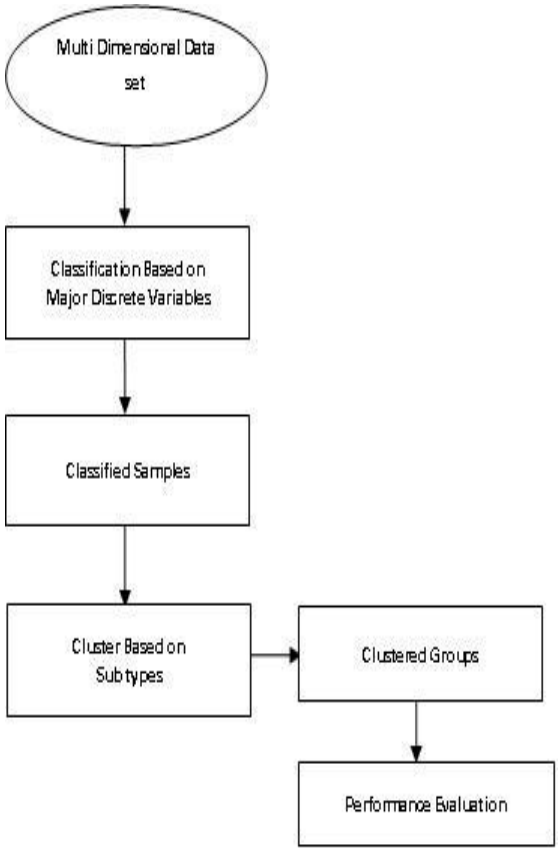

Fig 1: Hybrid model for Clustering and classification

4. PROPOSED WORK

With the combination of supervised and unsupervised learning approach, we proposed that

- A combined approach in needed in order to categorize and search the relevant data from multidimensional datasets
- For multi dimensional data sets, the primary partitioning is needed ; so that the categorized search gives better results with accuracy and time efficiency
- The classified samples can be sub grouped into smaller sets; so that the clustering can be done with global and local optimization

4.1 Proposed Model

Based on the drawbacks in existing approaches, we proposed a hybrid model for multi dimensional data sets. The major drawback of large datasets is its dimensionality. It is unavoidable, when needed information contains additional or unrelated data then it leads more difficult to search, analyze, and transfer the data. To overcome the above said problem, the major categorization of data based on requirement is needed. So that major part of large data can be divided in to two or more groups. One category contains the required data and other contains unrelated data respectively. We divided our work in to two parts; first approach is to divide the large data set in to major categories (based on its correlation) which requires discrete values to classify the data. For that a classifier should contain the data with related information in hierarchical form is needed. The C4.5 Decision tree algorithm is recommended to classify the data set into major discrete groups. Our second approach is to find the relativity among the categorized data. For that similar and dissimilar distance measures between the data items are considered. Based on its weight of the attributes in the group are organized. The k-means algorithm is used for clustering the similar data attributes in a categorized group.

5. EXPERIMENTAL EVALUATION

We have used colon cancer data set of colorectal cancer data from Biological data analysis web site [6]. The Data set contains 7,460 genes and 272 samples which contains both normal and infected genes. For our approach we have taken entire genes with samples and as stated above as a first approach we used C4.5 classifier to categorize data in terms of normal and infected genes based on its intensity range. The categorized genes are then clustered with the use of k-means algorithm. As a first step we implemented the data set into C4.5 classifier. The parameters taken for classification are mentioned below.

Table1. Classifier Parameter Initialization

Decision Tree (C 4.5)	**Top**
Min size of leaves	10
Confidence-level	0.25
Error Rate	0.8696

The following figure shows the graphical representation of major classification of genes as normal and tumor intensity.

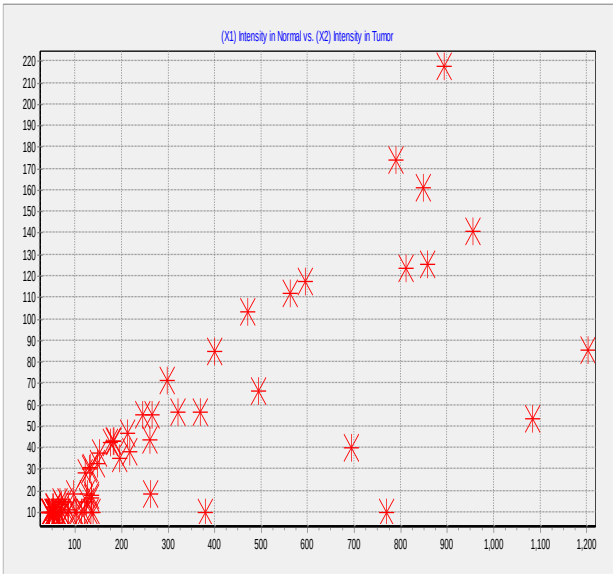

Fig.2. Normal Vs Tumor Intensity Classifier Representation

The second step is the given dataset is implemented directly into k-means algorithm for clustering. The parameters taken for clustering is tabled below.

Table.2. Cluster Parameter Initialization

Clusters (k-Means)	10
Max Iteration	10
Trials	5
Distance Normalization	variance

The figure shows the similar and dissimilar gene representation using k-means algorithm.

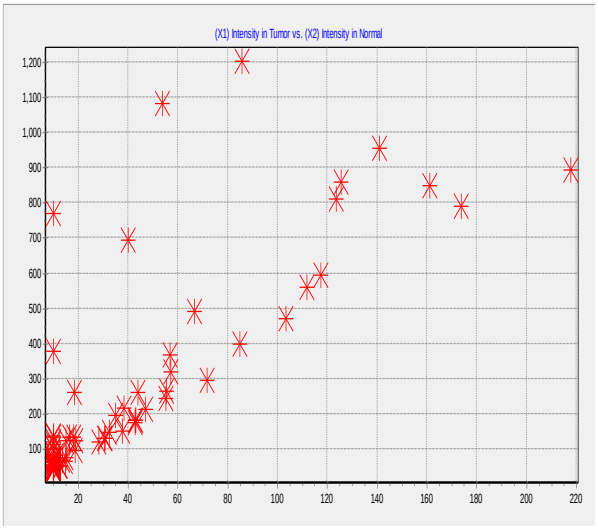

Fig.3. Normal Vs Tumor Intensity Cluster Representation

The final step of our work is the gene type is implemented using C4.5 classifier and the output obtained after classification is given as input for clustering process. The result is compared with individual implementation of previous steps. In order to evaluate the performance of hybrid method; the same parameters are applied for the proposed technique. The following graph shows the classification result of hybrid approach.

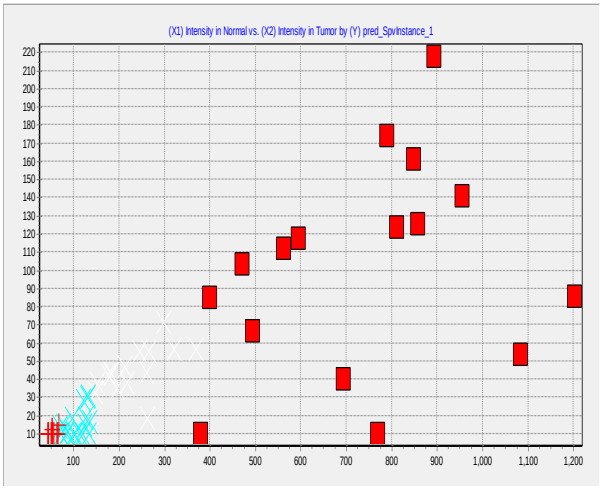

Fig.4. Normal Vs Tumor Intensity Hybrid Classifier Representation

The above graph denotes that the given genes are classified in to major categories which contain relevant attributes in each category.The following graph gives clear identification of similar and dissimilar representation of categorized groups. The irrelevant attributes are also considered and generated as separate clusters. Whereas the error rate based on the minimal size clusters are become comparatively less when it is compared with overall cluster centers.

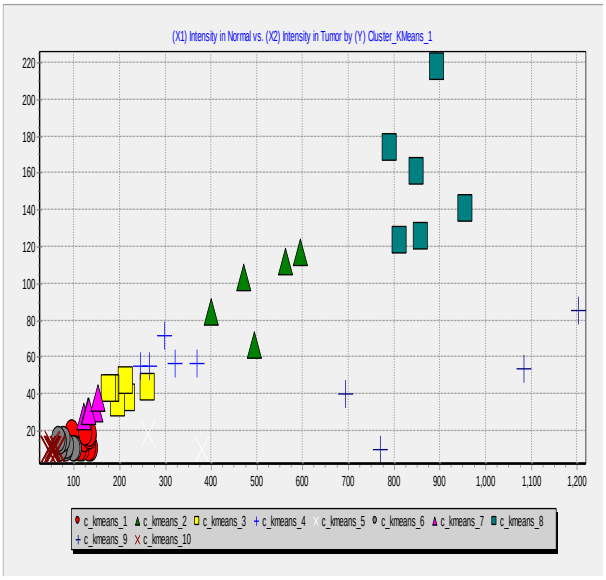

Fig.5. Normal Vs Tumor Intensity Hybrid (Classifier & Cluster) Representation

The experimented results error rate, computation time is analyzed and compared with the individual methods. The result shows that hybrid approach attains better results with less computation time. According to error rate, all the given attributes are represented as relevant or irrelevant groups so that the error rate must very less in hybrid approach.

Table3. Performance of Various Hybrid approach with Different groups methods

Method	Data Set	No. of Clusters/ D Tress	Computation Time
C 4.5	Colon	7 Nodes, 4 Leaves	31 Ms
K-Means	Colon	10 Clusters	15 Ms
Hybrid	Colon	10 Clusters	16 Ms

The table 3 shows that computation time of C4.5 classifier of using colon gene dataset is 31 milliseconds. The cluster using the same data set results 15 Milliseconds. But the combination of both C4.5 and k-means results 16 milliseconds. It reveals that the hybrid approach gives accurate results in less computation time.

6. CONCLUSION

From the analysis based on experimental results, we can conclude that our hybrid approach for multi dimensional data base gives better results in comparison with existing approaches. The large data sets are categorized using C4.5 classifier produces decision tree with relevant and irrelevant attributes in a set. This phenomenon makes possible to group the similar attributes in to group called cluster. Based on the hybrid approach one can divide the large database in to major groups. The major groups can be further clustered in to similar group which enables to achieve high accuracy rate with less computation time. This hybrid approach is suitable for large data bases having multi dimensional complexity. By using this approach one can retrieve exact information from

the data base with in stipulated time by removing or minimizing the additional features of large data.

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Profit Maximization for Service Providers using Hybrid Pricing in Cloud Computing

N.Ani Brown Mary
Anna University
Tirunelveli, India

Abstract: Cloud computing has recently emerged as one of the buzzwords in the IT industry. Several IT vendors are promising to offer computation, data/storage, and application hosting services, offering Service-Level Agreements (SLA) backed performance and uptime promises for their services. While these 'clouds' are the natural evolution of traditional clusters and data centers, they are distinguished by following a pricing model where customers are charged based on their utilization of computational resources, storage and transfer of data. They offer subscription-based access to infrastructure, platforms, and applications that are popularly termed as IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service). In order to improve the profit of service providers we implement a technique called hybrid pricing , where this hybrid pricing model is a pooled with fixed and spot pricing techniques.

Keywords: Service-Level Agreements, Infrastructure as a Service, Platform as a Service, Software as a Service, Hybrid Pricing.

1. INTRODUCTION

Cloud computing is not a total new concept; it is originated from the earlier large-scale distributed computing technology. However, it will be a subversion technology and cloud computing will be the third revolution in the IT industry, which represent the development trend of the IT industry from hardware to software, software to services, distributed service to centralized service. Cloud computing is also a new model of business computing, it will be widely used in the near future. The core concept of cloud computing is reducing the processing burden on the users' terminal by constantly improving the handling ability of the "cloud", eventually simplify the users' terminal to a simple input and output. All of this is available through a simple Internet connection using a standard browser or other connection. It manages a variety of different workloads, including the batch of back-end operations and user-oriented interactive applications. It rapidly deploy and increase workload by speedy. It provides physical machines or virtual machines. It supports redundancy, self-healing and highly scalable programming model, so that workload can be recover from a variety of inevitable hardware/software failure.

The manufacturing industry is undergoing a major transformation enabled by IT and related smar ttechnologies. Cloud computing is one of such smar ttechnologies. The main thrust of Cloud computing is to provide on-demand computing services with high reliability, scalability and availability in a distributed environment. The National Institute of Standards and Technology(NIST) [14] defined cloud computing as''a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can rapidly provisioned and released with minimal management effort or service provider interaction.'' Cloud computing provides resources such as processing power, bandwidth and storage capacity. Software as a service providers has to rent resources from the infrastructure as a service providers and provide it to the users, so there is no profitable pricing function for the service providers. So we implement a pricing function called Hybrid pricing to improve the profit of service providers. Here, section II consist of Related Work , section III consist of System Design, section IV,V,VI consists of Fixed, Spot and Hybrid pricing Implementations. At last Section VII consist of Results that has been obtained.

2. RELATED WORK

Cloud computing is an emerging technology in the IT world. Some features of cloud, such as low cost, scalability, robustness and availability are attracting large-scale industries as well as small business towards cloud. Cloud computing is a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. At present

some major cloud providers are Amazon Web Services [1], Microsoft Azure [2] and Google AppEngine [3]. These cloud providers offer many type of services for monitoring, managing and provisioning resources and application services. A cloud provider can support more number of users with same number of resources [4]. During the busy hours service provider needs more resources and at other periods of time load on the service providers are very less, so there is a need of continuous scale up and scale down the service providers infrastructure of resources. These scale up and scale down operations require dynamic provision [6].

Yi et al. give an approach to minimize the costs of computations using Amazon EC2s spot instances for resource provisioning. This paper also considers the application of market oriented mechanisms in [7]. Fabien Hermenier et al. proposed a new approach, Entropy, in a homogeneous cluster environment, which takes into account both the problem of allocating the virtual machines to available nodes and the problem of how to migrate the virtual machines to these nodes. The performance overhead is determined by the time required to choose a new configuration and the time required to migrate virtual machines according to the configuration. The Entropy resource manager can choose migrations that can be implemented efficiently, incurring a low performance overhead in [10]. Wei et al. used game theory to handle the resource allocation in cloud computing. In their approach, a Binary Integer Programming method is proposed to solve the parallel tasks allocation problem on unrelated machines connected across the Internet. Their algorithms take both optimization and fairness into account and provide a relatively good compromise resource allocation. But these methods can only be used for seeking optimal allocation solution for the complex and dynamic problems that can be divided into multiple cooperative subtasks in [13].

3. SYSTEM DESIGN

When two or more pricing joined together it is called Hybrid pricing. Here fixed and spot pricing are combined to form the Hybrid pricing technique. IaaS providers maintain the virtual machine with the help of the cloud storage. SaaS providers rent resources from the IaaS providers and provide it to the users. Figure 1 Shows clearly the cloud environment consist of virtual machines and it all maintained in the cloud storage and that was controlled by the controller storage. A SaaS provider rents resources from IaaS providers and leases software as services to users. SaaS providers aim at minimizing their operational cost by efficiently using resources from IaaS providers, and improving Customer Satisfaction Level (CSL) by satisfying SLAs, which are used to guarantee QoS requirements of accepted users. From SaaS provider's point of view, there are two layers of SLA with both users and resource providers.. It is important to establish two SLA layers, because SLA with user can help the SaaS provider to improve the customer satisfaction level by gaining users' trust of the quality of service; SLA with resource providers can enforce resource providers to deliver the satisfied service. If any party in the contract violates its terms, the defaulter has to pay for the penalty according to the clauses defined in the SLA.

An IaaS provider, offers VMs to SaaS providers and is responsible for dispatching VM images to run on their physical resources. The platform layer of SaaS provider uses VM images to create instances. It is important to establish SLA with a resource provider, because it enforces the resource provider to guarantee service quality. Furthermore, it provides a risk transfer for SaaS providers, when the terms are violated by resource provider. In this work, we do not consider the compensation given by the resource provider because 85% resource providers do not really provide penalty enforcement for SLA violation currently [22].

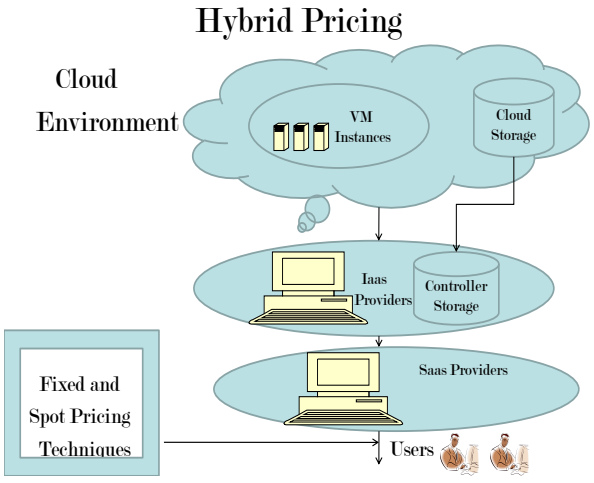


Figure 1: Architecture for Hybrid Pricing

Users and the providers negotiate for the services, that is they have an agreement between them. After having their agreement, resources will be provided to users with the help of the Service Level Agreement contract. If the request can be accepted, a formal agreement (SLA) is signed between both parties to guarantee the QoS requirements such as response

time. That contract has been explained clearly in figure 2. The Service Level Agreement includes the following constraints Service Initiation Time that gives how long it takes to deploy a VM. Then Price shows how much a SaaS provider has to pay per hour for using a VM from a resource provider. Then Input Data Transfer Price shows how much a SaaS provider has to pay for data transfer from local machine to resource provider's VM. Then Output Data Transfer Price shows how much a SaaS provider has to pay for data transfer from resource provider's VM to local machine. Then Processing Speed shows how fast the VM can process. Then Data Transfer Speed shows how fast the data is transferred and it depends on the location distance and also the network performance.

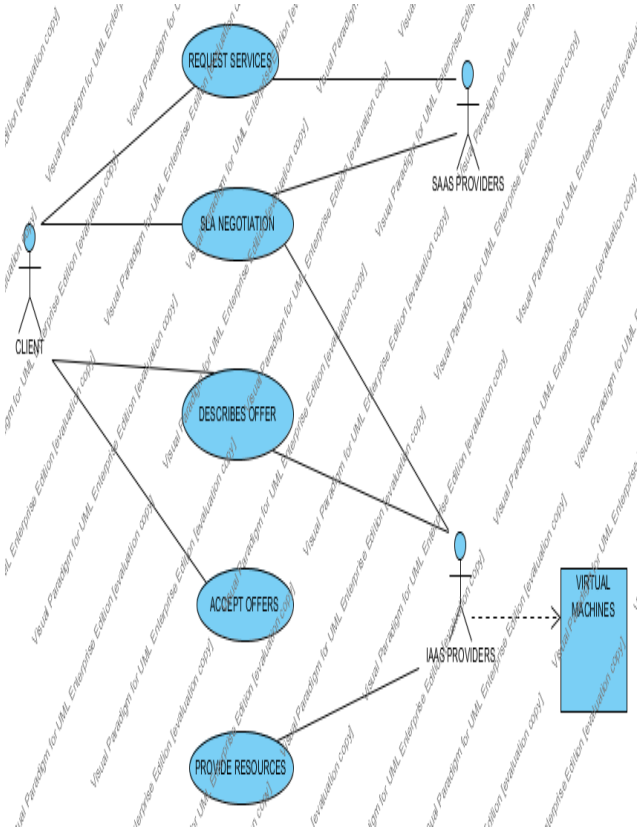
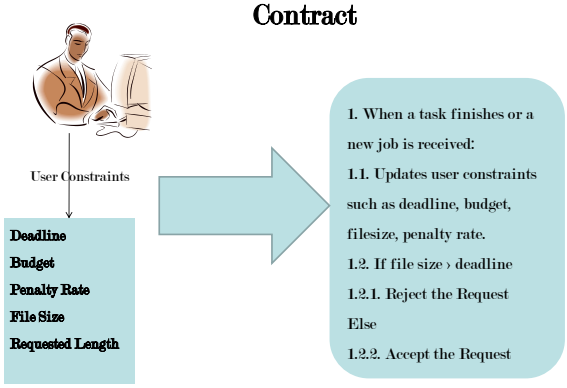


Figure 2: SLA contract

Algorithm for Accepting or Rejecting SLA Contract



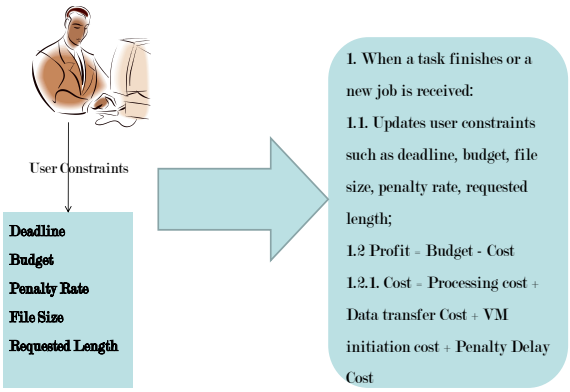
This algorithm depends on user accept or reject the offer provided by IaaS providers. Here cost and profit are calculated. If there is profit for SaaS providers, request will be accepted or rejected. For one second only thousand million instruction per second can be calculated. So users deadline is compared with the file size, if file size is more than the deadline then request will be rejected or it will be accepted. Thus the SLA contract will be either accepted or rejected with the help of the constraints.

4. FIXED PRICING IMPLEMENTATION

If the Investment Return is greater than the Expected Investment Return then the resources will be provided. Only fixed price will be offered for users. Here we get users five constraints they are deadline, budget, penalty rate ratio, input file size and requested length. Deadline first shows the maximum time user would like to wait for the result. Then the Budget shows how much user is willing to pay for the requested services. Then Penalty Rate Ratio shows ratio for consumers' compensation if the SaaS provider misses the deadline. Then Input File Size asks the size of input file provided by users. Then Requested Length shows how many Millions of Instructions (MI) are required to be executed to serve the request.

In fixed pricing, we calculate the cost with help of processing cost + data transfer cost + virtual machine initiation cost + penalty delay cost. Then profit for providers is calculated by reducing the cost from the budget that is obtained from users.

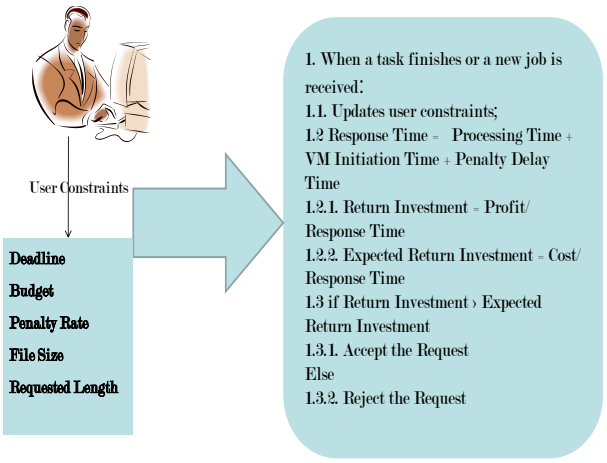
Algorithm for Fixed Pricing



5. SPOT PRICING IMPLEMENTATION

When more than one users request for the same resource at the same time , depending on the profit of SaaS providers the resource will be provided to the user. This algorithm is based on users given inputs such as Deadline, Budget, File Size. Here Investment Return and Expected Investment Return are calculated. In this technique, response time is calculated by just calculating the processing time, virtual machine initiation time and penalty delay time. Return Investment is calculated by the profit by the response time. Expected Return Investment is calculated by the cost by the response time. The condition is if the Return Investment Return is more than the Expected Investment Return then there is profit for providers so the resources are provided.

Algorithm for Spot Pricing

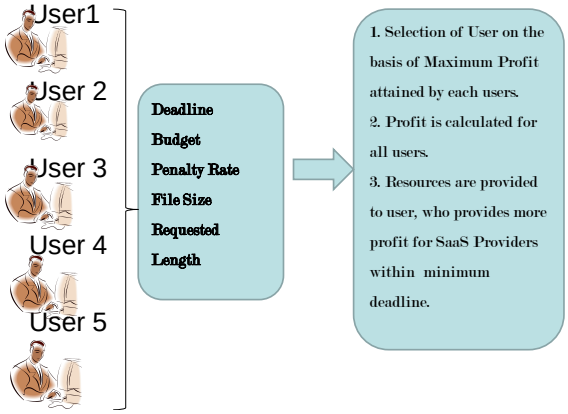


6. HYBRID PRICING IMPLEMENTATION

Hybrid pricing is a complete combination of fixed and spot pricing. This algorithm is used when more than one user request for the same resources at the same time. Deadline , Budget and File size are obtained by more than one user. The user who provides more profit for SaaS providers will be selected and resources will be provided.

From a SaaS provider's point of view, there is a legal contract-SLA with any customer and if any party violates SLA terms, the defaulter has to pay for the penalty according to the clauses defined in the SLA. The SLA properties include SaaS provider pre-defined parameters and the customer specified QoS parameters. The properties defined in the SLA are as follows, Request Type defines the customer request type, which is 'fist time rent' or 'upgrade service'. 'First time rent' means the customer is the customer who is renting a new service from this SaaS provider. 'Upgrade service' includes two types of upgrade, which are 'add account' and 'upgrade product'. Then Product Type shows the software product offered to customers. Then Account Type constrains the maximum number of accounts a customer can create. Contract Length shows how long the software service is legally available for a customer to use. Number of Accounts shows the actual number of accounts that a customer wants to create. Then Number of Records shows the maximum number of records a customer is able to create for each account during the transaction and this will impact the data transfer time during the service upgrade. Response Time represents the elapsed time between the end of a demand on a software service and the beginning of a service.

Algorithm for Hybrid Pricing



Here the concept of both fixed and spot pricing are combined together to form the hybrid pricing. Since fixed and spot pricing are totally new concept they both are combined together to improve the profit of service providers.

7. RESULTS

The results shows the comparison between fixed, spot and hybrid pricing. On comparing with deadline and budget we can see each results clearly shows the profit maximization using hybrid pricing. Totally there are five constraints , here we took two constraints they are deadline and budget. Both are compared with the three pricing techniques.

Table 1: Deadline Vs Profit

Deadline(secs)/ Profit(Rupees)	Fixed Pricing	Spot Pricing	Hybrid Pricing
Tight	1000	2200	3800
Medium	1800	3400	4600
Relax	2100	3600	4900
Very Relax	2900	4400	5800

This table shows clearly that Hybrid pricing increases the profit compared with the fixed and spot pricing. Tight shows that seconds range between one to six seconds and medium shows the range between six to twelve seconds. Relax shows that the process is performed in very relaxed way and very relax shows that user is waiting for a long time.

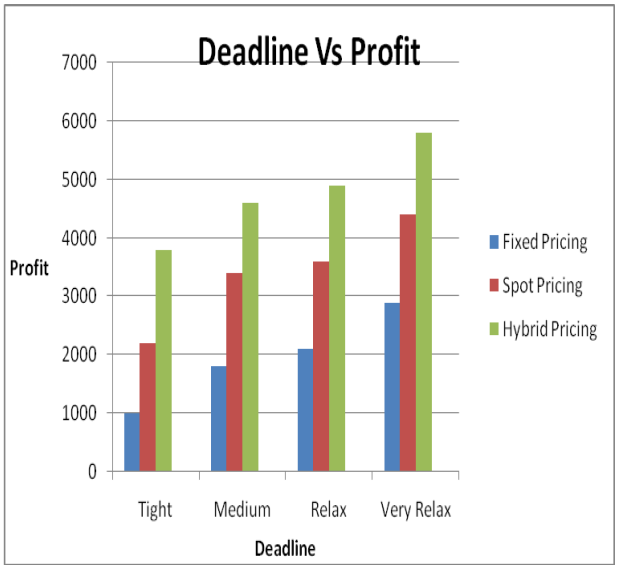


Figure 3: Deadline Vs Profit

This figure shows the profit maximization using hybrid pricing to a value of 6000 compared to the fixed and spot pricing. When compared to tight, very relax provides more profit for service providers. This shows Hybrid pricing provides more profit compared to other pricing techniques.

Table 2: Budget Vs Profit

Budget / Profit(Rupees)	Fixed Pricing	Spot Pricing	Hybrid Pricing
Small	1245	2300	3756
Medium	2600	3400	4200
Large	4600	5235	6344

This table shows that the budget that is provided by users in three ways that is small budget users, medium budget users and large budget users. Here the profit is obtained more in hybrid pricing technique. When compared with fixed pricing , spot pricing gives more profit. When compared with hybrid pricing , this provides more profit.

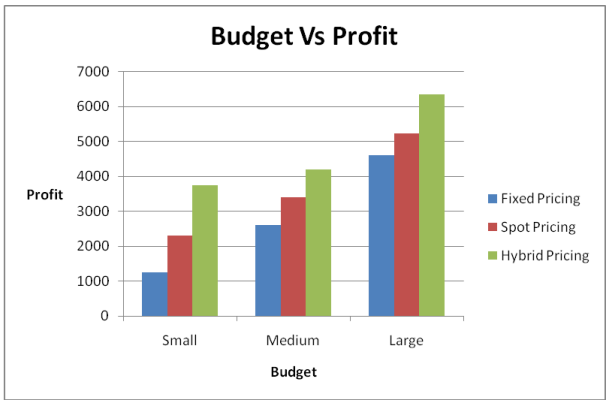


Figure 4: Budget Vs Profit

This graph clearly shows that the profit is maximized in spot pricing compared to the fixed pricing and then profit is more in hybrid pricing compared to the spot pricing techniques.

8. CONCLUSION

Thus the main goal to improve the profit of service providers has been satisfied. The three pricing techniques has been explained and implemented and their results are shown. Fixed and Spot pricing both are the best techniques but when they are combined and used it provides more profit when are used single-handedly.

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Intuitionistic Fuzzy Semipre Generalized Connected Spaces

M. Thirumalaiswamy
Department of Mathematics,
NGM College, Pollachi-642001,
Tamil Nadu, India

K. M. Arifmohammed
Department of Mathematics,
NGM College, Pollachi-642001,
Tamil Nadu, India

Abstract : In this paper, we introduce the notion of intuitionistic fuzzy semipre generalized connected space, intuitionistic fuzzy semipre generalized super connected space and intuitionistic fuzzy semipre generalized extremally disconnected spaces. We investigate some of their properties.

Keywords : Intuitionistic fuzzy topology, intuitionistic fuzzy semipre generalized connected space, intuitionistic fuzzy semipre generalized super connected space and intuitionistic fuzzy semipre generalized extremally disconnected spaces

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1. INTRODUCTION

In 1965, Zadeh [11] introduced fuzzy sets and in 1968, Chang [2] introduced fuzzy topology. After the introduction of fuzzy set and fuzzy topology, several authors were conducted on the generalization of this notion. The notion of intuitionistic fuzzy sets was introduced by Atanassov [1] as a generalization of fuzzy sets. 1997, Coker [3] introduced the concept of intuitionistic fuzzy topological spaces. In this paper, we introduce the notion of intuitionistic fuzzy semipre generalized connected space, intuitionistic fuzzy semipre generalized super connected space and intuitionistic fuzzy semipre generalized extremally disconnected spaces. And study some of their properties.

2. PRELIMINARIES

Definition 2.1:[1] Let X be a non-empty fixed set. An intuitionistic fuzzy set (IFS in short) A in X is an object having the form $A = \{\langle x, \mu A(x), \nu A(x)\rangle / x \in X\}$ where the functions $\mu A: X \to [0, 1]$ and $\nu A : X \to [0, 1]$ denote the degree of membership (namely $\mu A(x)$) and the degree of non-membership (namely $\nu A(x)$) of each element $x \in X$ to the set A respectively and $0 \leq \mu A(x) + \nu A(x) \leq 1$ for each $x \in X$. Denote by IFS(X), the set of all intuitionistic fuzzy sets in X.

Definition 2.2:[1] Let A and B be IFSs of the form $A = \{\langle x, \mu A(x), \nu A(x)\rangle / x \in X\}$ and $B = \{\langle x, \mu B(x), \nu B(x)\rangle / x \in X\}$. Then

1. $A \subseteq B$ if and only if $\mu A(x) \leq \mu B(x)$ and $\nu A(x) \geq \nu B(x)$ for all $x \in X$
2. $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$
3. $Ac = \{\langle x, \nu A(x), \mu A(x)\rangle / x \in X\}$
4. $A \cap B = \{\langle x, \mu A(x) \wedge \mu B(x), \nu A(x) \vee \nu B(x)\rangle / x \in X\}$
5. $A \cup B = \{\langle x, \mu A(x) \vee \mu B(x), \nu A(x) \wedge \nu B(x)\rangle / x \in X\}$

For the sake of simplicity, we shall use the notation $A = \langle x, \mu A, \nu A\rangle$ instead of $A = \{\langle x, \mu A(x), \nu A(x)\rangle / x \in X\}$. Also for the sake of simplicity, we shall use the notation $A = \langle x, (\mu A, \mu B), (\nu A, \nu B)\rangle$ instead of $A = \langle x, (A/\mu A, B/\mu B), (A/\nu A, B/\nu B)\rangle$. The intuitionistic fuzzy sets $0\sim = \{\langle x, 0, 1\rangle / x \in X\}$ and $1\sim = \{\langle x, 1, 0\rangle / x \in X\}$ are respectively the empty set and the whole set of X.

Definition 2.3:[3] An intuitionistic fuzzy topology (IFT in short) on X is a family τ of IFSs in X satisfying the following axioms:

1. $0\sim, 1\sim \in \tau$
2. $G1 \cap G2 \in \tau$, for every $G1, G2 \in \tau$
3. $\cup Gi \in \tau$ for any family $\{Gi / i \in J\} \subseteq \tau$

In this case the pair (X, τ) is called an intuitionistic fuzzy topological space(IFTS in short) and any IFS in τ is known as an intuitionistic fuzzy open set(IFOS in short)in X. The complement Ac of an IFOS A in an IFTS (X, τ) is called an intuitionistic fuzzy closed set (IFCS in short) in X.

Definition 2.4:[3] Let (X, τ) be an IFTS and $A = \langle x, \mu A, \nu A\rangle$ be an IFS in X. Then

1. $int(A) = \cup\{ G / G$ is an IFOS in X and $G \subseteq A \}$
2. $cl(A) = \cap\{ K / K$ is an IFCS in X and $A \subseteq K \}$
3. $cl(Ac) = (int(A))c$
4. $int(Ac) = (cl(A))c$

Definition 2.5:[10] An IFS A of an IFTS (X, τ) is an

1. intuitionistic fuzzy semipre closed set (IFSPCS for short) if there exists an IFPCS B such that int(B) ⊆ A ⊆ B

2. intuitionistic fuzzy semipre open set (IFSPOS for short) if there exists an IFPOS B such that B ⊆ A ⊆ cl(B)

Definition 2.6:[4] Let A be an IFS in an IFTS (X, τ). Then

1. spint (A) = ∪{ G / G is an IFSPOS in X and G ⊆ A }
2. spcl (A) = ∩{ K / K is an IFSPCS in X and A ⊆ K }

Note that for any IFS A in (X, τ), we have spcl(Ac) = (spint(A))c and spint(Ac) = (spcl(A))c .

Definition 2.7:[7] An IFS A in an IFTS (X, τ) is said to be an intuitionistic fuzzy semipre generalized closed set (IFSPGCS for short) if spcl(A) ⊆ U whenever A ⊆ U and U is an IFSOS in (X, τ).

The family of all IFSPGCSs of an IFTS (X, τ) is denoted by IFSPGC(X). Every IFCS and IFSPCS is an IFSPGCS but the converses are not true in general.

Definition 2.8:[5] The complement Ac of an IFSPGCS A in an IFTS (X, τ) is called an intuitionistic fuzzy semipre generalized open set (IFSPGOS for short) in X.

The family of all IFSPGOSs of an IFTS (X, τ) is denoted by IFSPGO(X). Every IFOS and IFSPOS is an IFSPGOS but the converses are not true in general.

Definition 2.9:[9] Let A be an IFS in an IFTS (X, τ). Then semipre generalized interior of A (spgint(A) for short) and semipre generalized closure of A (spgcl(A) for short) are defined by

1. spgint (A) = ∪{ G / G is an IFSPGOS in X and G ⊆ A }

2. spgcl (A) = ∩{ K / K is an IFSPGCS in X and A ⊆ K }

Note that for any IFS A in (X, τ), we have spgcl(Ac) = (spgint(A))c and spgint(Ac) = (spgcl(A))c.

Definition 2.10:[5] An IFTS(X, τ) is said to be an intuitionistic fuzzy semipre T*1/2 space (IFSPT*1/2 space for short) if every IFSPGCS is an IFCS in (X, τ).

Definition 2.11:[8] A mapping f : (X, τ) → (Y, σ) is called an intuitionistic fuzzy semipre generalized continuous (IFSPG continuous for short) mappings if f -1(V) is an IFSPGCS in (X, τ) for every IFCS V of (Y, σ).

Definition 2.12:[8] A mapping f: (X, τ) → (Y, σ) be an intuitionistic fuzzy semipre generalized irresolute (IFSPG irresolute) mapping if f -1(V) is an IFSPGCS in (X, τ) for every IFSPGCS V of (Y, σ).

Definition 2.13:[4] Two IFSs A and B are said to be q-coincident (A q B in short) if and only if there exists an element x ∈ X such that μA(x) > νB(x) or νA(x) < μB(x).

Definition 2.14:[4] Two IFSs A and B are said to be not q-coincident (A qc B in short) if and only if A ⊆ Bc.

Definition 2.15:[6] An IFTS (X, τ) is said to be an intuitionistic fuzzy C5-connected (IFC5-connected for short) space if the only IFSs which are both intuitionistic fuzzy open and intuitionistic fuzzy closed are 0~ and 1~.

3. INTUITIONISTIC FUZZY SEMIPRE GENERALIZED CONNECTED SPACES

Definition 3.1: An IFTS (X, τ) is said to be an intuitionistic fuzzy semipre generalized connected space (IFSPG connected space for short) if the only IFSs which are both an IFSPGOS and an IFSPGCS are 0~ and 1~.

Theorem 3.2: Every IFSPG connected space is IFC5-connected but not conversely.

Proof: Let (X, τ) be an IFSPG connected space. Suppose (X, τ) is not IFC5-connected, then there exists a proper IFS A which is both an IFOS and an IFCS in (X, τ). That is, A is both an IFSPGOS and an IFSPGCS in (X, τ). This implies that (X, τ) is not IFSPG connected. This is a contradiction. Therefore (X, τ) must be an IFC5-connected space.

Example 3.3: Let X = {a, b} and G = ⟨ x, (0.5, 0.6), (0.5, 0.4)⟩ . Then τ = {0~, G, 1~} is an IFT on X. Then X is an IFC5-connected space but not IFSPG connected, since the IFS A = ⟨ x, (0.5, 0.7), (0.5, 0.3)⟩ in X is both an IFSPGCS and an IFSPGOS in X.

Theorem 3.4: An IFTS (X, τ) is an IFSPG connected space if and only if there exists no non-zero IFSPGOSs A and B in (X, τ) such that B = Ac, B = (spcl(A))c, A = (spcl(B))c.

Proof: Necessity: Assume that there exist IFSs A and B such that A ≠ 0~ ≠ B, B = Ac, B = (spcl(A))c, A = (spcl(B))c. Since (spcl(A))c and (spcl(B))c are IFSPGOSs in (X, τ), A and B are IFSPGOSs in (X, τ). This implies (X, τ) is not IFSPG connected, which is a contradiction. Therefore there exists no non-zero IFSPGOSs A and B in (X, τ) such that B = Ac, B = (spcl(A))c, A = (spcl(B))c.

Sufficiency: Let A be both an IFSPGOS and an IFSPGCS in (X, τ) such that 1~ ≠ A ≠ 0~. Now by taking B = Ac, we obtain a contradiction to our hypothesis. Hence (X, τ) is an IFSPG connected space.

Theorem 3.5: Let (X, τ) be an IFSPT*1/2 space, then the following statements are equivalent:

(i) (X, τ) is an IFSPG connected space,

(ii) (X, τ) is an IFC5-connected space.

Proof: (i) ⇒ (ii) is obvious by Theorem 3.2.

(ii) ⇒ (i) Let (X, τ) be an IFC5-connected space. Suppose (X, τ) is not IFSPG connected, then there exists a proper IFS A in (X, τ) which is both an IFSPGOS and an IFSPGCS in (X, τ). But since (X, τ) is an IFSPT*1/2 space, A is both an IFOS and an IFCS in (X, τ). This implies that (X, τ) is not IFC5-connected, which is a contradiction to our hypothesis. Therefore (X, τ) must be an IFSPG connected space.

Theorem 3.6: If f : (X, τ) → (Y, σ) is an IFSPG continuous surjection and (X, τ) is an IFSPG connected space, then (Y, σ) is an IFC5-connected space.

Proof: Let (X, τ) be an IFSPG connected space. Suppose (Y, σ) is not IFC5-connected, then there exists a proper IFS A which is both an IFOS and an IFCS in (Y, σ). Since f is an IFSPG continuous mapping, f -1(A) is both an IFSPGOS and an IFSPGCS in (X, τ). But this is a contradiction to our hypothesis. Hence (Y, σ) must be an IFC5- connected space.

Theorem 3.7: If f : (X, τ) → (Y, σ) is an IFSPG irresolute surjection and (X, τ) is an IFSPG connected space, then (Y, σ) is also an IFSPG connected space.

Proof: Suppose (Y, σ) is not an IFSPG connected space, then there exists a proper IFS A such that A is both an IFSPGOS and an IFSPGCS in (Y, σ). Since f is an IFSPG irresolute surjection, f -1(A) is both an IFSPGOS and an IFSPGCS in (X, τ). But this is a contradiction to our hypothesis. Hence (Y, σ) must be an IFSPG connected space.

Definition 3.8: An IFTS (X, τ) is IFSPG connected between two IFSs A and B if there is no IFSPGOS E in (X, τ) such that A ⊆ E and E qc B.

Example 3.9: Let X = {a, b} and G = ⟨ x, (0.5, 0.4), (0.5, 0.6)⟩ . Then τ = {0~, G, 1~} is an IFT on X. Let A = ⟨ x, (0.5, 0.4), (0.5, 0.3)⟩ and B = ⟨ x, (0.5, 0.4), (0.5, 0.5)⟩ be two IFSs in X. Hence (X, τ) is IFSPG connected between the IFSs A and B.

Theorem 3.10: If an IFTS (X, τ) is IFSPG connected between two IFSs A and B, then it is IFC5-connected between A and B but the converse may not be true in general.

Proof: Suppose (X, τ) is not IFC5-connected between A and B, then there exists an IFOS E in (X, τ) such that A ⊆ E and E qc B. Since every IFOS is an IFSPGOS, there exists an IFSPGOS E in (X, τ) such that A ⊆ E and E qc B. This implies (X, τ) is not IFSPG connected between A and B, a contradiction to our hypothesis. Therefore (X, τ) must be IFC5-connected between A and B.

Example 3.11: Let X = {a, b} and G = ⟨ x, (0.5, 0.4), (0.5, 0.6)⟩ . Then τ = {0~, G, 1~} is an IFT on X. Let A = ⟨ x, (0.4, 0.4), (0.6, 0.6)⟩ and B = ⟨ x, (0.3, 0.3), (0.4, 0.4)⟩ be two IFSs in X. Then X is IFC5-connected between A and B, since there exists no IFOS E in X such that A ⊆ E and E q B. But it is not IFSPG connected between the two IFS A and B, since there exists an IFSPGOS E = ⟨ x, (0.4, 0.4), (0.5, 0.5) ⟩ in X such that A ⊆ E and E q B.

Theorem 3.12: If an IFTS (X, τ) is IFSPG connected between A and B and A ⊆ A1, B ⊆ B1, then (X, τ) is IFSPG connected between A1 and B1.

Proof: Suppose that (X, τ) is not IFSPG connected between A1 and B1, then by Definition 3.8, there exists an IFSPGOS E in (X, τ) such that A1 ⊆ E and E qc B1. This implies E ⊆ B1c. A1 ⊆ E implies A ⊆ A1 ⊆ E. That is A ⊆ E. Now let us prove that E ⊆ Bc, that is E qc B. Suppose that E q B, then by Definition 2.13, there exists an element x in X such that μE(x) > νB(x) and νE(x) < μB(x). Therefore μE(x) > νB(x) > νB1(x) and νE(x) < μB(x) < μB1(x), since B ⊆ B1. Hence μE(x) > μB1(x) and νE(x) < νB1(x). Thus E q B1. That is E q B1, which is a contradiction. Therefore E qc B. That is E ⊆ Bc. Hence (X, τ) is not IFSPG connected between A and B, which is a contradiction to our hypothesis. Thus (X, τ) must be IFSPG connected between A1 and B1.

Theorem 3.13: Let (X, τ) be an IFTS and A and B be IFSs in (X, τ). If A q B, then (X, τ) is IFSPG connected between A and B.

Proof: Suppose (X, τ) is not IFSPG connected between A and B. Then there exists an IFSPGOS E in (X, τ) such that A ⊆ E and E ⊆ Bc. This implies that A ⊆ Bc. That is A qc B. But this is a contradiction to our hypothesis. Therefore (X, τ) is must be IFSPG connected between A and B.

Definition 3.14: An IFSPGOS A is an intuitionistic fuzzy regular semipre generalized open set (IFRSPGOS for short) if A = spgint(spgcl(A)). The complement of an IFRSPGOS is called an intuitionistic fuzzy regular semipre generalized closed set (IFRSPGCS for short).

Definition 3.15: An IFTS (X, τ) is called an intuitionistic fuzzy semipre generalized (IFSPG for short) super connected space if there exists no proper IFRSPGOS in (X, τ).

Theorem 3.16: Let (X, τ) be an IFTS. Then the following statements are equivalent:

(i) (X, τ) is an IFSPG super connected space

(ii) For every non-zero IFSPGOS A, spgcl(A) = 1~

(iii) For every IFSPGCS A with A ≠ 1~, spgint(A) = 0~

(iv) There exists no IFSPGOSs A and B in (X, τ) such that A ≠ 0~ ≠ B, A ⊆ Bc

(v) There exists no IFSPGOSs A and B in (X, τ) such that A ≠ 0~ ≠ B, B = (spgcl(A))c, A = (spgcl(B))c

(vi) There exists no IFSPGCSs A and B in (X, τ) such that A ≠ 0~ ≠ B, B = (spgint(A))c, A = (spgint(B))c

Proof: (i) ⇒ (ii) Assume that there exists an IFSPGOS A in (X, τ) such that A ≠ 0~ and spgcl(A) ≠ 1~. Now let B = spgint(spgcl(A))c. Then B is a proper IFRSPGOS in (X, τ), which is conradiction. Therefore spgcl(A) = 1~.

(ii) ⇒ (iii) Let A ≠ 1~ be an IFSPGCS in (X, τ). If B = Ac, then B is an IFSPGOS in (X, τ) with B ≠ 0~. Hence spgcl(B) = 1~. This implies (spgcl(B))c = 0~. That is spgint(Bc) = 0~. Hence spgint(A) = 0~.

(iii) ⇒ (iv) Suppose A and B be two IFSPGOSs in (X, τ) such that A ≠ 0~ ≠ B and A ⊆ Bc. Then Bc is an IFSPGCS in (X, τ) and B ≠ 0~ implies Bc ≠ 1~. By hypothesis spgint(Bc) = 0~. But A ⊆ Bc. Therefore 0~ ≠ A = spgint(A) ⊆ spgint(Bc) = 0~, which is a contradiction. Therefore (iv) is true.

(iv) ⇒ (i) Suppose 0~ ≠ A ≠ 1~ be an IFRSPGOS in (X, τ). If we take B = (spgcl(A))c, we get B ≠ 0~, since if B = 0~ then this implies (spgcl(A))c = 0~. That is spgcl(A) = 1~. Hence A = spgint(spgcl(A)) = spgint(1~) = 1~, which is a contradiction. Therefore B ≠ 0~ and A ⊆ Bc. But this is a contradiction to (iv). Therefore (X, τ) must be an IFSPG super connected space.

(i) ⇒ (v) Suppose A and B be two IFSPGOSs in (X, τ) such that A ≠ 0~ ≠ B and B = (spgcl(A))c, A = (spgcl(B))c. Now we have spgint(spgcl(A)) = spgint(Bc) = (spgcl(B))c = A, A ≠ 0~ and A ≠ 1~, since if A = 1~, then 1~ = (spgcl(B))c ⇒ spgcl(B) = 0~ ⇒ B = 0~. Therefore A ≠ 1~. That is, A is a proper IFRSPGOS in (X, τ), which is a contradiction to (i). Hence (v) is true.

(v) ⇒ (i) Let A be an IFSPGOS in (X, τ) such that A = spgint(spgcl(A)), 0~ ≠ A ≠ 1~. Now take B = (spgcl(A))c. In this case we get, B ≠ 0~ and B is an IFSPGOS in (X, τ). Now B = (spgcl(A))c and (spgcl(B))c = (spgcl(spgcl(A))c)c = spgint(spgcl(A)) = A. But this is a contradiction to (v). Therefore (X, τ) must be an IFSPG super connected space.

(v) ⇒ (vi) Suppose A and B be two IFSPGCS in (X, τ) such that A ≠ 1~ ≠ B, B = (spgint(A))c, A = (spgint(B))c. Taking C = Ac and D = Bc, C and D become IFSPGOSs in (X, τ) with C ≠ 0~ ≠D and D = (spgcl(C))c, C = (spgcl(D))c, which is a contradiction to (v). Hence (vi) is true.

(vi) ⇒ (v) can be proved easily by the similar way as in (v) ⇒ (vi).

Definition 3.17: An IFTS (X, τ) is said to be an intuitionistic fuzzy semipre generalized (IFSPG for short) extremally disconnected if the semipre generalized closure of every IFSPGOS in (X, τ) is an IFSPGOS in (X, τ).

Theorem 3.18: Let (X, τ) be an IFTS space. Then the following statements are equivalent:

(vi) ⇒ (v) can be proved easily by the similar way as in (v) ⇒ (vi).

Definition 3.17: An IFTS (X, τ) is said to be an intuitionistic fuzzy semipre generalized (IFSPG for short) extremally disconnected if the semipre generalized closure of every IFSPGOS in (X, τ) is an IFSPGOS in (X, τ).

Theorem 3.18: Let (X, τ) be an IFTS space. Then the following statements are equivalent:

(i) (X, τ) is an IFSPG extremally disconnected

(ii) For each IFSPGCS A, spgint(A) is an IFSPGCS

(iii) For each IFSPGOS A, spgcl(A) = (spgcl(spgcl(A))c)c

(iv) For each pair of IFSPGOSs A and B with spgcl(A) = Bc implies that spgcl(A) = (spgcl(B))c

Proof : (i) ⇒ (ii) Let A be any IFSPGOS. Then Ac is an IFSPGOS. So (i) implies that spgcl(Ac) = (spgint(A))c is an IFSPGOS. Thus spgint(A) is an IFSPGCS in (X, τ).

(ii) ⇒ (iii) Let A be an IFSPGOS. We have (spgcl(spgcl(A))c)c = (spgcl(spgint(Ac)))c. Since A is an IFSPGOS, Ac is IFSPGCS. So by (ii) spgint(Ac) is an IFSPGCS. That is spgcl(spgint(Ac)) = spgint(Ac). Hence (spgcl(spgint(Ac)))c = (spgint(Ac))c = spgcl(A).

(iii) ⇒ (iv) Let A and B be any two IFSPGOSs in (X, τ) such that spgcl(A) = Bc. (iii) implies that spgcl(A) = (spgcl(spgcl(A))c)c =(spgcl(Bc)c)c = (spgcl(B))c.

(iv) ⇒ (i) Let A be any IFSPGOS in (X, τ). Put B = (spgcl(A))c, then B is an IFSPGOS and spgcl(A) = Bc. Hence by (iv) , spgcl(A) = (spgcl(B))c. Since spgcl(B) is an IFSPGCS, it follows that spgcl(A) is an IFSPGOS. This implies that (X, τ) is an IFSPG extremally disconnected space.

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Cognitive Radio: An Emerging trend for better Spectrum Utilization

Atul Singh Jamwal
Deptt. Of Computer Science
SVIET, Banur
India

Gurpinder Kaur
Deptt. Of Computer Science
SVIET, Banur
India

Abstract: Due to the rapid development of wireless communications in recent years, the demand on wireless spectrum has been growing dramatically, resulting in the spectrum scarcity problem. Works have shown that the fixed spectrum allocation policy commonly adopted today suffer from the low spectrum utilization problem. Both academic and regulatory bodies have focused on dynamic spectrum access to fully utilize the scarce spectrum resource. Cognitive radio, with the capability to flexibly adapt its parameters, has been proposed as the enabling technology for unlicensed secondary users to dynamically access the licensed spectrum owned by legacy primary users on a negotiated or an opportunistic basis. In this paper we present a volumetric survey on various methods used to adapt changes used in cognitive radio.

Key words: Cognitive Radio, spectrum holes, primary users, spectrum sensing, network management.

1. INTRODUCTION

Cognitive radio network is a new emerging research area recently. It enhances the existing software-defined radio, whose physical layer behavior is largely defined in software. Cognitive radio has the following characteristics.[3] First, it is aware of its environment and its capabilities. Second, it is able to independently alter its physical layer behavior based on its previous experience and its current environment. Finally, it is capable of performing the complex adaptation strategies according to the cognitive cycle shown in. With these capabilities, when spectrum environment changes around cognitive user, it is capable of sensing these changes and independently changing its physical layer settings such as transmission power, channel selection and etc to meet some constraints or requirements of the users.

Cognitive radio gains popularity in the research area because it enables [4] the current fixed spectrum channel assigned by FCC to be utilized by the new users. For example, most of the spectrums assigned to TV channels are idle most of the time, while wireless network users share a small range of spectrum, 2.4 G Hz and 5G Hz. When there are many wireless users at a time, the network is congested because of the limited channel. With the spectrum opportunities provided by the cognitive radio network, the wireless network users are able to share the idle spectrum for TV channel, on the condition that it does not interfere with the normal TV channel.

2. BACKGROUND

The concept of cognitive radio was first proposed by Joseph Mitola III [1] in a seminar at KTH (the Royal Institute of Technology in Stockholm) in 1998 and published in an article by Mitola and Gerald Q. Maguire, Jr. in 1999. It was a novel approach in wireless communications, which Mitola later described as: "The point in which wireless personal digital assistants (PDAs) and the related networks are sufficiently computationally intelligent about radio resources and related computer-to-computer communications to detect user communications needs as a function of use context, and to provide radio resources and wireless services most appropriate to those needs". In November 2002, Federal Communication Commission (FCC) of USA first prepared a report which lists some of the provisions for spectrum management in Cognitive Radio [2]. In this report FCC described some regulatory policies for the efficient use of Spectrum under Cognitive Radio. FCC noted that utilization of radio network is not balanced. Some frequency bands are overloaded and some are under loaded, creating inefficient spectrum utilization. Now the task was to make the network intelligent enough to adapt dynamically in overloaded or under loaded conditions without the interference of users.

3 ISSUES IN COGNITIVE RADIO

3.1Cognitive Radio and Spectrum Sensing

The most important aspect of using cognitive radio is the ability to sense the unused spectrum. Spectrum Sensing can be

defined as the [4] combination of signal detection and modulation classification and use the general term automatic modulation classification (AMC) to denote this combined process.

Spectrum sensing can also be defined on the basis of interference temperature. An unused spectrum has different sensing temperature as compare to used one [1]. This difference is due to interference and has different frequency bands. An unused spectrum can be sensed using this frequency band difference.

Spectrum holes are another ways of finding the unused spectrum. Spectrum holes are created where an unused band is present. Identify these spectrum holes can make the spectrum easily sensed for unused bandwidth. All channels are classified into different spectrum holes. These are:

- White spectrum holes, which are not fully used.
- Grey spectrum holes which are partially used.
- Black spectrum holes which are fully used.

After detecting the channel unused, a user can freely use the white spectrum holes and partially used the grey spectrum holes and black spectrum holes are not used at all as it is assumed that these types of holes are fully used by primary or licensed users. The use these fully used spectrum holes may hampers the communication of primary users.

3.2Cognitive Radio and Spectrum Decision

When the unused channel is found the next step will be the spectrum decision by which cognitive radio must find the initial point of its operation and select the appropriate technical parameters according to the present state of the environment in which it has to operate on. This spectrum decision is very crucial as if wrongly made can interrupt the communication of primary users. Cognitive radio is assumed to have the capability to self adjust dynamically according to its changing environment characteristics and is able to freely make decision depending upon the parameters of the current environment. It means that it must have such a decision making power that come into use while operating in the changing environment. To operate with self decision making capabilities, cognitive radio must be entrenched with some kind of artificial intelligence techniques so that can take its decisions efficiently and independently without interfering the other users.

3.3 Cognitive Radio and Spectrum Sharing

Sharing of unused spectrum among various users is another issue while using the cognitive radio. Since there is very limited unlicensed band available and can be used by anybody, these bands are mostly overloaded and heavily used ones, because it much easier and cheaper for users to access these bands. It means decision must be chosen so not to interfere with primary users and also do not overlap with other secondary users. Sharing should be done on first come first serve manner or apply some other allocation techniques on network sharing on priority basis to increase the spectrum utilization. Moreover spectrum sharing can be done by giving each secondary user a time quantum within which he must have to finish his network use and handover the network to be used by other users. Sharing of unused bandwidth with proper coordination and follow some regulatory rules and other policies should be done in efficient and altruistic manner.

3.4 Cognitive Radio and Network Security

One of the major issues concerned with cognitive radio is network‘s vulnerability to be open to all the users whether they are authorized or unauthorized. Since network is freely accessible to malicious users they can interrupt the primary authorized users by interfering between their spectrums. A cognitive radio should also have some security mechanisms to recognize the users of the network. A cognitive radio network should also be imparted with encryption techniques to communicate securely. To address these security issues regulatory bodies must have some provisions or policies to use the spectrum safely and securely.

3.5 Spectrum Management

The key challenge in implementing a cognitive radio network is allocation of frequency bands to different users. Licensed users generally have stable frequency band whereas unlicensed users use dynamically allocated bands. It is quite difficult to distribute unused frequency bands which reside between stable bands as it may interrupt the primary users. There must be some heuristic algorithms to allocate a sequence of dynamically changing band which also keep these bands away from stable bands.

4. CONCLUSION

Although cognitive radio is an emerging trend for utilizing the spectrum efficiently still there are some concerns which must be addressed to use it best possible. It would be recommended if cognitive radio is used with some powerful network security techniques so that its use does not interrupt the primary users. Moreover some strict provisions must be implemented by the regulatory bodies for effective and efficient use of this technique.

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Non-Blind Deblurring Using Partial Differential Equation Method

Devender Sharma
CSE Department
HCE,Sonepat,
India.

Puneet Sharma
CSE Department
HCE,Sonepat,
India.

Ritu Sharma
ECE Department
BMIET,sonepat,
India.

Abstract: In this paper, a new idea for two dimensional image deblurring algorithm is introduced which uses basic concepts of PDEs... The various methods to estimate the degradation function (PSF is known in prior called non-blind deblurring) for use in restoration are observation, experimentation and mathematical modeling. Here, PDE based mathematical modeling is proposed to model the degradation and recovery process. Several restoration methods such as Weiner Filtering, Inverse Filtering [1], Constrained Least Squares, and Lucy -Richardson iteration remove the motion blur either using Fourier Transformation in frequency domain or by using optimization techniques. The main difficulty with these methods is to estimate the deviation of the restored image from the original image at individual points that is due to the mechanism of these methods as processing in frequency domain .Another method, the travelling wave de-blurring method is a approach that works in spatial domain.PDE type of observation model describes well several physical mechanisms, such as relative motion between the camera and the subject (motion blur), bad focusing (defocusing blur), or a number of other mechanisms which are well modeled by a convolution. In last PDE method is compared with the existing restoration techniques such as weiner filters, median filters [2] and the results are compared on the basis of calculated PSNR for various noises

Keywords: PDE,PSF,Deblurring,Weiner filter

1. INTRODUCTION

Images are produced in order to record or display useful information. Due to imperfections in the electronic or photographic medium, the recorded image often represents a degraded version of the original scene. The degradations may have many causes, but two types of degradations are often dominant: blurring and noise. The restoration and enhancement of the blurred and noised images are of fundamental importance in image processing applications.To find the original image the degraded images has to be deblurred. The field of image deblurring is concerned with the reconstruction or restoration of the uncorrupted image from a distorted and noisy one. The restoration (deblurring) of images is an old problem in image processing, but it continues to attract the attention of researchers and practitioners. A number of real-world problems from astronomy to consumer imaging find applications for image restoration algorithms. Image restoration is an easily. visualized example of a larger class of inverse problems that The degradation, of an image can be caused by many factors. The movement during the image captures process, by the camera or, when long exposure times are used, by the subject. The out-of-focus optics, use of a wide-angle lens, atmospheric turbulence, or a short exposure time, which reduces the number of photons captured. The confocal microscopy is an optical imaging technique. It enables the reconstruction of 3-D structures from the obtained images.An ideal camera or recording device would record an image so that the intensity of a small piece (pixel) of the recorded image was directly proportional to the intensity of the corresponding section of the scene being recorded. The real cameras violate this model in two ways. First, the recorded intensity of a pixel is related to the intensity in a larger neighborhood of the corresponding section of the scene. This effect in visual images is called blurring. Second, the recorded intensities are contaminated by random noise. The Noise is a unwanted or undesirable information that contaminates an image. Noise appears in images from a variety of sources. First, the digital image acquisition process, which converts an optical image into continuous electrical signal that is then sampled, is the primary process by which noise appears in digital image. The image noise is a random variation of brightness or color information in images produced by the camera. There are fluctuations caused by natural phenomena that add a random value for a given pixel. A blurred or degraded image can be approximately described by this equation

$$k = H*f + n, \quad (1)$$

Where the k is the blurred image, the H is the distortion operator also called the point spread function(PSF), f is the original true image, n is the additive noise, introduced during

image acquisition, that corrupts the image. The figure shown represents the PSF , point spread function

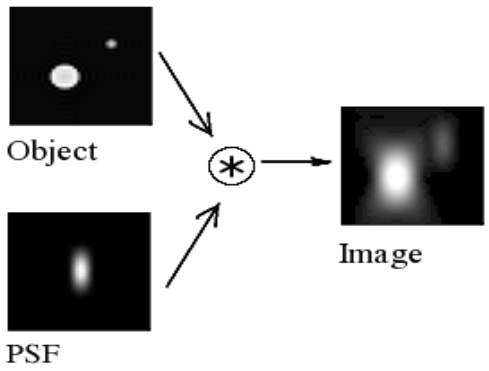

Figure:1 Degradation in image by PSF

The degraded images are deblurred using the traditional techniques .

1.1 Weiner Filter

The method is founded on considering image and noise as random process and objective is to find an estimate of deblurred image of the uncorrupted image such that mean square error between them is minimized.The simplest approach is to restore the original image simple by dividing the transform of degraded image by degradation function.

F'(u,v)=F(u,v)+N(u,v)/H(u,v) (2)

These are the frequency transform of deblurred image,original image,noise density and degraded function

1.2 Order Statistics Filters

These are the spatial filters [4] whose response is based on ordering of the pixels contained in the image area and compassed by the filter.The response of the filter at any point is determined by ranking result.

F1(x,y)=median{g(s,t)} (3)

F1(x,y)=max{g(s,t)} (4)

F1(x,y)=mean{g(s,t)} (5)

2. PURPOSED METHOD

Image restoration is the pre-processing method that targets to suppress degradation using knowledge about its nature. Restoration attempts to recover an image that has been degraded using a priori knowledge of the degradation phenomenon. Hence, the restoration techniques are focussed towards modelling the degradation and applying the inverse process in order to recover the original image. The relative motion between the camera and the object may lead to blurring of image during its formation on the film of the camera.The travelling wave de-blurring method is a approach that works in spatial domain but the mathematical model discussed in this paper is not generalized and discretization issues and stability criteria of differential equation has not been addressed. In fact, when the proposed differential equation is discretized using forward differencing scheme is unconditionally unstable which may not produce the desired results. A generalized PDE [3] based image model is proposed to model the phenomenon of blurred image formation due to relative motion between camera and the object and further the recovery of original image in spatial domain. Lax scheme is used to discretize the resulting PDE which is mathematically stable and produces good result. Therefore, with the use of Lax method for discretizing the proposed PDE that was initially a flux conservative equation transforms to a ID flux conservative equation with an added diffusion term which is in the form of Navier-Stokes equation. The, additional diffusion term contributes towards further smoothing of image. Let vector $\underline{X} \in R^n$, $f : R^n \longrightarrow R$ and $\underline{X} = (x_1, x_2, x_3, \ldots\ldots x_n)$ and f is a function of $\underline{X}$. For 1D object $f(\underline{X}) = x$ and for 2D object i.e. images $f(\underline{X}) = (x, y)$. Let $\underline{V}$ represents the velocity vector of object and $\underline{V} = (v_1, v_2, \ldots\ldots, v_n)$.If object is moving in horizontal direction only then velocity reads as $\underline{V} = v_x$ and if object is under motion in XY-space in both horizontal and vertical directions then velocity vector reads as $\underline{V} = (v_x, v_y)$. If n-dimensional object $f(\underline{X})$ keeps a linear uniform motion at a rate $\underline{V}$ in n-Dim space under the surveillance of a camera. The total exposure $g(\underline{X}, t)$ at any point of the recording medium(e.g., film) is obtained by integrating the instantaneous exposure over the time interval 0<=t<=T during which camera shutter is open. After discretization using Navier-Strokes equation, we get Observed object for duration T can be modeled as –

$$g(\underline{X}, t) = \int_0^T f(\underline{X} - \underline{V}t)dt \quad (6)$$

$$g_j^{n+1} = g_j^n - (v\Delta t)\frac{\partial g}{\partial x} + \frac{(\Delta x)^2}{2}\frac{\partial^2 g}{\partial x^2} \quad (7)$$

From above derived equation the PDE equation is

$$It = It - (v\Delta t)\frac{\partial g}{\partial x} + \frac{(\Delta x)^2}{2}\frac{\partial^2 g}{\partial x^2} \quad (8)$$

2.1 Algorithm for implementing vertical deblurring:

The Algorithm for this scheme is as follows:-

1. Read the original image s of size mxn.

2. Introduce the motion blur in y direction to get s(y, x, t) or we can directly have the blurred image s(y, x, t).

Id =s(y, x): Initial Image

3. Set dy=0. 1, dt = 0.1

4. for t=1: n iterations

$$Id = Id - (v\Delta t)\frac{\partial s}{\partial y} + \frac{(\Delta y)^2}{2}\frac{\partial^2 s}{\partial y^2}$$

// Evolves the sol. after n iterations end

5. Display the image

2.2 The Combined Deblurring Algorithm:-

1. Read the original image K of size mxn.

2. Filter the image K to Produce blurred version h(x,y) by introducing motion in x-direction.

3. Filter K(x,y) to get final version K(x,y) by introducing motion blur in y-direction K(x,y) is the final blurred image with motion introduced in both x and y directions).

Initial Image I = K(x,y)

4. Set dx=0.1

t = 0.1, no_iterations=50, v_x =1

5. For t=1: no_iterations

$$I = I - (v_x\Delta t)\frac{\partial K}{\partial x} + \frac{(\Delta x)^2}{2}\frac{\partial^2 K}{\partial x^2}$$

6. R=I

7. Set dy=0.1dt= 0.1, num_iterations=50, v_y =1

8. For t=1: num_iterations

9. $$R = R - (v_y\Delta t)\frac{\partial I}{\partial y} + \frac{(\Delta y)^2}{2}\frac{\partial^2 I}{\partial y^2}$$

10. Get R and display as final deblurred Image

3. RESULTS

The blurring of images can be caused by movement of object or camera while capturing the image. The deblurring of Images is the reconstruction or restoration of the uncorrupted image from a distorted and noisy one. In this paper, an idea for two directional image deblurring algorithm is introduced which uses basic concepts of PDEs having the prior knowledge about the PSF. Motion Blurring is introduced in two directions: horizontal and vertical. Then we proposed PDEs based model for image deblurring considering both the directions which is based on the mathematical model. A simple two dimensional algorithm has been introduced and implemented. The results show better quality of images by applying this algorithm compared to the previously designed techniques.The results are compared on the basis of PSNR calculated for the several noises such as Gaussian noise, salt and pepper noise, speckle noise etc. The deblurring is done for the mean taken as 0 and variance is 0.001 for all the noises. The results shown below for the Gaussian noise deblurred by the various filters and is shown that PSNR is better for the PDE method.

Figure: 2 Original image

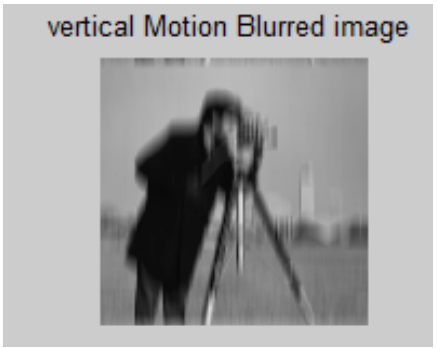

Figure: 3 Image blurred in Y direction

Figure: 4 Image blurred in X direction

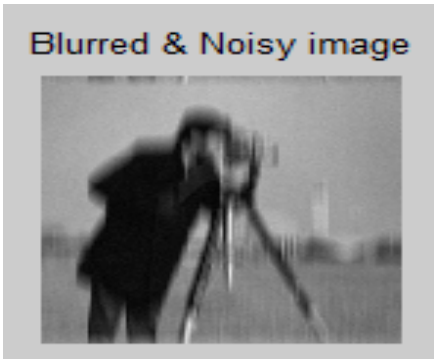

Figure: 5 Noise added in blurred image

Figure: 6 Deblurred image in Y-direction

Figure: 7 Deblurred image in X-direction

Figure: 8 Deblurred image in Y-direction

Figure:9 Deblurred image in X-direction

Figure:10 Deblurred image in Y-direction

Figure: 11 Deblurred image in X-direction

3.2 PSNR Table:

The PSNR based comparison is done among the different techniques.PSNR Table is calculated for different techniques and for several noises and is shown that PDE shows better results.

Table1: PSNR calculation for different techniques.

Noise type	Blurr	Technique	PSNR
Gaussian	Vertical	MedianFilters	28.1294
Gaussian	Vertical	Wiener Filter	14.9225
Gaussian	Vertical	PDE	40.1383
Impulse	Vertical	MedianFilters	36.9146
Impulse	Vertical	Wiener Filter	8.8892
Impulse	Vertical	PDE	24.855
Poisson	Vertical	MedianFilters	23.3081
Poisson	Vertical	Wiener Filter	9.7698
Poisson	Vertical	PDE	26.9374
Speckle	Vertical	MedianFilters	19.5736
Speckle	Vertical	Wiener Filter	7.2725
Speckle	Vertical	PDE	19.7322

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Risk Prediction for Production of an Enterprise

Kumar Ravi
Department of Computer Science
School of Engineering, Pondicherry University
Pondicherry, India

Sheopujan Singh
Department of Mathematics and Computer Application
S. Sinha College
Aurangabad, Bihar, India

Abstract: Despite all preventive measures, there is so much possibility of risks in any project development as well as in enterprise management. There is no any standard mechanism or methodology available to assess the risks in any project or production management. Using some precautionary steps, the manager can only avoid the risks as much as he can. To address this issue, this paper presents a probabilistic risk assessment model for the production of an enterprise. For this, Multi-Entity Bayesian Network (MEBN) has been used to represent the requirements for production management as well as to assess the risks adherence in production management, where MEBN combines expressivity of first-order logic and probabilistic feature of Bayesian network. Bayesian network provides the feature to represent the probabilistic uncertainty and reasoning about probabilistic knowledge base, which is used here to represent the probable risks behind each causes of a risk. The proposed probabilistic model is discussed with the help of a case study, which is used to predict risks inherent in the production of an enterprise, which depends upon various measures like labour availability, power backup, transport availability etc.

Keywords: Bayesian network, UnBBayes, MEBN, PR-OWL

1. INTRODUCTION

Risk management is particularly important for the supply chain management because of the inherent uncertainties in the various stages of it. It occurs due to loosely defined requirements, under or over estimation of time and resources required for product development, dependence on individual skills, and requirements changes due to changes in customer needs. The manager of an enterprise should be aware of the impact of these risks on the project, the product and the business in advance, and should have some contingency plans so that, if the risks do occur, those can be managed effectively [7]. Although several steps for risk management are needed to address as shown in Fig. 1, but here risk assessment have been considered mainly.

There is no standard mechanism to handle the risk, so it can be minimized using some preplanned strategies. Risk is quite uncertain with respect to various attributes like time, schedule, requirements, human resource, raw material etc. So, a probabilistic approach has been used to represent these attributes as well as its effects on the incurred risks in this literature, which is based on Bayesian network.

Bayesian network is a graphical representation of random variables and their conditional dependencies in the form directed acyclic graph (DAG), which is widely used in the field of Semantic web to represent probabilistic relationship among components of knowledge base, where probabilistic dependence between components of knowledge base has been used for the situation awareness, recommender system, sentiment analysis, and data mining. Currently well known Semantic Web (SW) languages like Resource Description Framework (RDF), Resource Description Framework Schema (RDF/S), Web Ontology Language (OWL) etc and their constructs have been used to construct the Bayesian network. One of them is Probabilistic Web Ontology Language (PR-OWL) based on MEBN to represent the uncertainty incurred within any knowledge base system.

Modeling of uncertainty has been widely done using MEBN [2], [9], [14], which can be used to determine the probability of events that are influenced by various variables. Using it, the degree of belief can be specified to determine the favorable and contradicting outcomes for given evidences. It can be used as dynamic Bayesian network, using which degree of belief can be modified time to time according to likeness of the situation or to observe the effect of different evidences for propositions. To model the domain, we need to represent them in the form of Bayesian network, which is a major task to have a well defined probabilistic model. The generation of Bayesian network needed following 3 major steps [1].

-First, identification of propositions and evidences.
-Second, identification of random variables for nodes and creation of dependence graph using them.
-Third, assignment of Conditional Probability Table (CPT) for each node.

To do this, in addition to above listed tasks, incorporation of existing knowledge can be done with the help of domain ontology.

This paper is arranged in following manner. The section 2 will present the survey on risk prediction in various fields like network security, water management, power supply, health risks etc. Some milestones in creation of Bayesian network from semantic web languages is discussed in section 3, out of that MEBN is used in this paper to create a probabilistic model. Section 4 describes a case study for modeling and prediction of causes and effects of risks for an enterprise production. Conclusion has been drawn in section 5.

2. LITERATURE SURVEY

This paper is mainly motivated from [14], which has used MEBN and PR-OWL for risk assessment in the process of Security Certification and Accreditation (C&A). Due to diverse uncertainties in the field of software performance, major security requirements and their causal relationship has been represented using MEBN, which provides probabilistic model driven risk assessment on security requirements.

Bayesian network and Monte Carlo simulation have been used to predict the thermal overload risk for the next hour on the current weather conditions and power system operating conditions [3]. According to [15], an electricity supply industry faces sort of risks like risk of load forecast error, risk of equipment, risk of transmission constraints, risk of financial return, risk within contracts etc. So, some of these risks will also be considered as a part of proposed model in the form of power backup. Nevertheless Bayesian network, this literature has used auto-regressive integrated moving average (ARIMA) models and artificial neural network (ANN) structures.

Caruso (2006) has analyzed the supplier and consumer risk for daily market-price of power uncertainties and it aggregates risk measures for the power supply. Monte Carlo algorithm has been used to verify the simulated results by the OPF-based problem [16].

Fuzzy dominance and similarity analysis have been considered to represent a framework to integrate probabilistic health risk assessment into a comprehensive, yet simple, cost-based multi-criteria decision analysis framework [4]. It has been done for the management of contaminated ground water resources using health risk assessment and economic analysis through a multi-criteria decision analysis framework. These are the trade-off between

population risk and individual risk, the trade-off between the residual risk and the cost of risk reduction, and cost-effectiveness as a justification for remediation.

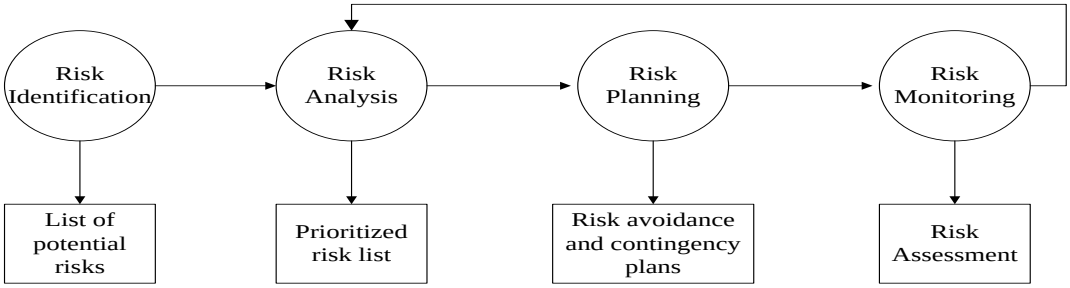

Figure 1 Phases of risk management [7]

Fuzzy-probabilistic modeling process has been adopted for power system risk assessment which can capture both randomness and fuzziness of loads and component outage parameters. This is based on a hybrid method of fuzzy set and Monte Carlo simulation. An actual example using a regional system at the British Columbia Transmission Corporation has been given to demonstrate the application of the presented fuzzy-probabilistic model [5].

Risk assessment is done for information security domain, where Bayesian network has been used as Attack graphs and attack trees to assess the cause-consequence relationships between various network states [6]. Security risk assessment and mitigation have been considered as two major steps of risk management to manage IT infrastructure. Genetic algorithm has been used to refine the outcomes resulted for risk mitigation.

3. BAYESIAN NETWORK AND SEMANTIC WEB FOR UNCERTAINTY REPRESENTATION

Four major works to represent uncertainty on the basis of Bayesian network has been discussed in further sub-sections, which can be used risk prediction. These proposed models will be co-related with following three steps

1. Propositions and evidences identification
2. Identification of random variables for nodes and representation of them in the form of dependence graph.
3. Assignment of Conditional Probability Table (CPT) for each node.

3.1 BayesOWL

This is one of the first successful approaches to create Bayesian network using terminologies of OWL [11]. For the identification of evidences and propositions, it has used the concept of the ontology, which is represented as nodes in the underlying network and for the logical relation between concepts viz. union, intersection, complementation, disjoint, equivalence, and inheritance, it introduces link node, which works as the bridge between given nodes.

The node representing degree of truth in fractional form will be considered as random variable.

For the creation of conditional probability table, some propositional formulas have been given for each logical relations, where CPT will be created for both types of node representing concepts of taxonomies as well as for link nodes.

It considers only terminologies or vocabularies of the knowledge base and it is unable to represent assertions of the knowledge base.

3.2 OntoBayes [12]

Instead of creating single graph, it creates two graphs, one for the Bayesian network i.e. Bayesian graph and other for the ontology constructs i.e. OWL graph. It considers triple form of OWL like subject, predicate, and objects (s, p, o). While both graph will have three constructs of OWL, Bayesian graph will consider only one predicate of the RDF language. Predicate of the OWL will represent dependence of successor nodes on predecessor nodes, which is represented in OWL as <rdfs:dependsOn>.

So, similar to BayesOWL, subject and object will be used as propositions and evidences for the Bayesian graph. Predecessor node will be represented as random variables and CPT will be created according to specification of random variable. It can represent only discrete random variable but not Boolean random variable.

3.3 Using Netica API[1]

Fenz (2012) has used Netica API and Jena API[2] to create a security ontology, where Netica API is used as plugin with Protege[3] to select components and attributes representing uncertain features of the ontology. It has been followed three basic steps given below to create Bayesian Network from ontology.

(i) The determination of relevant influence factors,
(ii) The determination of relationships between the identified influence factors, and
(iii) The calculation of the conditional probability tables for each node in the Bayesian network.

In general, two different methods or a combination of both are used to construct a Bayesian network: (i) automated construction of Bayesian networks from existing data, and (ii) the domain expert-based construction of Bayesian networks covering complex knowledge domains with insufficient or non-existing empirical data regarding relevant variables.

This proposal is mainly based on second approach and it involves both manual and automatic operations. The proposal proposed a generic method for the ontology-based Bayesian network construction by (i) using ontology classes/individuals to create the nodes of the Bayesian network, (ii) using ontology properties to link the Bayesian network nodes, (iii) utilizing the ontological knowledge base to support the conditional probability table calculation for each node, and (iv) enriching the Bayesian network with concrete findings from existing domain knowledge. The developed method enables the semiautomatic construction and modification of Bayesian networks based on existing ontologies. The method is demonstrated on the example of threat probability determination, which uses a security ontology as its underlying formal knowledge base.

It is based on mainly four phases, out of them first step will be done manually and remaining steps will be done automatically using Netica API:

1. Selection of relevant classes, individuals, and properties: Domain expert has to select classes, individuals, and properties which are relevant to the problem and needed to represent in Bayesian network.

[1] http://www.norsys.com/netica_api.html
[2] http://jena.apache.org/
[3] http://protege.stanford.edu/

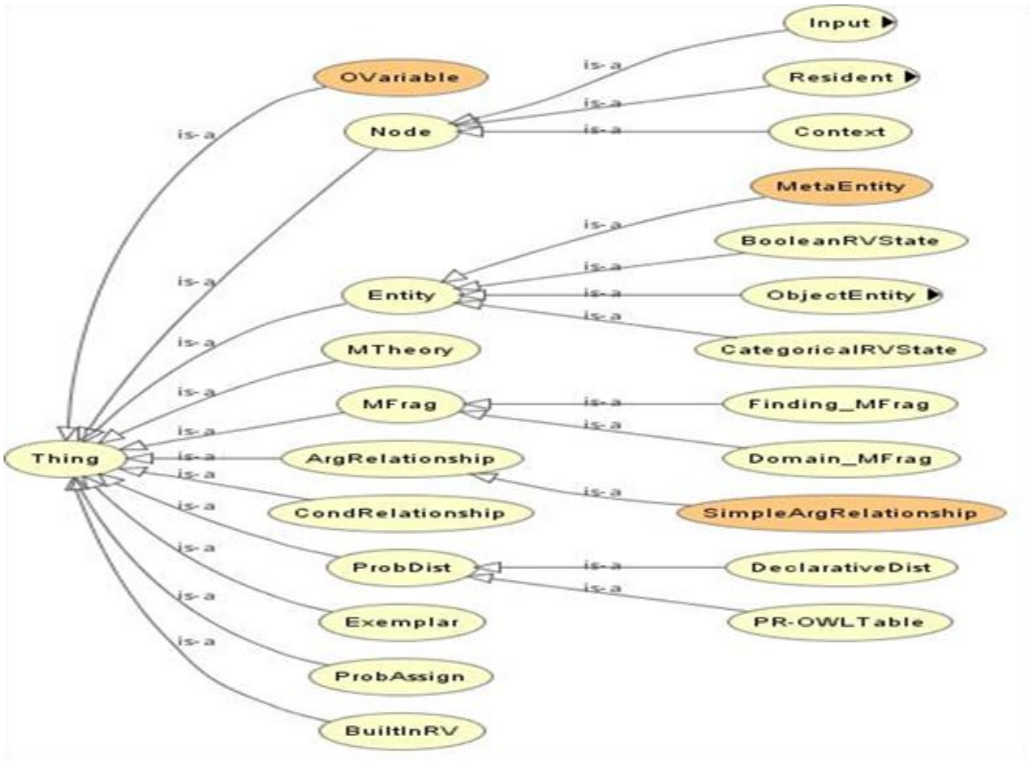

Figure 2. PR-OWL **c**lasses in detail [10]

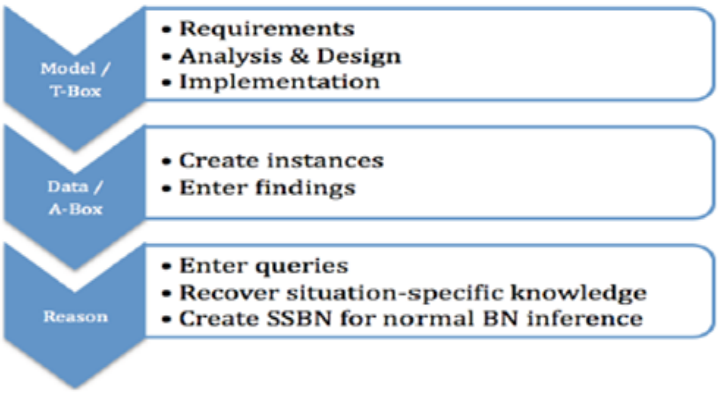

Figure 3. Uncertainty Reasoning Process for Semantic Technologies

2. Creation of the Bayesian network structure
3. Construction of the CPTs
4. Incorporation of existing knowledge facts

3.4 Multi-Entity Bayesian Network (MEBN) [2]

MEBN uses first order logic along with Bayesian network to create dynamic Bayesian network, which can represent uncertainty for complex situations and for different purposes like situation awareness, prediction, weather forecasting, battlefield strategy management etc. MEBN can be used to create multiple instances of whole Bayesian graph. MEBN can generate dynamic Bayesian network and it is able to represent different type of uncertainty like structural uncertainty, attribute uncertainty, number uncertainty, type uncertainty, referential uncertainty etc.

Components of MEBN are MEBN Theory (*MTheory*), MEBN Fragments (*MFrags*), context node, resident node, input node, and probability distribution table as shown in Fig. 2.

Here, MTheory will combine a set of MFrags and represent a whole probabilistic ontology. Each MFrag will contain different types of nodes like context, resident, input and ordinary variable. Each MFrag will represent a Bayesian network and nodes of one MFrag can be re-used as input nodes into other MFrag as well.

For propositions and evidences, it uses uncertain feature of the model, which can have different states either in binary or discrete form.

Instead of having nodes for random variable only in one form, it uses mainly 3 forms of nodes, where first node is known as *context node*, which can specify constraints using first-order logic formula on the used random variable for reasoning or decision purposes in complex situations. Second node is the most important node i.e. *resident node*, which will have different states of random variable and it will be associated with a Conditional Probability Table (CPT), and last one is the *input node*, which is the resident node of other MFrag. Context nodes and input nodes will be connected using edges to form directed acyclic graph (DAG) and each edge will represent the dependence of one node to other.

For CPT, at first it is required to specify probability for each states of random variable, which will be used for the creation of joint probability distribution table for the resident node or random variable. For the decision purposes, it will use the joint probability distribution table.

MEBN is realized in Probabilistic-Web Ontology Language (PR-OWL) [13] to create the probabilistic ontology. Modeling of uncertain situation can be done using MEBN and PR-OWL, which is efficient for the expression of complex situations. UnBBayes is a graphical user interface developed in Java, which implements PR-OWL to create a probabilistic ontology [9]. It provides facilities to create and save a knowledge base as well as to generate the Situation-Specific Bayesian Network (SSBN). Bayesian inference and SSBN inference algorithm are used to find out the inconsistencies in the ontology and to estimate the probability of an event.

PR-OWL 1.0 cannot support continuous random variable, so, PR-OWL 2.0 [10] is proposed to overcome the major disadvantages of PR-OWL 1.0 1) it cannot provide mapping to properties of OWL and 2) although it provides concept of meta-entities for the definition of complex types, it does not have type compatibility with OWL. Major classes of PR-OWL 1.0 are shown in Fig. 2.

4. A CASE STUDY FOR RISK PREDICTION FOR PRODUCTION OF AN ENTERPRISE

Prediction of risk has been done using different techniques [3] [4] [5] [6] [14][15]. Prediction is quite uncertain so, we have come up with a new model using Uncertainty Reasoning Process for Semantic Technologies (URP-ST) [10] to predict the production of an enterprise. Production of an enterprise depends upon various causes, which are listed in following sub-sections.

4.1 Modeling of System

Modeling of system includes 3 steps as shown in Fig. 3.

4.1.1 Identifying Requirements

Production of an enterprise will depend upon several factors some of them are listed below, which can be seen as basic requirements. These requirements will be considered to build the probabilistic model to estimate the probability of affect on the production rate.

4.1.1.1 Labour availability

Most important requirement for production is human resource, which is very uncertain feature for any manufacturing enterprise due to dependence on following attributes.

4.1.1.1.1 Probability of strike by labour

Strike by labour will severely affect the production rate. To avoid this, there should be proper management of their requirements.

4.1.1.1.2 Contractual state of staff

Completion of contract of major technical staffs will affect the project because new staff cannot be trained in short period to take over the running project.

4.1.1.1.3 Variability of staff joining and resigning

If there is lack of constant support of staff then it will result poor quality of product as well as time delay.

4.1.1.1.4 Labour Health Situation

Water and clean accommodation area are major concerns for good health, but every enterprise cannot ensure this, because this will increase the expenditure [4].

4.1.1.1.5 Labour Union Support

Labour union leader may mitigate the labours for unnecessary demands.

4.1.1.2 Power backup

Possibility of power backup will depend upon governmental supply and enterprise's own power availability.

4.1.1.2.1 Oldness of power generator

If power generator is so old, it will often need some rest and repairing as well as it should not have extra overload.

4.1.1.2.2 Power grid availability

Availability of power grid and duration of supply should be considered for scheduling management [15].

4.1.1.2 Transport availability

For transportation of raw materials and produced items, enterprise needs transport. In transportation some difficulties may also occur, which are listed below and these factors also have a bit of uncertainty to affect the production rate.

4.1.1.3.1 Possibility of owned vehicles

Number of more owned vehicles will surely have less probability to affect the transportation facility.

4.1.1.3.2 Rented vehicles availability

This is more susceptible to the means of communication.

4.1.1.3.3 Public transport availability

Easy reach abilities to public cargo will be cost effective.

4.1.1.4. Legal impacts

Legal activities may also hamper the production which may include consumer's claim, copyright conflicts etc.

4.1.1.4.1 License from pollution control board

Periodical renewal of license will decrease the possibility of disturbance.

4.1.1.4.2 License from manufacturing governing bodies

4.1.1.4.3 Enterprise and personnel legal issues

Legal issues may obstruct the production.

4.1.1.4.4 Transportation permit

Permit should be available according to requirement of communication.

4.1.1.5. Raw material availability

Raw material should be available according to demand of supply, but it will depend upon the suppliers' capacities as well as on financial relationship with suppliers.

4.1.1.5.1 Raw Material Suppliers (RMS) availability

Easy availability of RMS will have less effect on production.

4.1.1.5.2 Communication facility between production unit and suppliers or warehouse

This should be trouble-free for less effect on production rate.

4.1.1.5.3 Goodwill of enterprise with RMS

Loss of goodwill is the loss of everything, so trust should be maintained between raw material supplier and enterprise.

4.1.1.5.4 Alternatives of RMS

Limited number of RMS will affect the production severely.

4.1.1.6. Market demand

The second most important aspect is demand of commodities in market, without it production of items is obviously useless.

4.1.1.6.1 Share market situation

The volume of production will be regulated according to share market situation.

4.1.1.6.2 Market agents' performance and dealers' interest Production will be affected by the interest of dealers and performance of market agents.

4.1.1.6.3 Enterprise competitors' production quantity, quality, and rate

For an enterprise it is one of the most influential measures to consider the market availabilities, qualities and rate.

4.1.1.7. Some other factors

These factors can also affect the output of an enterprise.

4.1.1.7.1 Social impact

In some enterprise social impact should also be considered, which depends upon the type of waste generated by production unit and the location of enterprise like in dense or sparse population.

4.1.1.7.2 Share market situation

Share market situation will affect the cost and product of product.

4.1.1.7.3 Inflation rate

It is obvious condition for share market situations.

4.1.1.7.4. Arrangement schedules of machine and labour

The efficient scheduling of machine and labour will increase the production rate.

4.1.1.7.5. Machineries availability

According to demand of production, the enterprise should have enough tools and machineries for good production rate.

4.1.1.7.6 Machine fault rate

It will depend upon the age of machineries' and load on machineries.

4.1.2 Analysis and Design

The proposed model should be able to identify the total probable risk upon specifying probabilities of various factors listed in the requirements section. The relationship among these factors can be seen in the implementation section. The proposed model should be able to achieve following objectives…

- Calculating probability of risk of unavailability of labours and its effect on final production.
- Calculating probability of risk of unavailability of power backup.
- Calculating probability of risk of unavailability of enough transport facilities.
- Calculating probability of affect of legal issues.
- Calculating probability of risk of unavailability of raw materials etc.

4.1.3 Implementation

For implementation, UnBBayes [9] have been used which provides graphical user interface to create complete probabilistic ontology on the basis of Multi-Entity Bayesian Logic. It provides graphical interface for each component of MEBN like Entities, MFrag, Context node, Resident node, input node, MTheory etc. which can be used as dragged and dropped on MFrag area. Identified entities have been shown in Fig. 4.

For each of the requirements, separate MFrag has been created but due to space constraints, only few of them are shown in Fig. 5 and these MFrags can be classified into two categories …

a) MFrag without dependence on other
   i) Strike
   ii) StaffContracts
   iii) LabourHealth
   iv) Variability of Staff

b) MFrags with dependence on other MFrag
   i) Labour Availability
   ii) riskonRawMaterialAvailability
   iii) Transport Availability
   iv) Legal Impacts
   v) PowerBackup
   vi) Market Demand

4.2 Creating instances, findings, and defining probability distribution table for each resident node

Fig. 6 shows the instances of Person entity, findings of RawMaterialAvailabilities, findings of EasyCommunication, and GoodwillStatus horizontally. These findings will be used as knowledge bases. The probability distribution table will be specified for each resident node, where probability for each state will represent the expected degree of risks for each factor. Probability distribution table can be manipulated using first order logic formula as shown in the last snapshot of Fig. 6.

4.3 Reasoning with knowledge base

Reasoning will be performed to predict the risk, which will generate the situation-specific Bayesian network as shown in Fig. 7.

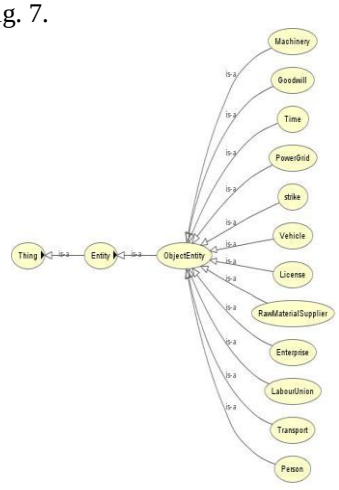

Figure 4 Identified Entities in proposed model

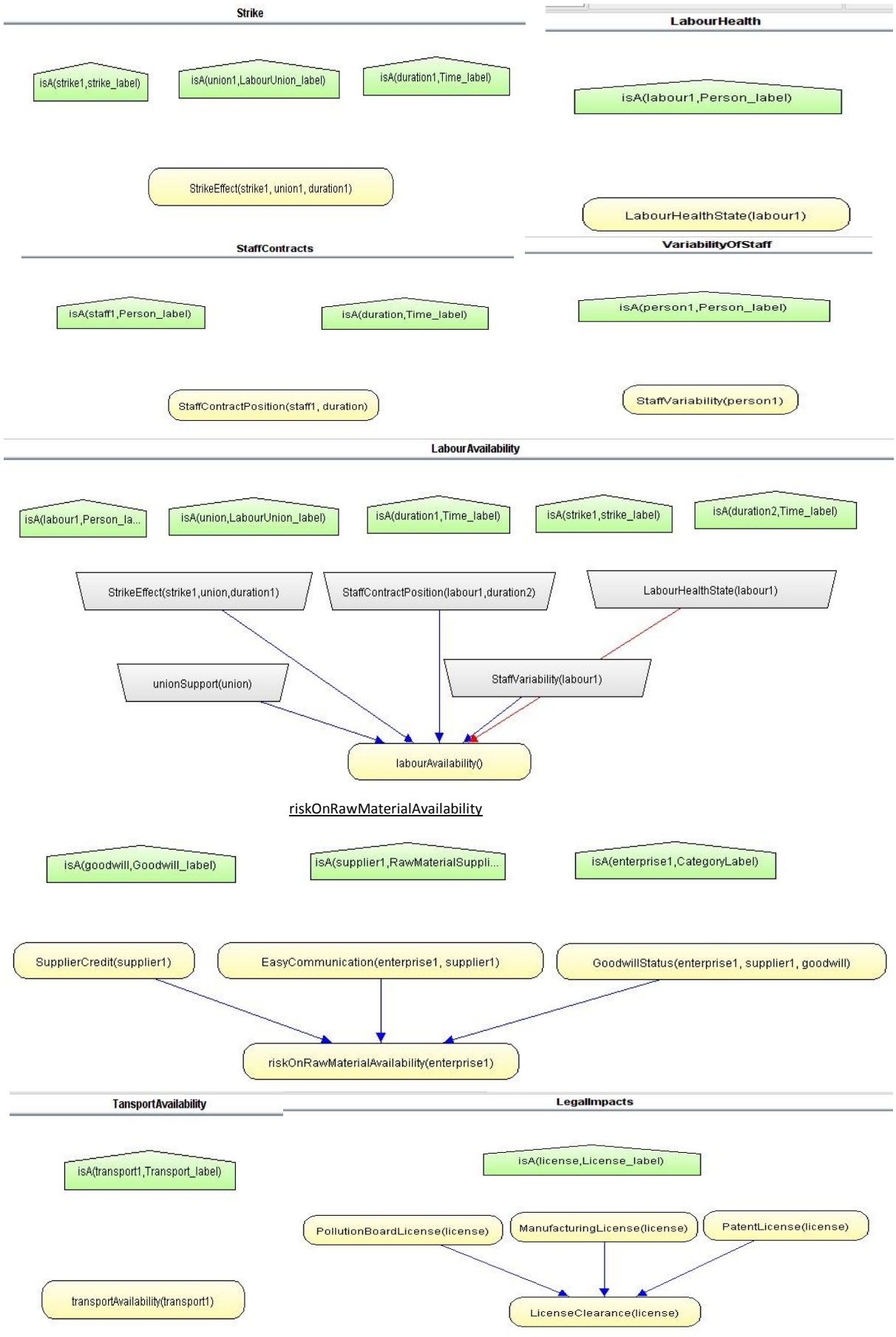

Figure 5. Probabilistic Ontology

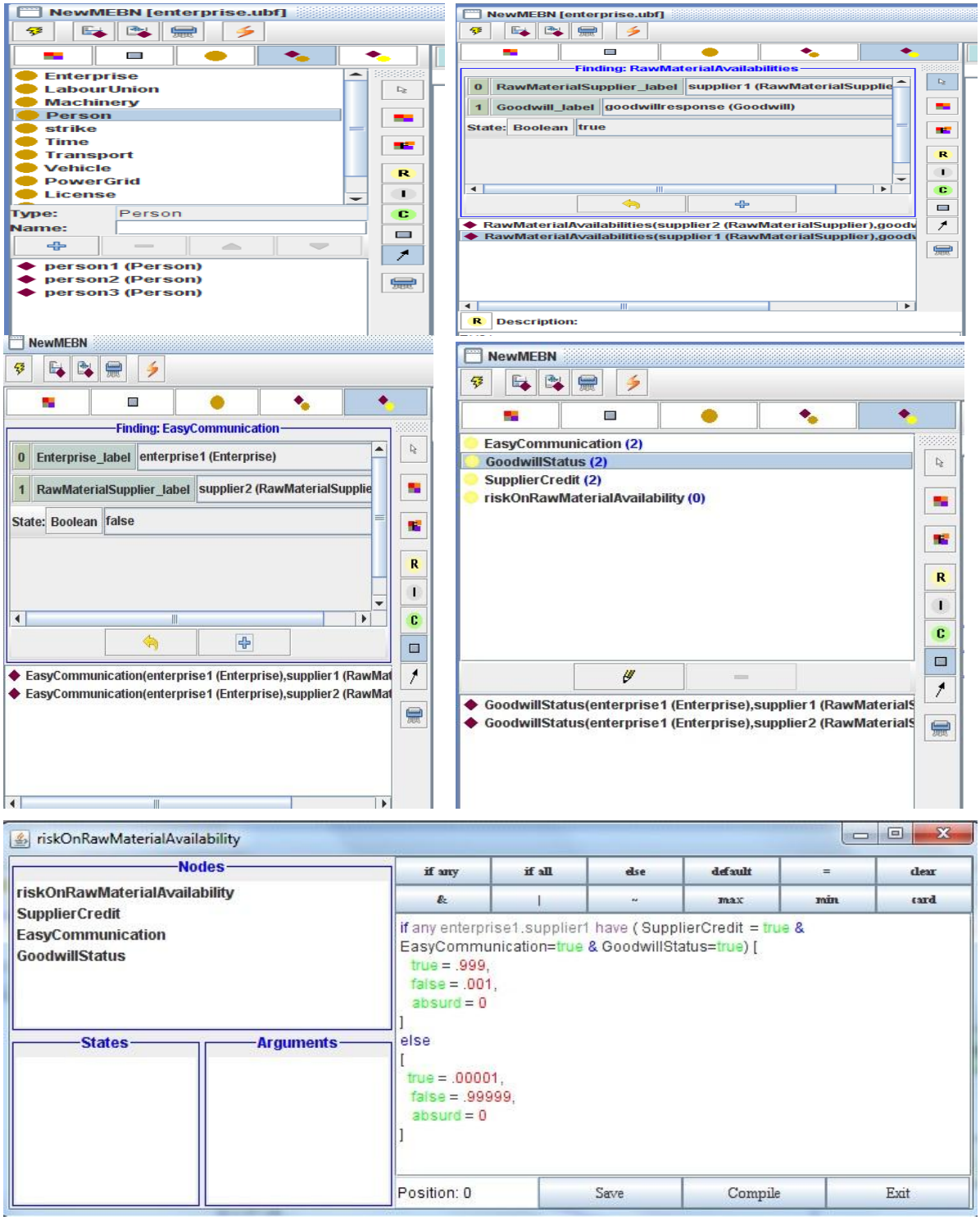

Figure 6. Entity Instances, Knowledge Base and CPT with First-Order Logic formula

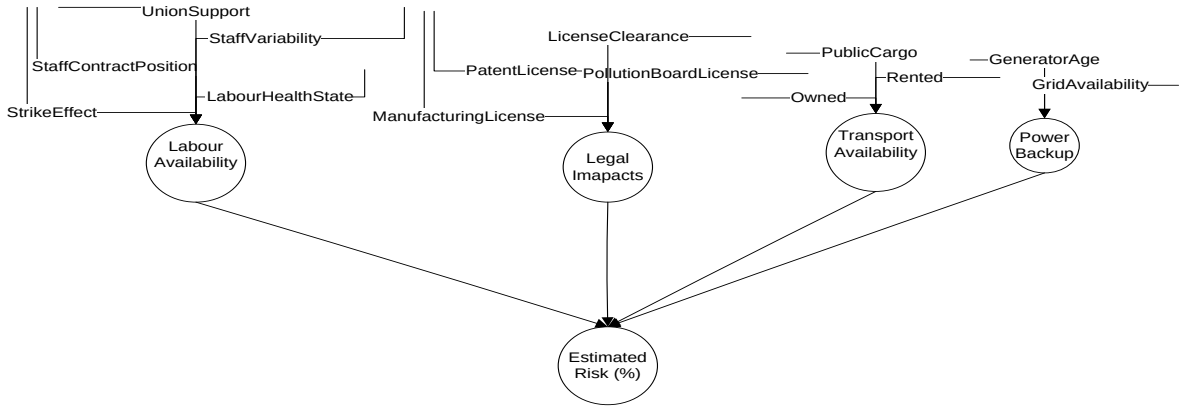

Figure 7. Situation-Specific Bayesian Network

5. CONCLUSION

This paper has presented a probabilistic model to represent the probable risk inherent in major causes for the production of an enterprise. The model can also be applied in other domain as well. MEBN and PR-OWL have been used to realize the model which is embedded in Java open source software UnBBayes.

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Watermarking of JPEG2000 Compressed Images with Improved Encryption

Kukoo Anna Mathew
Viswajyothi College of
Engineering and Technology,
Muvattupuzha, Kerala, India.

Abstract: The need for copyright protection, ownership verification, and other issues for digital data are getting more and more interest nowadays. Among the solutions for these issues, digital watermarking techniques are used. A range of watermarking methods has been projected. Compression plays a foremost role in the design of watermarking algorithms. For a digital watermarking method to be effective, it is vital that an embedded watermark should be robust against compression. JPEG2000 is a new standard for image compression and transmission. JPEG2000 offers both lossy and lossless compression. The projected approach is used to execute a robust watermarking algorithm to watermark JPEG2000 compressed and encrypted images. For encryption it uses RC6 block cipher. The method embeds watermark in the compressed- encrypted domain and extraction is done in the decrypted domain. The proposal also preserves the confidentiality of substance as the embedding is done on encrypted data. On the whole 3 watermarking schemes are used: Spread Spectrum, Scalar Costa Scheme Quantization Index Modulation, and Rational Dither Modulation.

Keywords: JPEG2000, compression, encryption, watermarking, spread spectrum, scalar costa scheme.

1. INTRODUCTION

The two active areas in academia and industry are multimedia communication and information security. These play a vital cause in the information era. Secure delivery of multimedia data will be possible if we merge these two aspects. Security of data can be achieved by maintaining confidentiality, authenticity and integrity. As a part of assuring these constraints, techniques such as watermarking have been introduced. Encryption is also an important tool in defending digital contents, e.g. in digital rights management (DRM) systems [1]-[4]. While encryption is used to look after the contents from unauthorized access, watermarking can be deployed to serve various other purposes.

Watermarking is a procedure for reducing counterfeiting. Also the multimedia data will be scattered in compressed and encrypted format, so watermarking this content will be a difficult process which is very much necessary for ownership, copyright and authentication purposes. In a DRM system there may be multiple levels of consumers and distributors. The distributors don't have access to the unencrypted data content. Basically distributors are those who issue compressed encrypted content, but at times the distributors will have to watermark the content, and so have to watermark in the compressed encrypted domain.

In this paper we present an approach for watermarking of compressed and encrypted images. A range of watermarking methods has been proposed. Compression plays a key part in the design of watermarking algorithms. For a digital watermarking scheme to be effective, it is vital that an embedded watermark should be robust against compression. JPEG2000 is a new standard for image compression and transmission. JPEG2000 offer both lossy and lossless compression. For encryption it uses RC4 stream cipher. The technique embed watermark in the compressed-encrypted domain and extraction is through the decrypted domain. Watermarking in compressed-encrypted content saves the computational complexity as it does not have need of decompression or decryption, and also conserve the confidentiality of the content.

There have been several related image watermarking techniques proposed to date. In [5], Deng *et al.* projected an efficient buyer-seller watermarking protocol based on composite signal representation specified in [6]. In [7] and [8], a few sub-bands of lower resolutions are preferred for encryption while watermarking the rest of higher resolution sub-bands. In [9], the encryption is performed on most significant bit planes despite the fact of watermarking the rest of lower significant bit planes. Prins *et al.* in [10] projected a robust quantization index modulation (QIM) based watermarking technique, which embeds the watermark in the encrypted domain. In [11] Li *et al.* projected a content-dependent watermarking technique, which embeds the watermark in an encrypted format, although the host signal is still in the plain text format.

2. PROPOSED SCHEME

The projected algorithm works on JPEG2000 compressed code stream. There are five different stages for JPEG2000 compression [12].

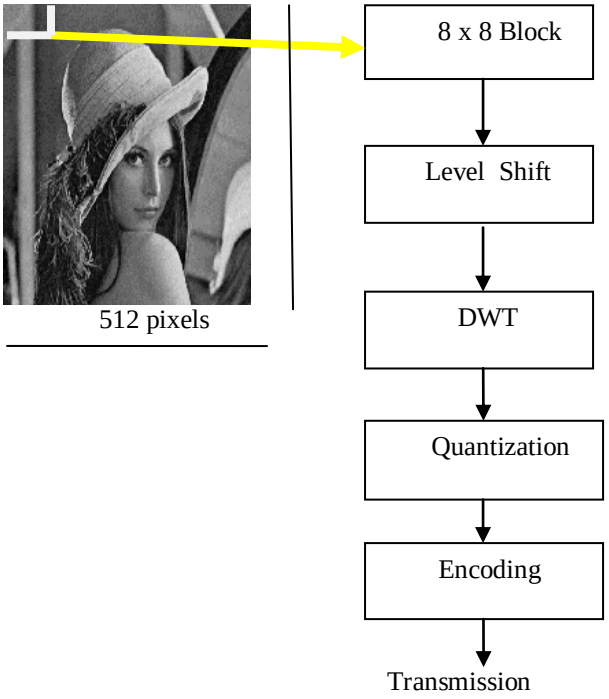

Figure 1. JPEG Algorithm block diagram

In JPEG2000 compression, the complete image is considered as a two-dimensional matrix. In this case, the 'lenna' image is a 512x512 pixels image. The intention of this algorithm is to reduce the number of bits used to signify the image. The procedure for compression is:

Step 1: Divide the entire image into several sub matrices of equal dimensions (8x8 blocks).

Step 2: Level shift the entire image. The image is a grayscale image with each pixel represented by 8 bits. Therefore image is level shifted by 128. Subtracting each element of the entire image by 128. Level shift is done to change the range from [0,255] to [-128,127].

Step 3: Perform DWT transform. The input signal X(n) is decomposed into 2 sets of coefficients cA and cD.

Step 4: Perform quantization or normalization to the matrix. This is done with the help of normalization matrix.

Step 5: Encoding is the final process. This arranges the pattern of coefficients of a block in descending order. The block is transformed from a 2-D matrix to a 1-D array of elements.

Thus, it is likely to select bytes generated from different bit planes of different resolutions for encryption and watermarking. The projected algorithm uses a symmetric stream cipher with additive homomorphic properties for encryption. In actuality the distributors get JPEG2000 compressed stream cipher encrypted images for distribution. The distributors can then pertain any robust additive watermarking technique to this compressed encrypted stream.

2.1 Encryption Algorithm

JPEG2000 gives out M, a packetized byte stream as output. In order to encrypt the message M, we use RC6 encryption scheme. RC6 algorithm has a modified Feistel structure and presented symbolically as RC6-w/r/b. w means 32 bits as the size of word, r denotes the number of round. If the size of block is 128 bits, then r, the number, is 20, b means 16 byte as the number of a key. The operations used in RC6 are defined as followings.

- A+B integer addition modulo 2w
- A-B integer subtraction modulo 2w
- A⊕B bitwise exclusive-or of w-bit words
- A× B integer multiplication modulo 2w
- A⋘B rotation of the w-bit word A to the left by the amount given by the least significant log w bits of B
- A⋙B rotation of the w-bit word A to the right by the amount given by the least significant log w bits of B
- (A,B,C,D)=(B,C,D,A) parallel assignment

The encryption and decryption of RC6 makes cipher text and plain text after carrying out twenty rounds continually with cipher text and plain text in the four storages (A, B, C, and D) per 32bit word.

After doing four words round function, it operates left / right rotate per word with parallel operation as shown in the pseudo code. Furthermore, before and after executing the round functions, it executes round key and add / subtract operations. The foremost security in the round functions is kept by data dependent rotate operation, and the amount of this rotate operation is formed by the fixed 5bit left rotate operation of the quadric, f(x) = x(2x+1).

In decryption operation, the round key of encryption is used with the inverse order. Thus, RC6 has a Feistel structure, however the operation between encryption and decryption is diverse. RC6 does not have a non-linear transformation s-box.

Input: Plain text stored in four w-bit input registers A, B, C, D
Number of r rounds
w-bit round keys S[0,…,2r + 3]
Output: Cipher text stored in A, B, C, D
Procedure: B = B + S [0];
D = D + S [1];
For (i=1; i<r; i++)
{
t = (B × (2B + 1)) ⋘log w;
u = (D× (2D + 1)) ⋘ log w;
A = ((A ⊕ t) ⋘ u) + S [2i];
C = ((C ⊕ u) ⋘ t) + S [2i+1];

```
            (A, B, C, D) = (B, C, D, A);
        }
        A = A + S [2r+2];
        C = C + S [2r+3];
```

Figure 2. RC6 Encryption Algorithm

```
Input: Cipher text stored in four w-bit input registers
        A, B, C, D
        Number of r rounds
        w-bit round keys S[0,…,2r + 3]
Output: Plain text stored in A, B, C, D
Procedure: C = C + S[2r+3];
        A = A + S[2r+2];
        for(i=r; i>=1; i--)
        {
                (A, B, C, D) = (D, A, B, C);
                u = (D × (2D + 1)) ≪ log w;
                t = (B × (2B + 1)) ≪ log w;
                C = ((C – S [2i+1]) ≫ t) ⊕u;
                A = ((A – S [2i]) ≫ u) ⊕ t;
        }
        D = D - S[1];

        B = B - S[0];
```

Figure 3. RC6 Decryption Algorithm

2.2 Embedding Algorithm

The watermark embedding is performed using a robust additive watermarking technique. As the embedding is done in the compressed ciphered byte stream, the embedding position plays a vital role in deciding the watermarked image quality. Hence, for watermarking, we deem the ciphered bytes from the less significant bit planes of the middle resolutions, because inserting watermark in ciphered bytes from most significant bit planes degrades the image quality to a larger extent. Also, the higher resolutions are exposed to transcoding operations and lower resolution contains a lot of information, whose amendment leads to loss of quality.

2.2.1 SS

Hartung et al. in [13] proposed a spread spectrum watermarking scheme. The embedding process is carried out by first generating the watermark signal **W**, by using watermark information bits, chip rate and PN sequence P. For watermarking, an a_j sequence of watermarking bits has to be embedded into the image, a_j = {-1, 1}. The signal is spread by a factor called chip rate, to obtain the spread sequence, $b_{i=} a_j$ where b_i = {1,-1}. The spread sequence is amplified with a locally adjustable amplitude factor and then modulated by a pseudo-noise sequence, Pi. The modulated signal (SS watermark signal)

$$Wi = \alpha * a_j * Pi. \qquad (1)$$

The watermark signal generated is added to the encrypted signal.

2.2.2 SCS-QIM

In [14], Eggers et al. projected SCS scheme for watermark embedding. In this method, given a watermark strength, we choose a quantizer from an group of quantizers to embed the watermark. The quantizer is chosen by:

$$U = (l+ k_{qimi}) \beta\Delta + w \beta\Delta/2 \qquad (2)$$

where w= {0,1} and l is different sets of quantizers . For making the codebook secure a random sequence k_{qimi} can be chosen. The embedding is done by:

$$q_i= Q_\Delta(c_i - \Delta(w_i/2 + k_{qimi})) - (ci-\Delta(w_i/2 + k_{qimi})) , \quad (3)$$

where Q_Δ (.) denotes scalar uniform quantization with step size Δ.

The watermark sequence is given by

$$W=\beta q. \qquad (4)$$

The watermark signal generated is added to the encrypted signal.

2.2.3 RDM

It is based on the quantization of the ratio of the host signal to a function g (.). This scheme was proposed by *Gonzalez et al [15]*. The quantizer is given by

$$Q'\Delta = 2\Delta + w\Delta/2 \qquad (5)$$

w= {-1, 1} is the information that is to be embedded into the host element.

The embedding is done by:

$$c_{wi} = g(c_{wi-1}) Q'\Delta (ci/ g(c_{wi-1})) \qquad (6)$$

where c_{wi} and c_{wi-1} are the current and previous watermarked samples. c_{wi} is an amplitude enhanced version of scaled-quantized . Thus we can write

$$w_i = c_{wi} - c_i \qquad (7)$$

gives the additive nature of watermark. The function g (.) is chosen such that the scheme is robust against amplitude scaling attacks. We scale g (.) by a constant factor S_c known at both encoder and decoder to control the amount of watermark added.

2.3 Watermark Detection

The watermark can be detected either in encrypted or decrypted compressed domain.

2.3.1 SS

The received signal is applied to a detector and then multiplied by the PN sequence, P used for embedding and summing it with chip rate, r.

$$S_{i} = b_i * r * \alpha * \sigma_p^2 \quad (8)$$

$$\text{Sign}(S_i) = b_{i,} \quad (9)$$

resulting in extraction of watermark information bits.

2.3.2 SCS-QIM

The watermark is estimated by quantizing the received signal to the in close proximity data in the code book.

$$\dot{w} = Q_{\Delta}(c_{wi}) - c_{wi} \quad (10)$$

2.3.3 RDM

The watermark is detected by performing minimum distance criterion by means of

$$\dot{w} = \text{argmin}_{(1,-1)} [c_{wi}/g(c_{wi-1}) - Q'\Delta (c_{wi} / g(c_{wi-1}))]^2 \quad (11)$$

Q'Δ give the 2 quantizers belonging to bits 1 and -1. The distance is computed consequent to both the quantizers and the one which gives minimum distance gives the watermark bit.

3. DISCUSSION

3.1 Security of Watermarking Algorithm

The watermarking algorithm is as robust as basic watermarking schemes, i.e., SS, SCS-QIM, and RDM. The attacks can be performed either in encrypted or decrypted compressed domain to regain or wipe out the watermark. The attacks are considered in compressed domain since watermark detection for ownership verification, traitor tracing, or copyright violation detection can straightforwardly be done as the content is often derivative and distributed in compressed layout. The robustness, for SS scheme, against filtering, such as 1 × 5 median filter and scaling attack can be enhanced by increasing the chip rate and estimating the scale factor [14], respectively. However in case of mean and Gaussian filtering, when the watermarked samples are replaced by the prediction made from the neighboring samples, the replaced samples may be very different compared to the unfiltered watermarked samples. This is due to the fact that the watermarked samples are uncorrelated and the calculation from the neighboring samples may not be a good approximation of the unfiltered watermarked samples. Thus, it leads to the addition of vast amount of noise to the watermarked samples which may be complex to eliminate and the detection performance is not effective. Further, SCS-QIM and RDM are not robust against filtering attack.

3.2 Effect of Scaling in RDM Detection

In case of watermarking by means of RDM, the quantity of watermark power embedded varies to a vast level due to varying quantization step size. Towards this, Abrardo et al. projected a watermarking design using trellis coded quantization [16]. Though, it still uses the function g (.) which might not perk up the watermarked quality when g (.) itself varies vastly. To prevail over this downside, we scale the step size or the function g (.), to suppress this high variation. Also, the watermark power can be controlled using the preferred scale. On the other hand, we are concerned in dealing with the impact of scaling on detection performance. The quantization of signal c_i with the quantizer Q'Δ can be written as Q'Δ (ci. Δ). When message c_i is scaled with a constant Sc, then we have

$$Q'\Delta(ci,\Delta / Sc) = 1/Sc\ Q'\Delta(Sc\ ci\ ,\ \Delta) \quad (12)$$

Consequently the properties of both the quantizers alter equivalently and as S_c is known, it does not impact the detection performance.

3.3 Security of Encryption Algorithm

A main objective of RC6 is simplicity. By keeping the cipher structure simple, it becomes accessible to a larger set of people for evaluation. The simplistic structure also plays a part in performance and security. The security of the cipher is amplified by the simple structure. For instance, the rate of diffusion is improved by several simple steps in the round: integer multiplication, the quadratic equation, and fixed bit shifting. The data-dependent rotations are improved, as the rotation amounts are determined from the high-order bits in *f(x)*, which in turn are dependent on the register bits. RC6 security has been evaluated to possess an "adequate security margin"; this rating is given with familiarity of theoretical attacks, which were devised out of the multiple evaluations. The AES-specific security evaluations provide ample breadth and depth to how RC6 security is affected by the simplicity of the cipher.

4. CONCLUSION

In this paper we propose a fresh technique to embed a robust watermark in the JPEG2000 compressed encrypted images using three different existing watermarking schemes. The algorithm is simple to put into service as it is directly performed in the compressed-encrypted domain, i.e., it does not involve decrypting or partial decompression of the content. Our proposal also preserves the confidentiality of content as the embedding is done on encrypted data. The homomorphic property of the cryptosystem is exploited, which allows us to detect the watermark after decryption and manage the image quality as well. The detection is carried out in compressed or decompressed domain. In case of decompressed domain, the non-blind detection is used. The research highlights are:

- The paper proposes a better compression method.

- The method uses three watermarking techniques.
- The paper uses RC6 encryption technique.
- The method can be extended to video with modifiying the method.

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Visual Image Quality Assessment Technique using FSIM

Rohit Kumar
Csvtu bhilai
Sscet bhilai
India

Vishal Moyal
Csvtu bhilai
Sscet bhilai
India

Abstract: The goal of quality assessment (QA) research is to design algorithms that can automatically assess the quality of images in a perceptually consistent manner. Image QA algorithms generally interpret image quality as fidelity or similarity with a "reference" or "perfect" image in some perceptual space**.** In order to improve the assessment accuracy of white noise, Gauss blur, JPEG2000 compression and other distorted images, this paper puts forward an image quality assessment method based on phase congruency and gradient magnitude. The experimental results show that the image quality assessment method has a higher accuracy than traditional method and it can accurately reflect the image visual perception of the human eye. In this paper, we propose an image information measure that quantifies the information that is present in the reference image and how much of this reference information can be extracted from the distorted image.

Keywords: Image quality assessment (IQA), structural similarity index (SSIM), feature similarity index (FSIM),phase congruency (PC), gradient magnitude(GM),low level feature

1.INTRODUCTION

Image quality assessment is an important study topic in the image processing area. Image quality is a fundamental characteristic of any image which measures the perceived image degradation .Generally, compared with an ideal or perfect image. Digital images are subject to a wide variety of distortions during acquisition, processing, compression, storage, transmission and reproduction, any of which may result in a degradation of visual quality. Imaging systems introduces some amount of distortion or artifacts which reduces the quality assessment and here it is our point of interest.

By defining image quality in terms of a deviation from the ideal situation, quality measures become technical in the sense that they can be impartially determined in terms of deviations from the ideal models.

Generally speaking, visual quality assessment can be divided into two categories one is subjective visual quality assessment and another one is objective visual quality assessment.

Subjective quality assessment is done by humans which represents the realistic opinion towards an Image. Image quality objective assessment uses the mathematical model to quantitative the assessment index and simulates human visual perception system to assess the image quality. Common image quality objective assessment indexes include PSNR (Peak Signal to Noise Ratio), SSIM (Structural Similarity), and FSIM (Feature-Similarity). Based upon the Availability of Reference Objective quality assessment is classified as no reference (NR),reduced reference(RR),full reference(FR)[1]methods. If there is no reference signal available for the distorted (test) one to compare with, then a quality evaluation method is termed as a No-reference (NR).If the information of the reference medium is partially available, e.g., in the form of a set of extracted features, then this is the so-called Reduced-Reference (RR) method**.** FR method needs the complete reference medium to assess the distorted medium. Since it has the full information about original medium,

it is expected to have the best quality prediction performance. Most existing quality assessment schemes belong to this category.

The following are implemented for image quality assessment algorithms as Mean square error (MSE), peak signal to noise (PSNR), structural similarity index (SSIM), feature similarity index (FSIM). Mean Squared Error is the average squared difference between a reference image and a distorted image. It is computed pixel-by-pixel by adding up the squared differences of all the pixels and dividing by the total pixel count. Peak Signal-to-Noise Ratio is the ratio between the reference signal and the distortion signal in an image, given in decibels. The higher the PSNR, the closer the distorted image is to the original SNR(Peak signal to noise).The simplest and most widely used image quality metrics are MSE and PSNR since they are easy to calculate and are also mathematically convenient in the context of optimization. However, they often correlate poorly with subjective visual quality. PSNR has always been criticized its poor correlation with human subjective evaluations. However according to our observations , PSNR sometimes still can work very well on some specific distortion types, such as additive and quantization noise. The structural similarity (SSIM) index is a method for measuring the similarity between two images. SSIM attempts to measure the change in luminance, contrast, and structure in an image [2-4]. The multi-scale extension of SSIM, called MS-SSIM [5], produces better results than its single-scale counterpart. Recent studies conducted in [6] and [7] have demonstrated that SSIM, MS-SSIM, and VIF could offer statistically much better performance in predicting images' fidelity than the other IQA metrics. However, SSIM and MS-SSIM share a common deficiency that when pooling a single quality score from the local quality map (or the local distortion measurement map), all

positions are considered to have the same importance. Feature similarity indexing maintains IQA (image quality assurance) based on the fact that human visual system (HVS) understands an image mainly according to its low-level features. The main feature of FSIM is phase congruency which is a dimensionless measure of a local structure. Actually, PC has already been used for IQA in the literature. In [8], Liu and Laganière proposed a PC-based IQA metric. In their method, PC maps are partitioned into sub-blocks of size 5×5. Then, the crosscorrelation is used to measure the similarity between two corresponding PC sub-blocks. The overall similarity score is obtained by averaging the cross correlation values from all block pairs. In [9], PC was extended to phase coherence which can be used to characterize the image blur. Based on [8], Hassen et al. proposed an NR IQA metric to assess the sharpness of an input image [10].Due to phase congruency the contrast of the image will affect Human visual system but the secondary feature of FSIM which is gradient magnitude control perception of image quality. Phase congruency and Gradient Magnitude play complementary roles in characterizing the image local quality and derive a single quality score.

2. DESIGN METHODOLOGY

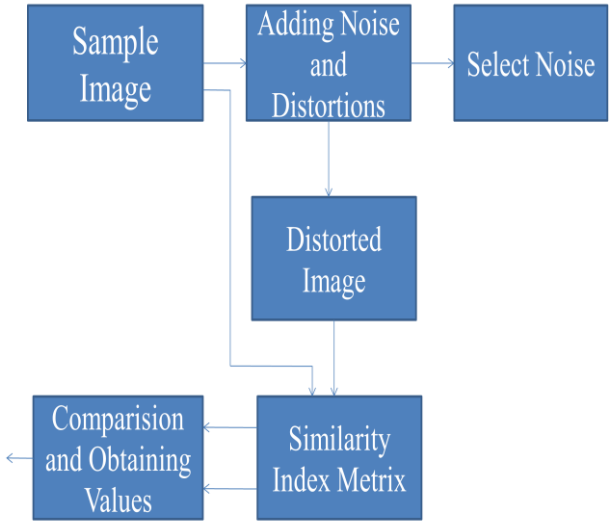

Fig. 1: Block diagram of proposed method

3.FEATURE SIMILARITY INDEXING

In this work, a full reference IQA is proposed based on the fact that human visual system (HVS) understands an image mainly according to its low-level features. The primary feature for this is the phase congruency (PC), which is a

dimensionless measure of the significance of a local structure, the image gradient magnitude (GM) is employed as the secondary feature . PC and GM play complementary roles in characterizing the image local quality and derive a single quality score.

3.1 Phase Congruency (PC)

Phase congruency is a new method for detecting features in images. One of its significant strengths is its invariance to lighting variation within an image, as well as being able to detect a wide range of interesting features. We present a method for estimating the phase congruency of localized frequencies that cannot be measured separately by Gabor filters. We show that by measuring the ratio of the standard deviation to the mean energy between different phase shifted Gabor filters that we are able to estimate whether the localised frequencies are phase congruent. Phase congruency reflects the behaviour of the image in the frequency domain. PC is contrast invariant while the contrast information does affect HVS' perception of image quality. We describes a new corner and edge detector [12-14] developed from the phase congruency model of feature detection[11].

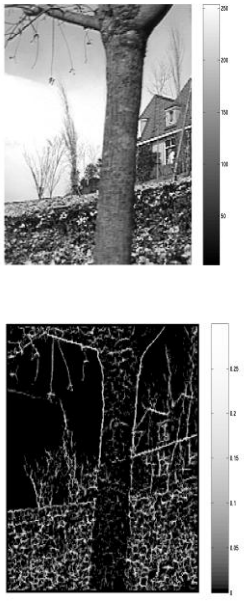

Fig. 2: (a) Original image (b) localized frequency based phase congruency

In this paper we adopt the method developed from the 1D signal I(x). Here M_n^e and the M_n^O are the even-symmetric and odd-symmetric filters on scale n and they form a quadrature pair. The signal will form a response vector at position x on scale n: $[e_n(x), o_n(x)] = [I(x)* M_n^e , I(x)*M_n^o]$, and the local amplitude on scale n is $A_n(x) = \sqrt{e_n(x)^2 + o_n(x)^2}$

Let $V(x) = \sum_n e_n(x)$ and $H(x) = \sum_n o_n(x)$ …(1)

Then phase congruency is given by

$$PC(x) = \frac{E(x)}{\in + \sum_n A_n(x)}$$

Where $E(x) = \sqrt{V^2(x) + H^2(x)}$

and ε is a small positive constant. We adopt the log-Gabor filters because:

1) Log-Gabor filters can be constructed with arbitrary bandwidth and the bandwidth can be optimised to produce a filter with minimal spatial extent.

2) log-Gabor functions, by definition, always have no DC component.

3) The transfer function of the log-Gabor filter has an extended tail at the high frequency end, which makes it more capable to encode natural images than ordinary.

3.2 Gradient magnitude (GM)

Image gradient computation is a traditional topic in image processing. Gradient operators can be expressed by convolution masks. Three commonly used gradient operators are the Sobel operator, the Prewitt operator and the Scharr-operator. Their performances will be examined in the section of experimental results. The partial derivatives $G_x(y)$ and $G_y(y)$ of the image f(y) along horizontal and vertical directions using the three gradient operators are used. The gradient magnitude (GM) of f(y) is then defined as $\sqrt{G_x^2 + G_y^2}$

3.3 FSIM algorithm

With the extracted PC and GM feature maps, in this section we present a novel Feature Similarity (FSIM) index for IQA. Suppose that we are going to calculate the similarity between images f_1 (test image) and f_2 (original image) denote by

PC_1 and PC_2. The Phase Congruency maps extracted from $f_1(x)$ and $f_2(x)$, and $G_1(x)$ and $G_2(x)$ the Gradient Magnitude maps extracted from them. It should be noted that for color images, Phase Congruency and Gradient map features are extracted from their luminance channels. FSIM will be defined and computation based on $PC_1(x)$, $PC_2(x)$, $G_1(x)$ and $G_2(x)$. Furthermore, by incorporating the image chrominance information into FSIM, an IQA index for color images or gray scale image, denoted by $FSIM_C$, will be obtained.

First we calculate the score of $PC_1(x)$ and $PC_2(x)$ and the similarity measure is defined as

$$S_{PC}(x) = \frac{2PC_1(x).PC_2(x) + T_1}{PC_1^2(x) + PC_2^2(x) + T_1} \quad \text{…….(2)}$$

Where T_1 is a positive constant to increase the stability of S_{PC}. In practice, T_1 can be determined based on the dynamic range of PC values. Equation shows commonly used measure to define the similarity of two positive real numbers and its result ranges within (0, 1].

Similarly, the GM values $G_1(x)$ and $G_2(x)$ are compared and the similarity measure is defined as

$$S_G(x) = \frac{2G_1(x).G_2(x) + T_2}{G_1^2(x) + G_2^2(x) + T_2} \quad \text{…….(3)}$$

Where T_2 is a positive constant depending on the dynamic range of GM values. In our experiments, both T_1 and T_2 will be fixed to all databases so that the proposed FSIM can be conveniently used. Then, $S_{PC}(x)$ and $S_G(x)$ are combined to get the similarity $S_L(x)$ of $f_1(x)$ and $f_2(x)$. We define $S_L(x)$ as

$$S_L(x) = [S_{PC}(x)]^{\alpha} . [S_G(x)]^{\beta} \quad \text{…….(4)}$$

Where α and β are parameters used to adjust the relative importance of PC and GM features. In this paper, we set α = β =1 for simplicity.

Thus $S_L(x) = [S_{PC}(x)].[S_G(x)]$.

4. EXPERIMENTAL RESULTS AND DISCUSSION

A. Databases and methods for comparison

There are some publicly available image databases in the IQA community, including TID2008, CSIQ, LIVE and A57. All of them will be used here for algorithm validation and comparison. The performance of the proposed FSIM and $FSIM_C$ indices will be evaluated and compared with four representative IQA metrics. Four commonly used performance metrics are employed to evaluate the competing IQA metrics.

B. Determination of parameters

There are several parameters need to be determined for FSIM and $FSIM_C$. To this end, we tuned the parameters based on a sub-data set of TID2008 database, which contains the first 8 reference images in TID2008 and the associated 544 distorted images.

C. Gradient operator selection

Table 1: SROCC values using three gradient operators

Database	SROCC
Sobel	0.8797
Prewitt	0.8776
Scharr	0.8825

In our proposed IQA metrics FSIM/$FSIM_C$, the gradient magnitude (GM) needs to be calculated. To this end, three commonly used gradient operators were examined, and the one providing the best result was selected. Such a gradient operator selection process was carried out by assuming that all the parameters discussed earlier. The selection criterion was also that the gradient operator leading to a higher SROCC would be selected.

5. CONCLUSION

In this paper, we proposed a novel efficient and effective IQA index, FSIM, based on a specific visual saliency model. FSIM is designed based on the assumption that an image's visual saliency map has a close relationship with its perceptual quality. Experimental results indicate that FSIM could yield statistically better prediction performance than all the other competing methods evaluated. Thus, FSIM can be the best candidate of IQA indices for real time applications.

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Power Optimization Technique for Sensor Network

M.Nemaraj
Department of ECE
Ganadipathy Tulsi's Jain
Engineering College
Vellore, Tamilnadu,
India

V.Jayaprakasan
Department of ECE
Ganadipathy Tulsi's Jain
Engineering College
Vellore, Tamilnadu,
India

V.Senthil Kumar
Department of ECE
Ganadipathy Tulsi's Jain
Engineering College
Vellore, Tamilnadu,
India

ABSTRACT: In this paper different power optimization techniques for wireless sensor network is proposed and compared. The energy conservation in a wireless sensor network is of great significance and very essential. The nodes in a wireless environment are subject to less transmission capabilities and limited battery resources. There are several issues that constrain the WSNs and challenges posed by the environment of handling traffic and the lifetime of the battery in the nodes. The battery of node is energy limited and is not convenient to be replaced by the restriction of circumstance. But we have to ensure that even the slightest of energy is utilized and the overall power conserved in a wireless environment is greatly reduced. This paper aims to reduce the power conservation in a wireless sensor network using Dijkstra's algorithm, with a set of optimal path and available idle nodes.

Keywords: wireless sensor network, Dijkstra's algorithm, optimal path, idle nodes

1. INTRODUCTION

Wireless sensor networks are a trend of the past few years, and they involve deploying a large number of small nodes. The nodes then sense environmental changes and report them to other nodes over flexible network architecture. Sensor nodes are great for deployment in hostile environments or over large geographical areas. This article will introduce basic concepts and architecture of sensor networks to familiarize you with their issues usage of sensor networks has been useful in a variety of domains. The primary domains at which sensor are deployed in Environmental observation, Military monitoring, Building monitoring, Healthcare.

Sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight and portable. Every sensor node is equipped with a transducer, microcomputer, transceiver and power source. The transducer generates electrical signals based on sensed physical effects and phenomena. The factors of sensor networks is bandwidth, battery power, memory, speed, cost, type of data, delay etc. Therefore the battery power required to transmit the data from source to destination may also vary since the power consumed is directly proportional to the distance between the source and destination. A node can easily transmit data to a distant node, if it has sufficient battery power. A node transmits its data to other node without any interference, if node lies in its vicinity. A large battery power is required to transmit the data to a node which is situated too far from source node. After few transmissions a node reaches to its threshold battery level and it may exclude from network path. After some time all the nodes may not be available during data transmission and the overall life time of the network may decrease.

In an energy management model which considers all possible radio operation modes is considered. In such model, each mobile node can be in one of two modes, i.e. active mode (AM) and power-save mode (PS). In active mode, a node is awake and may receive data at any time[1]. In power-save mode, a node is sleeping most of the time and wakes up periodically to check for pending messages. Transitions between power-save and active mode are triggered by packet arrivals and expiration of the keep alive timer.

Sub-state transitions inside power-save or active mode are controlled by the IEEE 802.11 MAC protocol. In such protocol, time is divided into beacon intervals for energy saving. At the beginning of each beacon interval there exists a specific time interval, called the Ad-hoc traffic indication message (hereafter referred as ATIM) window where every node is awake. When a node has a packet to transmit, it first transmits an ATIM frame to the destination node during the ATIM window. When the destination node receives the ATIM frame, it replies with an ATIM ACK. After the ATIM and ATIM ACKB handshake. Both the source and the destination will stay awake for the remaining beacon interval to perform the data transmission [1].

A node that has not transmitted or received an ATIM frame during the ATIM window may enter the sleep state after finishing its ATIM window. Since the performance of energy saving is significantly affected by the size of the ATIM window, Jung and Vaidya propose the idea of NPSM (i.e., New Power Saving Mechanism) and removes the ATIM window in order to reduce control overhead in. Using such mechanism time is still divided into beacon intervals. At the start of a beacon interval, every node enters an awaked state for a specified duration called DATA window [2]. The DATA window can be considered analogous to the ATIM window as mentioned above since every node is awake during the DATA window.

However, nodes transmit data packets during the DATA window without any ATIM or ATIM ACK transmission. NPSM has a different way to announce pending packets to destination nodes. While a path in the network is going to be used the nodes along that path should be awake quickly so as to avoid unnecessary delay for data transmission. On the contrary, the nodes should be allowed to sleep for energy saving. Since many control messages are flooded throughout

the network and provide poor hints for the routing of data transmissions, they will not trigger a node to stay in active mode.

However the data transmissions are usually bound to a path on relatively large time scales and they are a good hint for guiding energy management decisions. For data packets, the keep-alive timer should be set on the order of the packet inter-arrival time to ensure that nodes along the path do not go to sleep during active communication. There are also some controls messages such as route reply messages in on-demand routing protocols that provide a strong indication that subsequent packets will follow this route. Therefore such messages should trigger a node to switch to active mode.

The neighbor's power mode can be discovered in two ways. The first way is through explicit local HELLO message exchanges with piggybacked information about the energy management mode of a node. HELLO messages should be transmitted at fixed intervals regardless of the mode of a node. Link failure is assumed if no HELLO messages have been received during successive intervals, since the loss of only one HELLO message may have been caused by a broadcast collision. Another way is via passive inference. Compared to using HELLO messages, passive inference does not rely on additional control messages, which is more desirable from an energy conservation perspective. In the model, the passive inference is used to update neighbor's modes and link states.

Depending on the capability of the hardware and the MAC protocol, a node may be able to operate in promiscuous mode and passively snoop messages in the air. With MAC layer support, a node's energy management mode can be piggybacked in the control header of MAC layer data units. Note that nodes in power-save mode cannot hear messages from their neighbors and so do not have a good basis for determining the mode of their neighbors. Furthermore, nodes in power-save mode may not be transmitting and so their neighbors will have difficulty differentiating nodes that are in power-save mode from nodes that are away or dead. Thus, two types of indicators are used for such passive inference.

The first indicator is a lack of communication during a time interval. When no communications have been observed from a node that was in active mode, the neighbor is assumed to be in power-save mode. The other indicator is packet delivery failure to the neighbor. Entries for unreachable neighbors will be purged periodically. In Position based & On-Demand Energy models, the algorithm that gives a routing path to satisfy optimal energy consumption by using the objective function and the constraint are proposed[5]. Position-based routing algorithms usually use localized nodes. What is meant by saying "localized" is that nodes determine their positions using Global Positioning System [1]. The cost value C in graph G (V, C) can be the distance between nodes for that kind of algorithms. Each and every node can learn its neighbor's position via HELLO packets retrieved. So, it can easily calculate the distance using Equation (1) below.

$$d_{i,j} = \sqrt{(x_j - x_i)^2 + (y_j - y_i)^2 + (z_j - z_i)^2} \quad (1)$$

(x, y, z) values in Equation (1) are the values obtained from GPS and they are latitude, longitude, and altitude respectively.

2. PROPOSED WORK

Wireless sensor network is infrastructure less network. Communication in such type of network is either single hop or multi hop. A node can transmits or receive data to & from a node which lies in its vicinity. A node can transmit data to a longer distance if it has sufficient energy level. In wireless sensor network a node is not only transmitting its own data but it also forward data of other nodes. Resources available in at a node may halt the data transmission either temporarily or permanently.

All the nodes in the wireless sensor network are battery operated and the life time of the network is depends upon the available battery power of a node A node after data transmission may reach to a threshold level. If the battery power of a node reaches to threshold value, then node is not in position to either accept the data or send the data to other nodes in the network. It is known that the power required to transmit data from a source to destination node is directly proportional to the distance between the two nodes [4].

Thus for a destination which is located far away from the source, direct transmission of data from source to destination will conserve a tremendous amount of source power. In such cases we have to find an optimal power conservation methodology which can solve this crisis. The power consumed for data transmission among the nodes is given by the formula:

$$E(d) = ad^{\alpha} + c \quad (2)$$

Where 'a' is a parameter related to the information, 'd' is the distance between two nodes, constant 'c' represents the energy consumption of information processing and path loss index α relates to the propagation model, usually is set to 2 to 4. From equation 1 it is clear that the value of 'd' i.e. the distance between the source and destination increases, the power consumed will increase accordingly. It is also founded that if the number of nodes in between the source and destination are increased, they can be part of the communication between source and destination thus reducing the overall power required for transmission.

Proof:

Let us consider the following two scenarios:

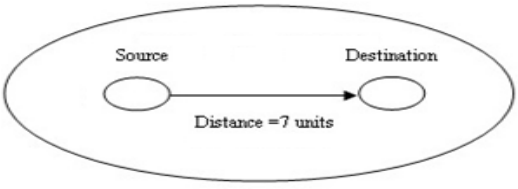

Figure 1: Transmission from source to destination without Intermediate Node

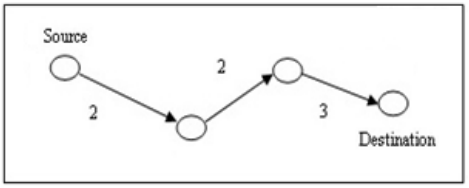

Figure 2: Transmission of data from source to destination through Intermediate Nodes.

Now, let us analyze the power consumed in both the cases. Let α =2 be the path loss index. Since we consider the same environment and the same information to be passed in both the scenarios, we can consider the values of a and c to be a constant (say k).In the first scenario the power consumed is E(d)= 72 + k units i.e 49 + k units. But in the second scenario it can easily be found that E(d) = (22 + 22 +32)+ k units i.e 17 units. Thus it is evident that as the number of intermediate nodes increases, the power consumed at the source will be greatly reduced. It is also of interest that the maximum level of power conservation is achieved with a single intermediate node, if its placed exactly at the centre of the source and destination. But in actual scenario, all intermediate nodes may not satisfy this principle. Hence we use available intermediate nodes which form a shortest power consumed path with the source and the destination.

2.1 Shortest Power Consumed Path

A number of intermediate nodes may be available between a source and destination. But all of these nodes cannot be used for data transmission. Some nodes may be having very limited amount of power left, some nodes may be performing data transmission by itself and may not be currently available, while some nodes may be inactive. Hence a set of nodes should be selected such that they form a path from source to destination and this is the optimal power consumed path. There may be different paths which are available between the source and destination but all of them may not yield the shortest power consumption. Hence it is very important to identify the shortest power consumed path. In the proposed method, we find the shortest power consumed path using Dijkstra's algorithm in which each edge represents the power required for data transmission among the respective nodes.

2.2 Dijkstra's Algorithm

Let the node at which we are starting be called the initial node. Let the distance of node Y be the distance from the initial node to Y.[3] Dijkstra's algorithm will assign some initial distance values and will try to improve them step by step.

a) Assign to every node a tentative distance value: set it to zero for our initial node and to infinity for all other nodes.

b) Mark all nodes unvisited. Set the initial node as current. Create a set of the unvisited nodes called the unvisited set consisting of all the nodes except the initial node.

c) For the current node, consider all of its unvisited neighbors and calculate their tentative distances. For example, if the current node A is marked with a tentative distance of 6, and the edge connecting it with a neighbor B has length 2, then the distance to B (through A) will be 6+2=8. If this distance is less than the previously recorded tentative distance of B, then overwrite that distance. Even though a neighbor has been examined, it is not marked as visited at this time, and it remains in the unvisited set.

d) When we are done considering all of the neighbors of the current node, mark the current node as visited and remove it from the unvisited set. A visited node will never be checked again; its distance recorded now is final and minimal.

e) If the destination node has been marked visited (when planning a route between two specific nodes) or if the smallest tentative distance among the nodes in the unvisited set is infinity (when planning a complete traversal) then stop. The algorithm has finished.

f) Set the unvisited node marked with the smallest tentative distance as the next "current node" and go back to step 3.

2.3 Idle Node Effect

Idle nodes are nodes which are inactive at present i.e they do not perform any actions such as sending or receiving data or are part of any listening process. They can be considered to be in a sleeping mode and such nodes can be rightly termed as 'Sleeping Nodes'. Since idle nodes are not part of any data transmission process they are not spending any of their energy. Therefore such nodes can be considered for being a member of our data transmission procedure. All idle nodes should be identified and based on their available energy they can be considered as a candidate for participating in our data transmission.

2.4 Sleep & Wake Up

Just like a semaphore in an operating system, the sleep and wakeup concept can be implemented in a Wireless environment. Here we consider all nodes participating in data transmission to be currently active nodes. Once the data transmission is over, these nodes may not be having any functions to perform. So such nodes can go off to a sleep mode, where practically negligible power is consumed. Whenever, these nodes are identified to be a part of an optimal power consumed path, a wakeup signal can be send by the source node to make the node aware that it has to switch from inactive or sleeping mode to the active mode. However it should be ensured that all sleeping nodes are activated before the start of data transmission since sleeping nodes cannot receive any data or transmit them. Thus it may lead to loss of data. So such a situation should be avoided in prior to data transmission.

3. PROPOSED ALGORITHM

Find the distance between each pair of nodes in the network scenario and find the Vicinity of each node.

a) Calculate the power required, E (d) for data transmission without intermediate nodes.

b) Using network topology finds all the edges and vertices; Vertices are the wireless nodes, denoted by the set {V} and an edge eijis present if node 'j' is in the vicinity of node 'i', for all i, j ε {V}

c) Each edge is marked with the power required for data transmission between the vertices to which the edge belongs to.

d) Apply Dijkstra's algorithm with 'power' as the matrix and find the minimal power consumed path from source to destination.

e) If there are any sleeping nodes in the path, send wakeup signals and alert them to be ready for data transmission

f) Remove any node from the optimal path if its current battery power is less than that required for transmission.

g) Once all nodes are ready, start data transmission.

h) After the entire data transmission, set all intermediate nodes to Sleep Mode.

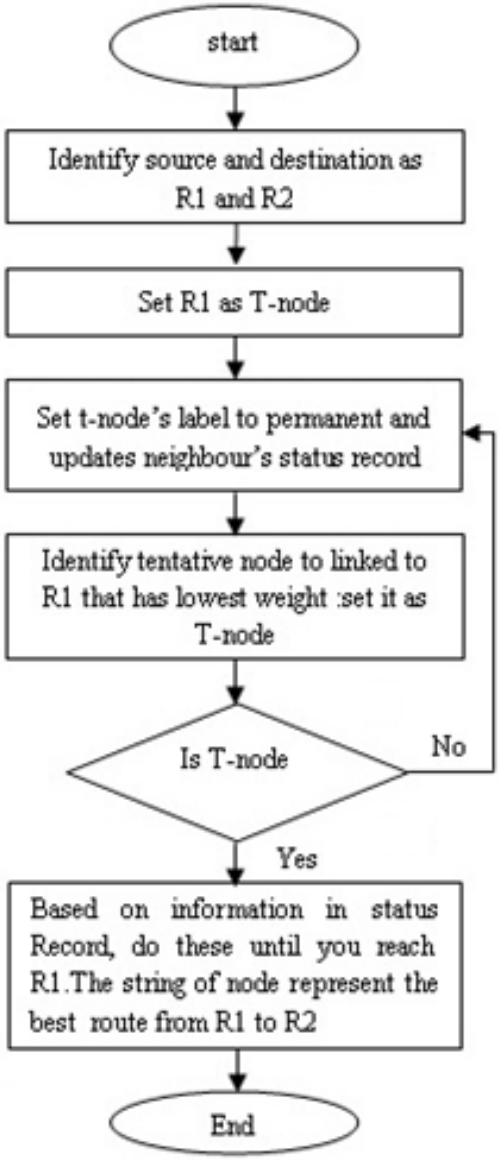

Figure.3 Flow Chart to find shortest path using Dijkstra's algorithm

4. SIMULATION RESULT

In the MATLAB a random network of 100 nodes was created and Dijkstra's algorithm is applied to network the nodes are in different energy level green, yellow, red green shows above 40% energy ,yellow shows below 40% energy and red shows the node is death . Band width used for radio device is taken as 2 Mbps. Dimension of the data packet is constant and it is 512 Byte. 5 flows of CBR traffic is generated It is assumed that the coverage area of the nodes is 100 m. Path loss constant (α) is 2.

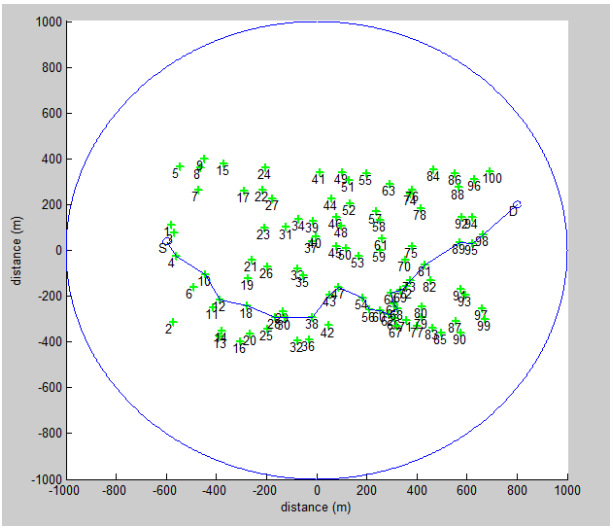

Figure.4 Randomly arranged nodes (100 nodes) with full energy level

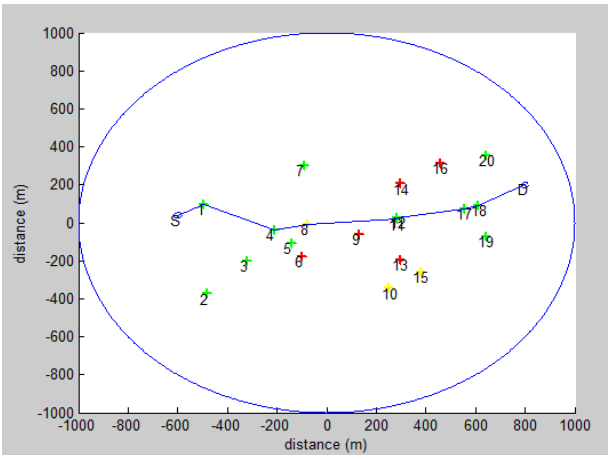

Figure.5 Nodes in different energy level

GREEN NODES :=> 40% ENERGY

YELLOW NODE: =< 40% ENEGRY

RED NODE: = OUT OF ENEGRY

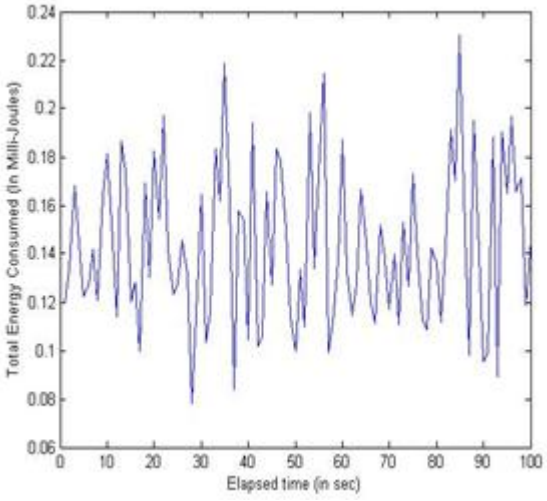

Figure.6 Energy consumed Vs Elapsed time

The fig.6 show the sensor device used maximum energy is 0.23 mill-joules/sec The optimal path shows the number nodes are used for source to destination

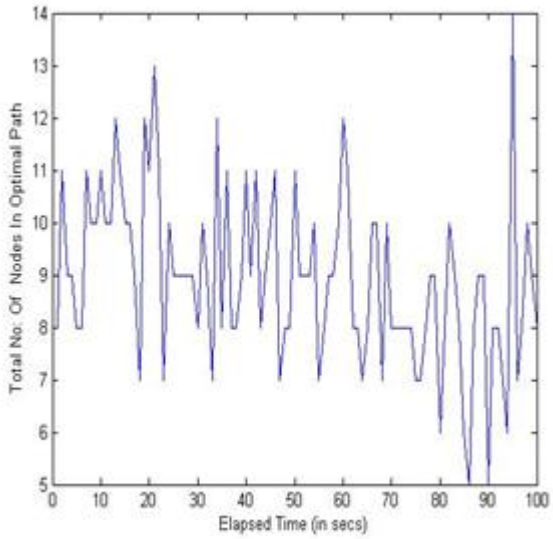

Figure.7 Total optimal path

4.1 Modified Dijkstra

Modify Dijkstra algorithm such that if there is more than one shortest path between node 'u' and 'v', dijkstra would select the shortest path with minimum nodes. For example if we can reach from 'u' to 'v' in cost 'S' in two different path (for example u-p-q-r-v and u-a-v both with same cost S) then our modified algorithm should select path u-a-v because it has minimum path weight as well as minimum node in between u and v. We would only modify the RELAX (u,v,w) function in the original Dijkstra algorithm. Here nc [V] means the smallest count of nodes between source (S) and corresponding node (V). We will initialize nc[s] = 0 for the algorithm.

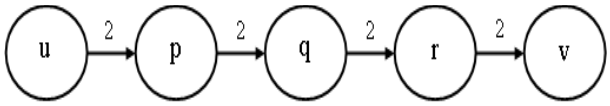

Figure.8 Path one

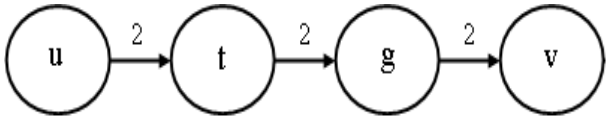

Figure.9 Path two

From the fig.8 & fig.9 both paths have a same source u and destination v point. cost value also same but the number of node is less in path two then the path one so modified dijkstra algorithm choose the path two for the shortest distance. from the table.1 shows the energy and optimal path variation. For dijkstra and modified dijksta algorithm.

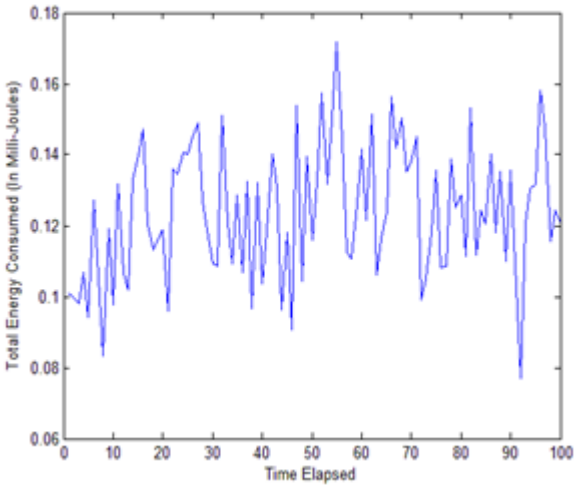

Figure.10 Energy consumed Vs Elapsed time for modified dijkstra

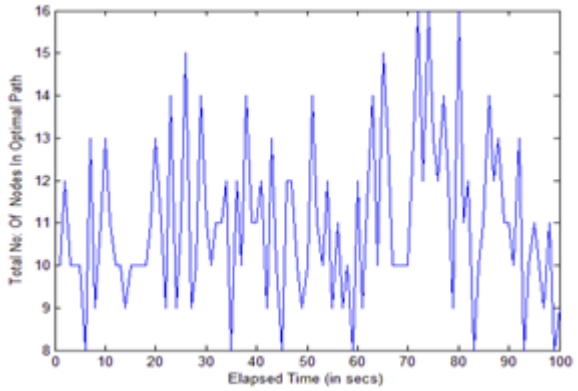

Figure.11 Total optimal path by modified dijkstra

Table.1 Comparison Table for Algorithm

S.No	Algorithm	Maximum Energy In Mili Joules	Maximum Optimal Path
1	DIJKSTRA	0.23(MJ)	14
2	MODIFIED DIJKSTRA	0.18(MJ)	16

5. CONCLUSION

The algorithm is intended to find the optimal power path in an sensor network environment using the concept of idle nodes and considering the application of Dijkstra's algorithm. The proposed algorithm optimizes energy consumption of nodes and minimizes total energy consumption. Such a network lives longer than the others.

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7. AUTHORS' PROFILE

M.Nemaraj received his Bachelor's Degree in Electronics and Communication Engineering from Anna University, Chennai, India in the year 2011. Presently he is pursuing Master Degree in Computer and Communication Engineering in Anna University, Chennai, India. His areas of interest are Wireless communication

V.Jayaprakasan received his Bachelor's Degree in Electronics and Communication Engineering from Bharadhidasan University, Tiruchirappalli, India in the year 1999 and Master's Degree in Communication Systems from Anna University, Chennai, India in the year 2006. He has started his teaching profession in the year 2006 in Ganadipathy Tulsi's Jain Engineering College, Vellore, Tamilnadu, India. Earlier he has 11 years industrial experience in an electronics based industry. Presently he is a Professor in Electronics and Communication Department. He has published 4 research papers in International Journals and 2 research papers in International Conferences. His areas of interest are Wireless communication, Networking and Signal Processing. He is a life member of ISTE.

V.Senthil Kumar received his Bachelor's Degree in Electronics and Communication Engineering from Madurai Kamaraj University, Madurai, India in the year 2000 and Master's Degree in Applied Electronics from Madras University, Chennai, India in the year 2002. Presently he is a Assistant Professor in Electronics and Communication Department in Ganadipathy Tulsi's Jain Engineering College, Vellore, Tamilnadu, India.. Earlier he has 10 years teaching experience in various institutions in Tamil Nadu. His areas of interest are Communication and Networking.

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Random Valued Impulse Noise Elimination using Neural Filter

R.Pushpavalli
Pondicherry Engineering College
Puducherry-605 014
India.

G.Sivaradje
Pondicherry Engineering College
Puducherry-605 014
India.

Abstract: A neural filtering technique is proposed in this paper for restoring the images extremely corrupted with random valued impulse noise. The proposed intelligent filter is carried out in two stages. In first stage the corrupted image is filtered by applying an asymmetric trimmed median filter. An asymmetric trimmed median filtered output image is suitably combined with a feed forward neural network in the second stage. The internal parameters of the feed forward neural network are adaptively optimized by training of three well known images. This is quite effective in eliminating random valued impulse noise. Simulation results show that the proposed filter is superior in terms of eliminating impulse noise as well as preserving edges and fine details of digital images and results are compared with other existing nonlinear filters.

Keywords: Feed forward neural network; Impulse noise; Image restoration; Nonlinear filter.

1. INTRODUCTION

The image corrupted by different types of noises is a frequently encountered problem in image acquisition and transmission. The noise comes from noisy sensors or channel transmission errors. Several kinds of noises are discussed here. The impulse noise (or salt and pepper noise) is caused by sharp, sudden disturbances in the image signal; its appearance is randomly scattered white or black (or both) pixels over the image. Digital images are often corrupted by impulse noise during transmission over communication channel or image acquisition. In the early stages, many filters had been investigated for noise elimination [1-3]. Majority of the existing filtering methods, compromise order statistics filters utilizing the rank order information of an appropriate set of noisy input pixels. These filters are usually developed in the general framework of rank selection filters, which are nonlinear operators, constrained to an output of order statistic from a set of input samples.

The standard median filter is a simple rank selection filter and attempts to remove impulse noise from the center pixel of the processing window by changing the luminance value of the center pixel with the median of the luminance values of the pixels contained within the window. This approach provides a reasonable noise removal performance with the cost of introducing undesirable blurring effects into image details even at low noise densities. Since its application to impulse noise removal, the median filter has been of research interest and a number of rank order based filters trying to avoid the inherent drawbacks of the standard median filter have been investigated [4-7]. These filters yield better edges and fine detail preservation performance than the median filter at the expense of reduced noise suppression.

Conventional order statistics filters usually distort the uncorrupted regions of the input image during restoration of the corrupted regions, introducing undesirable blurring effects into the image. In switching median filters, the noise detector aims to determine whether the center pixel of a given filtering window is corrupted or not. If the center pixel is identified by the noise detector as corrupted, then the output of the system is switched to the output of the noise filter, which has the restored value for the corrupted pixel. if the center pixel is identified as uncorrupted, which means that there is no need to perform filtering, the noise removal operator is bypassed and the output of the system is switched directly to the input. This approach has been employed to significantly exploiting different impulse detection mechanisms have been investigated [8-25]. Existing switching median filters are commonly found to be non-adaptive to noise density variations and prone to misclassifying pixel characteristics. This exposes the critical need to evolve a sophisticated switching scheme and median filter. In order to improve filtering performances, decision-based median filtering schemes had been investigated. These techniques aim to achieve optimal performance over the entire image. A good noise filter is required to satisfy two criteria, namely, suppressing the noise and preserving the useful information in the signal. Unfortunately, a great majority of currently available noise filters cannot simultaneously satisfy both of these criteria. The existing filters either suppress the noise at the cost of reduced noise suppression performance. In order to address these issues, many neural networks have been investigated for image denoising.

Neural networks are composed of simple elements operating in parallel. These elements are inspired by biological nervous systems. As in nature, the network function is determined largely the connection between elements. This type of training is used to perform a particular function by adjusting the values of the connections (weights) between elements. Commonly neural networks are adjusted or trained to a specific target output which is based on a comparison of the output and the target, until the network output matches the target. Typically many such input-target pairs are needed to train a network. A feed forward neural architecture with back propagation learning algorithms have been investigated [26-34] to satisfy both noise elimination and edges and fine details preservation properties when digital images are contaminated by higher level of impulse noise. Back propagation is a common method of training artificial neural networks algorithm so as to minimize the objective function. It is a multi-stage dynamic system optimization method.

In addition to these, the back-propagation learning algorithm is simple to implement and computationally efficient in which its complexity is linear in the synaptic weights of the neural

network. The input-output relation of a feed forward adaptive neural network can be viewed as a powerful nonlinear mapping. Conceptually, a feed forward adaptive network is actually a static mapping between its input and output spaces. Even though, intelligent techniques required certain pattern of data to learn the input. This filtered image data pattern is given through nonlinear filter for training of the input. Therefore, intelligent filter performance depends on conventional filters performance. This work aims to achieving good de-noising without compromising on the useful information of the signal.

In this paper, a novel structure is proposed to eliminate the impulse noise and preserves the edges and fine details of digital images; a feed forward neural architecture with back propagation learning algorithm is used and is referred as an Neural Filtering Technique for restoring digital images. The proposed intelligent filtering operation is carried out in two stages. In first stage the corrupted image is filtered by applying a special class of filtering technique. This filtered image output data sequence and noisy image data sequence are suitably combined with a feed forward neural (FFN) network in the second stage. The internal parameters of the feed forward neural network are adaptively optimized by training of the feed forward back propagation algorithm.

The rest of the paper is organized as follows. Section 2 explains the structure of the proposed filter and its building blocks. Section 3 discusses the results of the proposed filter on different test images. 4 is the final section, presents the conclusion.

2. PROPOSED FILTER

A feed forward neural network is a flexible system trained by heuristic learning techniques derived from neural networks can be viewed as a 3-layer neural network with weights and activation functions. Fig. 1 shows the structure of the proposed impulse noise removal filter. The proposed filter is obtained by appropriately combining output image from new tristate switching median filter with neural network. Learning and understanding aptitude of neural network congregate information from the two filters to compute output of the system which is equal to the restored value of noisy input pixel.

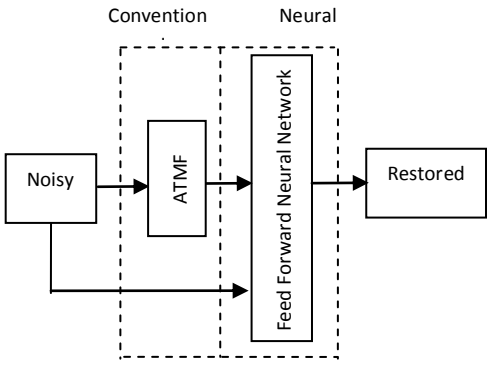

Fig. 1 Block diagram of proposed filter

The neural network learning procedure is used for the input-output mapping which is based on learning the proposed filter and the neural network utilizes back propagation algorithm. The special class of filter is described in section

2.1 asymmetric trimmed median filter

Standard Median filtering scheme is subsequently used to remove impulse noise and preserve edge and fine details on digital images, depending on the characteristic of pixel. According to the decision-mechanism, impulse noise is identified within the filtering window. In this paper, elimination of random valued impulse noise from digital images and filtering operation is obtained in two decision levels are as: 1) Action of "no filtering" is performed on the uncorrupted pixels at the first decision level. In second decision level, noisy pixels are removed as well as edges and fine details are preserved on the digital image simultaneously. This filtering operation is obtained by using median filtering at the current pixel within the sliding window on digital image. These values are the impulse noise intensity values. If the current pixel is detected as an uncorrupted pixel and it is left unaltered, otherwise, it is corrupted. Then median filter is performed on it. In order to apply the proposed filter, the corrupted and uncorrupted pixels in the selected filtering window are separated and then numbers of uncorrupted pixels are determined. The corrupted pixels in the image are detected by checking the pixel element value in the dynamic range of maximum (HNL) and minimum (LNL) respectively. Median is calculated only for a number of uncorrupted pixels in selected filtering window. Then the corrupted pixel is replaced by this new median value. This condition is used to preserves the Edges and fine details of the given image. Consider an image of size M×N having 8-bit gray scale pixel resolution. The steps involved in detecting the presence of an impulse or not are described as follows:

Step 1) A two dimensional square filtering window of size 3 x 3 is slid over on a contaminated image *x(i,j)* from left to right, top to bottom in a raster scan fashion.

$$w(i,j) = \left(X_{-n(i,j)}, \ldots, X_{-1(i,j)}, X_{0(i,j)}, X_{1(i,j)}, \ldots, X_{n(i,j)} \right) \quad (2.1)$$

where $X_{0(i,j)}$ (or $X_{(i,j)}$) is the original central vector-valued pixel at location *(i,j)*. Impulse noise can appear because of a random bit error on a communication channel. The source images are corrupted only by random valued impulse noise in the dynamic range of shades of salt (LNL) & pepper (HNL).

Step 2) In the given contaminated image, the central pixel inside the 3x3 window is checked whether it is corrupted or not. If the central pixel is identified as uncorrupted, it is left unaltered. A 3 x 3 filter window $w(i,j)$ centered around $X_{0(i,j)}$ is considered for filtering and is given by

$$w(i,j) = \left(X_{-4(i,j)}, \ldots, X_{-1(i,j)}, X_{0(i,j)}, X_{1(i,j)}, \ldots, X_{4(i,j)} \right) \quad (2.2)$$

Step 3) If the central pixel is identified as corrupted, determine the number of uncorrupted pixels in the selected filtering window and median value is found among these uncorrupted pixels. The corrupted pixel is replaced by this median value.

Step 4) Then the window is moved to form a new set of values, with the next pixel to be processed at the centre of the window. This process is repeated until the last image pixel is processed. Then the window is moved to form a new set of values, with the next pixel to be processed at the centre of the window. This process is repeated until the last image pixel is processed. This filter output is one of input for neural network training.

2.2 Feed forward Neural Network

In feed forward neural network, back propagation algorithm is computationally effective and works well with optimization and adaptive techniques, which makes it very attractive in dynamic nonlinear systems. This network is popular general nonlinear modeling tool because it is very suitable for tuning by optimization and one to one mapping between input and output data. The input-output relationship of the network is as shown in Fig.2. In Fig.2 x_m represents the total number of input image pixels as data, n_{kl} represents the number of neurons in the hidden unit, k represents the number hidden layer and l represents the number of neurons in each hidden layer. A feed forward back propagation neural network consists of three layers.

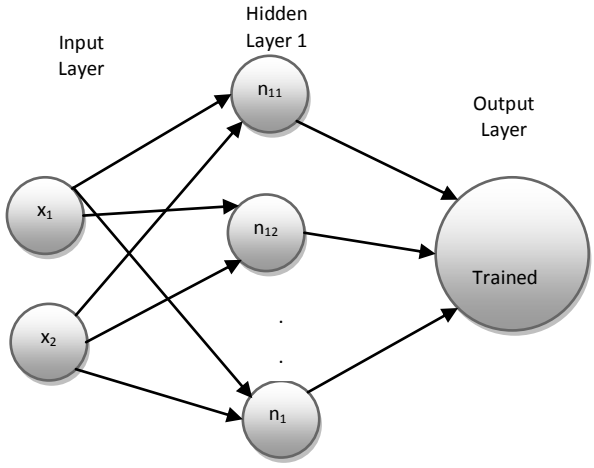

Fig.2 Feed Forward Neural Network Architecture

The first layer is referred as input layer and the second layer is represents the hidden layer, has a tan sigmoid (tan-sig) activation function is represented by

$$\phi(yi) = \tanh(vi) \qquad (2.3)$$

This function is a hyperbolic tangent which ranges from -1 to 1, y_i is the output of the ith node (neuron) and v_i is the weighted sum of the input and the second layer or output layer, has a linear activation function. Thus, the first layer limits the output to a narrow range, from which the linear layer can produce all values. The output of each layer can be represented by

$$Y_{Nx1} = f(W_{NxM} X_{M,1} + b_{N,1}) \qquad (2.4)$$

where Y is a vector containing the output from each of the N neurons in each given layer, W is a matrix containing the weights for each of the M inputs for all N neurons, **X** is a vector containing the inputs, b is a vector containing the biases and f(·) is the activation function for both hidden layer and output layer.

The trained network was created using the neural network toolbox from Matlab9b.0 release. In a back propagation network, there are two steps during training. The back propagation step calculates the error in the gradient descent and propagates it backwards to each neuron in the hidden layer. In the second step, depending upon the values of activation function from hidden layer, the weights and biases are then recomputed, and the output from the activated neurons is then propagated forward from the hidden layer to the output layer. The network is initialized with random weights and biases, and was then trained using the Levenberq-Marquardt algorithm (LM). The weights and biases are updated according to

$$Dn+1 = Dn - [J^T J + \mu I]^{-1} J^T e \qquad (2.5)$$

where *Dn* is a matrix containing the current weights and biases, *Dn+1* is a matrix containing the new weights and biases, e is the network error, *J* is a Jacobian matrix containing the first derivative of e with respect to the current weights and biases. In the neural network case, it is a K-by-L matrix, where K is the number of entries in our training set and L is the total number of parameters (weights+biases) of our network. It can be created by taking the partial derivatives of each in respect to each weight, and has the form:

$$J = \begin{bmatrix} \frac{\partial F(x_1, w)}{\partial w_1} \cdots \frac{\partial F(x_1, w)}{\partial w_w} \\ \frac{\partial F(x_1, w)}{\partial w_1} \cdots \frac{\partial F(x_1, w)}{\partial w_w} \end{bmatrix} \qquad (2.6)$$

where F(xi,L) is the network function evaluated for the i-th input vector of the training set using the weight vector L and wj is the j-th element of the weight vector L of the network. In traditional Levenberg-Marquardt implementations, the jacobian is approximated by using finite differences, Howerever, for neural networks, it can be computed very effieciently by using the chain rule of calculus and the first derivatives of the activation functions. For the least-squares problem, the Hessian generally doesn't needs to be caclualted. As stated earlier, it can be approximated by using the Jacobian matrix with the formula:

$$H = J^T J \qquad (2.7)$$

I is the identity matrix and μ is a variable that increases or decreases based on the performance function. The gradient of the error surface, g, is equal to *JTe.*

2.3 Training of the Feed Forward Neural Network

Feed forward neural network is trained using back propagation algorithm. There are two types of training or learning modes in back propagation algorithm namely sequential mode and batch mode respectively. In sequential learning, a given input pattern is propagated forward and error is determined and back propagated, and the weights are updated. Whereas, in Batch mode learning; weights are updated only after the entire set of training network has been presented to the network. Thus the weight update is only performed after every epoch. It is advantageous to accumulate the weight correction terms for several patterns. Here batch mode learning is used for training.

In addition, neural network recognizes certain pattern of data only and also it entails difficulties to learn logically to identify the error data from the given input image. In order to improve the learning and understanding properties of neural network, noisy image data and filtered output image data are introduced for training. Noisy image data and filtered output data are

considered as inputs for neural network training and noise free image is considered as a target image for training of the neural network. Back propagation is pertained as network training principle and the parameters of this network are then iteratively tuned. Once the training of the neural network is completed, its internal parameters are fixed and the network is combined with noisy image data and the nonlinear filter output data to construct the proposed technique, as shown in Fig.3. While training a neural network, network structure is fixed and the unknown images are tested for given fixed network structure respectively. The performance evaluation is obtained through simulation results and shown to be superior performance to other existing filtering techniques in terms of impulse noise elimination and edges and fine detail preservation properties.

The feed forward neural network used in the structure of the proposed filter acts like a *mixture* operator and attempts to construct an enhanced output image by combining the information from the noisy image and asymmetric trimmed median filter. The rules of mixture are represented by the rules in the rule base of the neural network and the mixture process is implemented by the mechanism of the neural network. The feed forward neural network is trained by using back propagation algorithm and the parameters of the neural network are then iteratively tuned using the Levenberg–Marquardt optimization algorithm, so as to minimize the learning error, *e*. The neural network trained structure is optimized and the tuned parameters are fixed for testing the unknown images.

The internal parameters of the neural network are optimized by training. Fig.3 represents the setup used for training and here, based on definition, the parameters of this network are iteratively optimized so that its output converges to original noise free image and completely removes the noise from its input image. The well known images are trained using this neural network and the network structure is optimized. The unknown images are tested using optimized neural network structure.

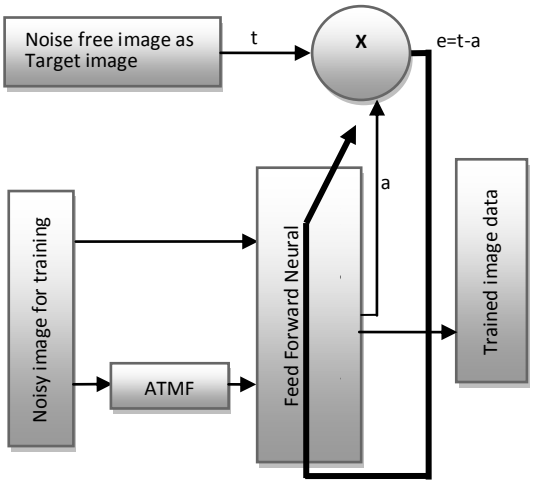

Fig.3 Training of the Feed forward Neural Network

In order to get effective filtering performance, already existing neural network filters are trained with image data and tested using equal noise density. But in practical situation, information about the noise density of the received signal is unpredictable one. Therefore; in this paper, the neural network architecture is trained using denoised three well known images which are corrupted by adding different noise density levels of 0.4, 0.45, 0.5 and 0.6 and also the network is trained for different hidden layers with different number of neurons. Noise density with 0.45 gave optimum solution for both lower and higher level noise corruption. Therefore images are corrupted with 45% of noise is selected for training. Then the performance error of the given trained data and trained neural network structure are observed for each network. Among these neural network Structures, the trained neural network structure with the minimum error level is selected (10^{-3}) and this trained network structures are fixed for testing the received image signal.

Network is trained for 22 different architectures and corresponding network structure is fixed. PSNR is measured on Lena test image for all architectures with various noise densities. Among these, based on the maximum PSNR values; selected architectures is summarized in table 4 for Lena image corrupted with 50% impulse noise. Finally, the maximum PSNR value with the neural network architecture of noise density 0.45 and two hidden layers with 2 neurons for each layer has been selected for training. Fig.4 shows the images which are used for training. Three different images are used for network. This noise density level is well suited for testing the different noise level of unknown images in terms of quantitative and qualitative metrics. The image shown in Fig.4 ($a_{1,\ 2\ and\ 3}$) are the *noise free training image: cameraman Baboonlion and ship*. The size of an each training image is 256 x 256. The images in Fig.4 ($b_{1,2\ and\ 3}$) are the *noisy training images* and is obtained by corrupting the noise free training image by impulse noise of 45% noise density. The image in Fig.4 ($c_{1,2\ and\ 3}$) are the trained images by neural network. The images in Fig.4 (b) and (a) are employed as the *input* and the *target (desired)* images during training, respectively.

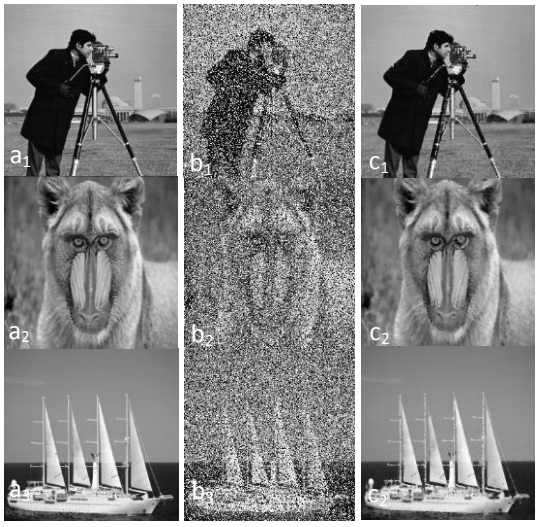

Fig.4 Performance of training image: ($a_{1,2\ and\ 3}$) original images, ($b_{1,2\ and\ 3}$) images corrupted with 45% of noise and ($c_{1,\ 2\ and\ 3}$) trained images

2.4 Testing of unknown images using trained structure of neural network

The optimized architecture that obtained the best performance for training with three images has 196608 data in the input layer, two hidden layers with 6 neurons for each layer and one output layer. The network trained with 45% impulse noise shows superior performance for testing under various noise levels. Also, to ensure faster processing, only the corrupted

pixels from test images are identified and processed by the optimized neural network structure. As the uncorrupted pixels do not require further processing, they are directly taken as the output.

The chosen network has been extensively tested for several images with different level of impulse noise. Fig.5 shows the exact procedure for taking corrupted data for testing the received image signals for the proposed filter. In order to reduce the computation time in real time implementation; in the first stage, a special class of filter is applied on unknown images and then pixels (data) from the outputs of noisy image and an asymmetric trimmed median filter are obtained and applied as inputs for optimized neural network structure for testing; these pixels are corresponding to the pixel position of the corrupted pixels on noisy image.

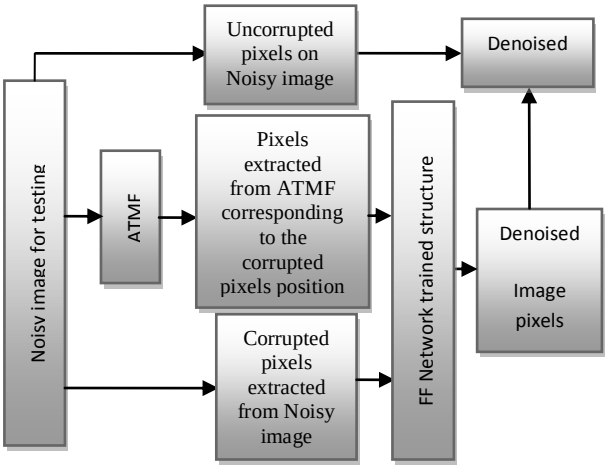

Fig.5 Testing of the images using optimized feed forward adaptive neural network structure

At the same time, noise free pixels from input are directly taken as output pixels. The tested pixels are replaced in the same location on corrupted image instead of noisy pixels. The most typical feature of the proposed filter offers excellent line, edge, and fine detail preservation performance and also effectively removes impulse noise from the image. Usually conventional filters are giving denoised image output and then these images are enhanced using these conventional outputs as input for neural filter while these outputs are combined with the network. Since, networks need certain pattern to learn and understand the given data.

2.5 Filtering of the Noisy Image

The noisy input image is processed by sliding the 3x3 filtering window on the image. This filtering window is considered for the nonlinear filter. The window is started from the upper-left corner of the noisy input image, and moved rightwards and progressively downwards in a *raster scanning* fashion. For each filtering window, the nine pixels contained within the window of noisy image are first fed to the new tristate switching median filter. Next, the center pixel of the filtering window on noisy image, the output of the conventional filtered output is applied to the appropriate input for the neural network. Finally, the restored image is obtained at the output of this network.

3. RESULTS AND DISCUSSION

The performance of the proposed filtering technique for image quality enhancement is tested for various level impulse noise densities. Four images are selected for testing with size of 256 x 256 including *Baboon, Lena, Pepper and Ship.* All test images are 8-bit gray level images. The experimental images used in the simulations are generated by contaminating the original images by impulse noise with different level of noise density. The experiments are especially designed to reveal the performances of the filters for different image properties and noise conditions. The performances of all filters are evaluated by using the *peak signal-to-noise ratio* (PSNR) criterion, which is defined as more objective *image* quality measurement and is given by the equation (3.1)

$$PSNR = 10\log_{10}\left(\frac{255^2}{MSE}\right) \qquad (3.1)$$

where

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}\left|(x(i,j)-y(i,j)\right|^2 \qquad (3.2)$$

Here, *M* and *N* represents the number of rows and column of the image and $x(i, j)$ and $y(i, j)$ represents the original and the restored versions of a corrupted test image, respectively. Since all experiments are related with impulse noise.

The experimental procedure to evaluate the performance of a proposed filter is as follows: The noise density is varied from 10% to 90% with 10% increments. For each noise density step, the four test images are corrupted by impulse noise with that noise density. This generates four different experimental images, each having the same noise density. These images are restored by using the operator under experiment, and the PSNR values are calculated for the restored output images. By this method ten different PSNR values representing the filtering performance of that operator for different image properties, then this technique is separately repeated for all noise densities from 10% to 90% to obtain the variation of the average PSNR value of the proposed filter as a function of noise density. The entire input data are normalized in to the range of [0 1], whereas the output data is assigned to one for the highest probability and zero for the lowest probability.

Table 1 PSNR obtained by applying proposed filter on Lena image corrupted with 50 % of impulse noise

S.No	Neural network architecture				PSNR
	No. of hidden layers	No. of neuron in each hidden layer			
		Layer 1	Layer2	Layer3	
1	1	5	-	-	26.9162
2	1	7	-	-	26.9538
3	1	9	-	-	26.9056
4	1	10	-	-	26.9466
5	1	12	-	-	26.9365
6	1	14	-	-	26.9323
7	2	22	-	-	26.9030
8	2	2	2	-	**27.1554**
9	2	4	4	-	26.9619
10	2	5	5	-	26.9267

The architecture with two hidden layers and each hidden layer has 2 neurons yielded the best performance. The various parameters for the neural network training for all the patterns are summarized in Table 2 and 3. In Table 2, Performance

error is nothing but Mean square error (MSE). It is a sum of the statistical bias and variance. The neural network performance can be improved by reducing both the statistical bias and the statistical variance. However there is a natural trade-off between the bias and variance. Learning Rate is a control parameter of training algorithms, which controls the step size when weights are iteratively adjusted. The learning rate is a constant in the algorithm of a neural network that affects the speed of learning. It will apply a smaller or larger proportion of the current adjustment to the previous weight If LR is low, network will learn all information from the given input data and it takes long time to learn. If it is high, network will skip some information from the given input data and it will make fast training. However lower learning rate gives better performance than higher learning rate. The learning time of a simple neural-network model is obtained through an analytic computation of the Eigen value spectrum for the Hessian matrix, which describes the second-order properties of the objective function in the space of coupling coefficients. The results are generic for symmetric matrices obtained by summing outer products of random vectors.

Table 2 Optimized training parameters for feed forward neural network

S.No	Parameters	Achieved
1	Performance error	0.00312
2	Learning Rate (LR)	0.01
3	No. of epochs taken to meet the performance goal	2500
4	Time taken to learn	1620 seconds

Table.3 Bias and Weight updation in optimized training neural network

		Hidden layer	
		Weight	**Bias**
1st Hidden layer	Weights from $x_{1\&2}$ to n_{11}	**-0.071;-0.22**	**0.266**
	Weights from $x_{1\&2}$ to n_{12}	**-0.249;0.062**	**-3.049**
2 Hidden layer	Weights from $n_{1,2,..6}$ to n_{21}	**0.123;-4.701**	**-4.743**
	Weights from $n_{1,2,..6}$ to n_{22}	**184.4;2.151**	**-4.617**
Output layer	Weights from n_{21} to o	**-34.976**	**-0.982**
	Weights from n_{22} to o	**-0.062**	

In Fig.6 and Fig.7 represent Performance error graph for error minimization and training state respectively. This Learning curves produced by networks using non-random (fixed-order) and random submission of training and also this shows the error goal and error achieved by the neural system. In order to prove the effectiveness of this filter, existing filtering techniques are experimented and compared with the proposed filter for visual perception and subjective evaluation on Lena image including an Asymmetric Trimmed Median Filter (ATMF) and proposed filter in Fig.8. Lena test image contaminated with the impulse noise of various densities are summarized in Table 3 for quantitative metrics for different filtering techniques and compared with the proposed filtering technique and is graphically illustrated in Fig.9. This graphical illustration shows the performance comparison of the proposed intelligent filter. This qualitative measurement proves that the proposed filtering technique outperforms the other filtering schemes for the noise densities up to 50%.

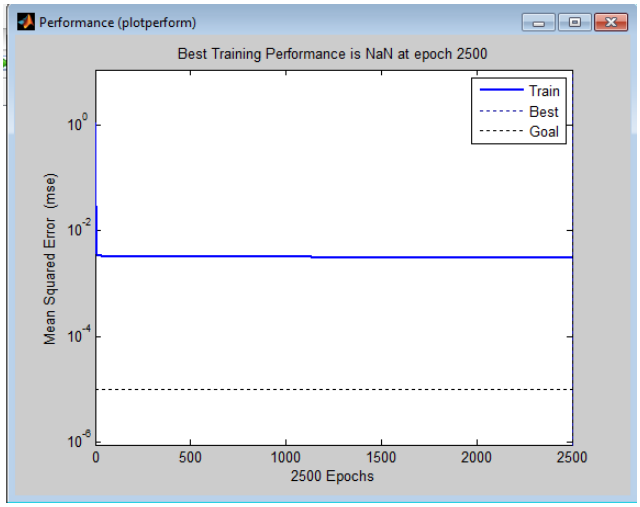

Fig.6 Performance error graph for feed forward neural network with back propagation algorithm

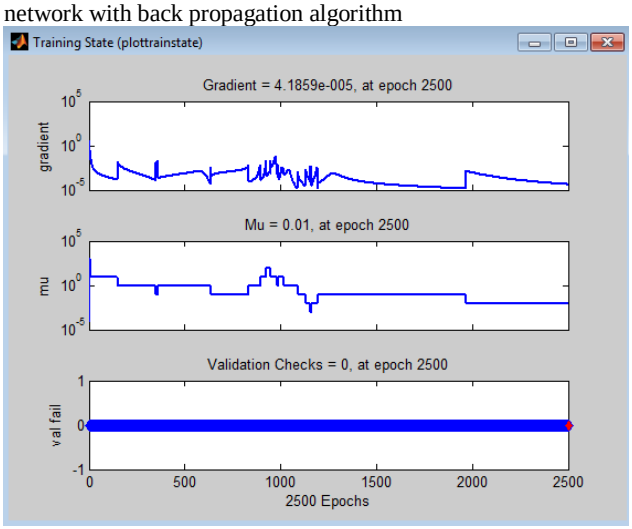

Fig. 7 Performance of gradient for feed Forward neural network with back propagation algorithm

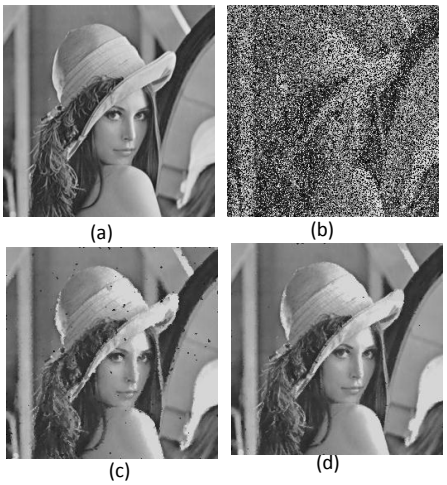

Fig.8 Subjective Performance comparison of the proposed filter with other existing filters on test image Lena (a) Noise

free images, (b) image corrupted by 80% impulse noise, (c) images restored by ATMF and (d) image restored by the proposed filter

Table 3. Performance of PSNR for different filtering techniques on Lena image corrupted with various % of impulse noise

Noise level	ATMF (1-59, 196-255)	Proposed filter (1-59, 196-255)
10	33.3743	33.8700
20	31.7138	31.8925
30	30.3687	31.0138
40	28.6183	29.2464
5-0	26.7540	27.1554
60	24.5403	25.0490
70	23.1422	23.5807
80	21.8535	21.5282
90	19.5594	20.2367

The PSNR performance explores the quantitative measurement. In order to check the performance of the feed forward neural network, percentage improvement (PI) in PSNR is also calculated for performance comparison between conventional filters and proposed neural filter for Lena image and is summarized in Table 4. This PI in PSNR is calculated by the following equation 3.3.

$$PI = \left[\frac{PSNR_{CF} - PSNR_{NF}}{PSNR_{CF}} x100 \right] \quad (3.3)$$

where PI represents percentage in PSNR, $PSNR_{CF}$ represents PSNR for conventional filter and $PSNR_{NF}$ represents PSNR values for the designed neural filter.

Here, the conventional filters are combined with neural network which gives the proposed filter, so that the performance of conventional filter is improved.

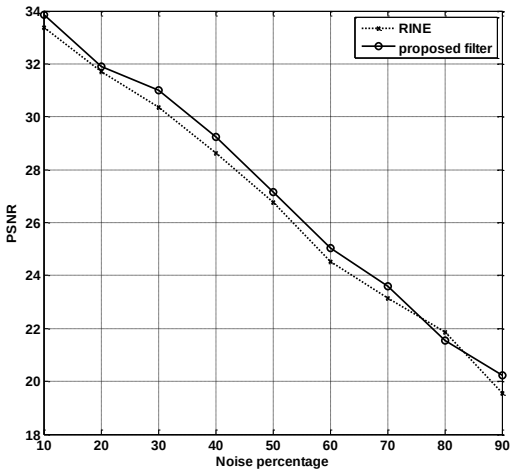

Fig.9 PSNR obtained using proposed filter and compared with existing filtering technique on Lena image corrupted with different densities of impulse noise

Table 4. Percentage improvement in PSNR obtained on Lena image corrupted with different level of impulse noise

Noise %	Proposed filter (PF)	ATMF	PI for Proposed filter
10	45.36	42.57	6.5539
20	40.23	38.87	3.4984
30	37.56	35.38	6.1616
40	34.93	33.17	5.3059
50	31.63	29.34	8.8275
60	27.52	25.75	6.8737
70	22.17	19.52	13.575
80	16.90	13.47	25.464
90	12.68	10.13	25.173

In Table 4, the summarized PSNR values for conventional filters namely NF and DBSMF seem to perform well for human visual perception when images are corrupted up to 30% of impulse noise. These filters performance are better for quantitative measures when images are corrupted up to 50% of impulse noise. In addition to these, image enhancement is nothing but improving the visual quality of digital images for some application. In order to improve the performance of visual quality of image using these filters, image enhancement as well as reduction in misclassification of pixels on a given image is obtained by applying Feed forward neural network with back propagation algorithm.

The summarized PSNR values in Table 4 for the proposed neural filter appears to perform well for human visual perception when images are corrupted up to 50% of impulse noise. These filters performance are better for quantitative measures when images are corrupted up to 70% of impulse noise. PI is graphically illustrated in Fig.10.

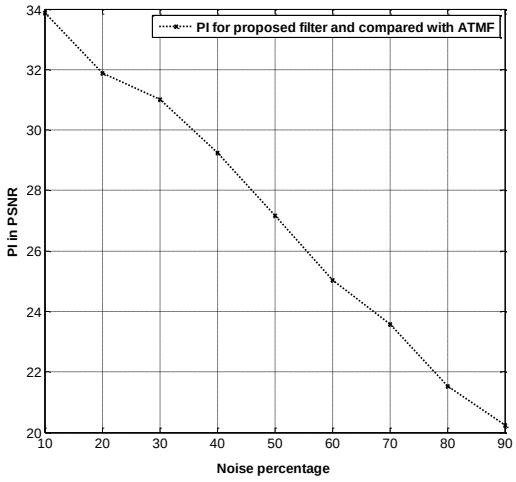

Fig.10 PI in PSNR obtained on Lena image for the proposed filter corrupted with various densities of mixed impulse noise

Digital images are nonstationary process; therefore depends on properties of edges and homogenous region of the test images, each digital images having different quantitative measures. Fig.11 illustrate the subjective performance for proposed filtering Technique for Baboon, Lena, Pepper and Rice images: noise free image in first column, images corrupted with 50% impulse noise in second column, Images restored by proposed Filtering Technique in third column. This will felt out the properties of digital images.

Performance of quantitative analysis is evaluated and is summarized in Table.5. This is graphically illustrated in Fig.12. This qualitative and quantitative measurement shows that the proposed filtering technique outperforms the other filtering schemes for the noise densities up to 50%. Since there is an improvement in PSNR values of all images up to

50% while compare to PSNR values of conventional filters output which are selected for inputs of the network training.

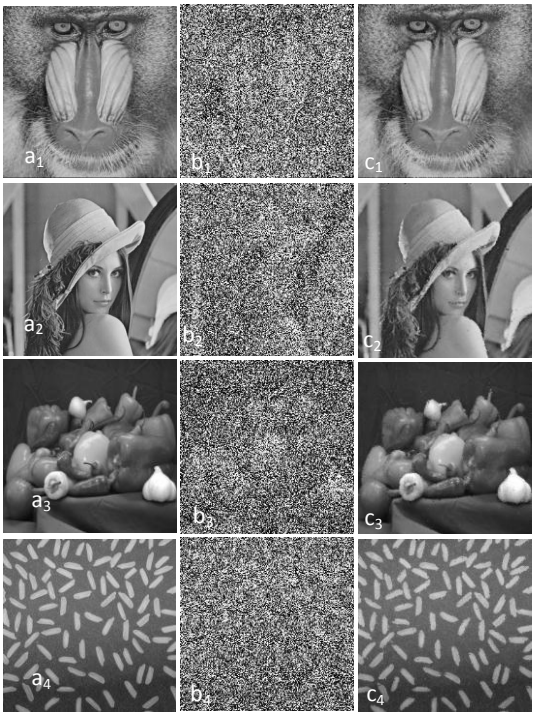

Fig.11 Performance of test images:($a_{1,2\ and\ 3}$) original images,($b_{1,2\ and\ 3}$) images corrupted with 80% of noise and ($d_{1,\ 2\ and\ 3}$) images enhanced by proposed filter

Table 5 PSNR obtained for the proposed filter on different test images with various densities of random valued impulse noise

Noise level	Images			
	Baboon	Lena	pepper	Rice
10	28.45	33.87	37.38	35.26
20	26.86	31.89	35.95	33.16
30	24.79	31.01	35.16	32.10
40	23.94	29.24	32.67	30.64
50	22.23	27.15	31.93	28.90
60	21.40	25.05	29.05	27.04
70	19.46	23.58	27.44	25.42
80	17.41	21.53	25.47	23.47
90	15.67	20.24	24.84	22.82

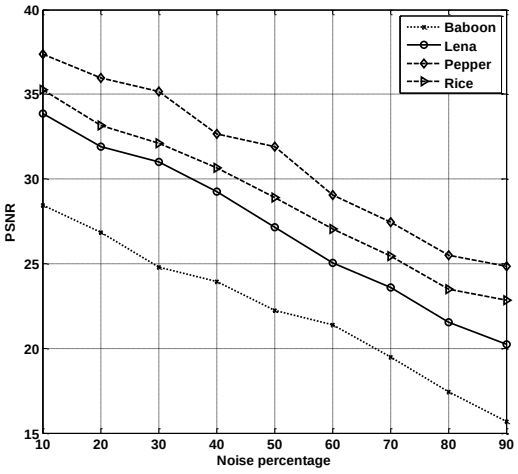

Fig. 12 PSNR obtained by applying proposed filter technique for different images corrupted with various densities of mixed impulse noise

The qualitative and quantitative performance of Pepper and Rice images are better than the other images for the noise levels ranging from 10% to 50%. But for higher noise levels, the Pepper image is better. The Baboon image seems to perform poorly for higher noise levels. Based on the intensity level or brightness level of the image, it is concluded that the performance of the images like pepper, Lena, Baboon and Rice will change. Since digital images are nonstationary process. The proposed filtering technique is found to have eliminated the impulse noise completely while preserving the image features quite satisfactorily. This novel filter can be used as a powerful tool for efficient removal of impulse noise from digital images without distorting the useful information in the image and gives more pleasant for visual perception.

In addition, it can be observed that the proposed filter for image enhancement is better in preserving the edges and fine details than the other existing filtering algorithm. It is constructed by appropriately combining a two nonlinear filters and a neural network. This technique is simple in implementation and in training; the proposed operator may be used for efficiently filtering any image corrupted by impulse noise of virtually any noise density. It is concluded that the proposed filtering technique can be used as a powerful tool for efficient removal of impulse noise from digital images without distorting the useful information within the image.

4. CONCLUSION

A neural filtering Technique is described in this paper for image restoration. This filter is seen to be quite effective in preserving image boundary and fine details of digital images while eliminating random valued impulse noise. The efficiency of the proposed filter is illustrated applying the filter on various test images contaminated different levels of noise. This filter outperforms the existing median based filter in terms of objective and subjective measures. So that the proposed filter output images are found to be pleasant for visual perception.

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Image Segmentation Using Two Weighted Variable Fuzzy K Means

S. Suganya
CMS College of Science and Commerce
Coimbatore, Tamil Nadu, India

Rose Margaret
CMS College of Science and Commerce
Coimbatore, Tamil Nadu, India

Abstract: Image segmentation is the first step in image analysis and pattern recognition. Image segmentation is the process of dividing an image into different regions such that each region is homogeneous. The accurate and effective algorithm for segmenting image is very useful in many fields, especially in medical image. This paper presents a new approach for image segmentation by applying k-means algorithm with two level variable weighting. In image segmentation, clustering algorithms are very popular as they are intuitive and are also easy to implement. The K-means and Fuzzy k-means clustering algorithm is one of the most widely used algorithms in the literature, and many authors successfully compare their new proposal with the results achieved by the k-Means and Fuzzy k-Means. This paper proposes a new clustering algorithm called TW-fuzzy k-means, an automated two-level variable weighting clustering algorithm for segmenting object. In this algorithm, a variable weight is also assigned to each variable on the current partition of data. This could be applied on general images and/or specific images (i.e., medical and microscopic images). The proposed TW-Fuzzy k-means algorithm in terms of providing a better segmentation performance for various type of images. Based on the results obtained, the proposed algorithm gives better visual quality as compared to several other clustering methods.

Keyword —Fuzzy-K-means Clustering (FKM), image segmentation, W-k-Means, variable weighting

1. INTRODUCTION

Image segmentation techniques play an important role in image recognition system. It helps in refining our study of images. One part being edge and line detection techniques highlights the boundaries and the outlines of the image by suppressing the background information. They are used to study adjacent regions by separating them from the boundary

Clustering is a process of grouping a set of objects into classes of similar characteristics. It has been extensively used in many areas, including in the statistics [1], [2], machine learning [3], pattern recognition [4], data mining [5], and image processing [6]. In digital image processing, segmentation is essential for image description and classification. The algorithms are normally based on similarity and particularity, which can be divided into different categories; thresholding template matching [7], region growing [8], edge detection [9], and clustering [10]. Clustering algorithm has been applied as a digital image segmentation technique in various fields. Recently, the application of clustering algorithms has been further applied to the medical field, specifically in the biomedical image analysis wherein images are produced by medical imaging devices. The most widely used and studied is the K-means (KM) clustering. KM is an exclusive clustering algorithm, (i.e., data which belongs to a definite cluster could not be included in another cluster).

There are several clustering algorithms proposed to overcome the aforementioned weaknesses. Fuzzy K-means (FKM), an overlapping clustering that employs yet another fuzzy concept, allows each data to belong to two or more clusters at different degrees of memberships. In the FKM, there is no

clear, significant boundary between the elements if they do, or do not belong to a certain class. In 2010, [11] successfully proposed a modified version of K-means clustering, namely, adaptive Fuzzy k -Means (AFKM) clustering. The study proved that AFKM possesses a great ability in overcoming common problems in clustering, such as dead centers and centre redundancy. In this paper, we introduce a new version of clustering algorithm called two weighted variable - Fuzzy-K-means (TWvFKM) clustering algorithm. In this algorithm to build a cluster-based classification model automatically. In the TWv-Fuzzy k-means algorithm, to distinguish the impacts of different views and different variables in clustering, the weights of views and individual variables are introduced to the distance function. The view weights are computed from the entire variables, whereas the weights of variables in a view are computed from the subset of the data that only includes the variables in the view. Therefore, the view data, while the variable weights in a view only reflect the importance of variables in the view. We present an optimization model for the TWv-Fuzzy-k-means algorithm and introduce the formulae, derived from the model, for computing both view weights and variable weights. K-means algorithm as an extension to the standard -means clustering process with two additional steps to compute view weights and variable weights in each iteration. TW-k-means can automatically compute both view weights and individual variable weights. Moreover, it is a fast clustering algorithm which has the same computation complexity as k-means and FKM. We compared TWv-Fuzzy-k-means (TWvFKM) with various clustering algorithms (K-means, FKM, and AFKM) and the results have shown that the TWv-Fuzzy-k-means algorithm significantly out performed the other algorithms

This paper is organized as follow: Section II give details of the Image Segmentation Section III describes in detail the proposed TWvFKM clustering algorithm. Section III presents the data used and also discusses the type of analyses applied to test the capability of the proposed algorithm. Section IV presents the segmentation results obtained by the proposed algorithm. In addition, a comparison of performance comparison with several selected conventional clustering algorithms is also presented. The comparison is done based on both qualitative and quantitative analyses. Finally, Section V concludes the work focused on of this paper

2. IMAGE SEGMENTATION

Image Segmentation is the process of dividing a digital image into constituent regions or objects [12]. The purpose of segmentation is to simplify the representation of an image into that which is easier to analyze. Image segmentation is typically used to locate objects and boundaries in images. Segmentation algorithms are based on the two basic properties of an image intensity values: discontinuity and similarity. The first step in image analysis is segment the image.

Segmentation subdivides an image into its constituent parts or objects. The level to which this subdivision is carried depends on the problem being viewed. Some time need to segment the object from the background to read the image correctly and identify the content of the image for this reason there are two techniques of segmentation, discontinuity detection technique and Similarity detection technique. In the first technique, one approach is to partition an image based on abrupt changes in gray-level image. The second technique is based on the threshold and region growing.

2.1 Image Segmentation by Clustering

Clustering is a classification technique. Given a vector of N measurements describing each pixel or group of pixels (i.e., region) in an image, a similarity of the measurement vectors and therefore their clustering in the N-dimensional measurement space implies similarity of the corresponding pixels or pixel groups. Therefore, clustering in measurement space may be an indicator of similarity of image regions, and may be used for segmentation purposes.

The vector of measurements describes some useful image feature and thus is also known as a feature vector. Similarity between image regions or pixels implies clustering (small separation distances) in the feature space.

Clustering methods were some of the earliest data segmentation techniques to be developed.

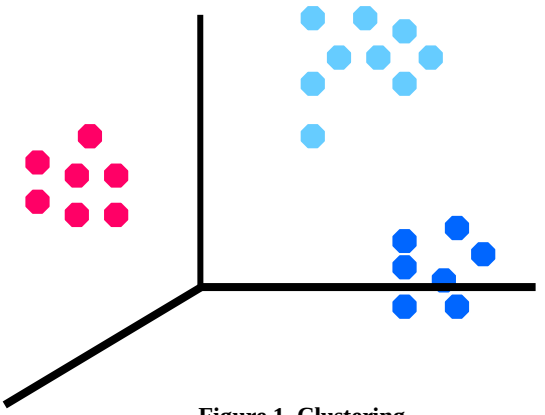


Figure 1. Clustering

Similar data points grouped together into clusters.

Most popular clustering algorithms suffer from two major drawbacks

- **First**, the number of clusters is predefined, which makes them inadequate for batch processing of huge image databases
- **Secondly**, the clusters are represented by their centroid and built using a Euclidean distance therefore inducing generally an hyperspheric cluster shape, which makes them unable to capture the real structure of the data.
- This is especially true in the case of color clustering where clusters are arbitrarily shaped

3. PROPOSED ALGORITHM

3.1 Fuzzy –K- Mean of Clustering Algorithm

TWvFKM is a clustering algorithm, which partitions a data set into clusters according to some defined distance measure. Images are considered as one of the most important medium of conveying information. Understanding images and extracting the information from them such that the information can be used for other tasks is an important aspect of Machine learning. One of the first steps in direction of understanding images is to segment them and find out different objects in them. To do this, we look at the algorithm namely TWvFKM clustering. It has been assumed that the number of segments in the image is known and hence can be passed to the algorithm.

Proposed algorithm namely TWv-Fuzzy-k-means clustering algorithm that can automatically compute variable weights in the k-means clustering process. TWV-Fuzzy-k-means extends the standard k-means algorithm with one additional step to compute variable weights at each iteration of the clustering process. The variable weight is inversely proportional to the sum of the within-cluster variances of the variable. As such, noise variables can be identified and their affection of the cluster result is significantly reduced. This TWvFKM weights both views and individual variables and is an extension to W-*k*-means. Domeniconi et al. [15] have proposed the Locally Adaptive Clustering (LAC) algorithm which assigns a weight to each variable in each cluster.

TWvF-K- Mean algorithm is one of the most important clustering algorithms, the first samples are divided into two or more clusters. In this fuzzy algorithm the number of clusters has been already specified. In FWv-Fuzzy- K Mean of clustering algorithm the main function is:

$$J = \sum_{I=0}^{C} \sum_{k=0}^{n} U_{ik}^{m} d_{ik}^{2} = \sum_{I=0}^{C} \sum_{k=0}^{n} U_{ik}^{m} |x_k - v_i|_k^2$$

In formula 1: m is a real number which is bigger than 1. In most of the cases, m=2. If m=1, the non-fuzzy c-mean of main clustering function is obtained. In above formula X^k is the k^{th} sample, and V^i is the center of it he cluster and n is the number of samples. U^{ik} shows the dependency of I^{th} sample in k^{th} cluster. $|X|$ is determined the similarity of sample(distance) from the center of cluster and can use every function that shows the similarity of sample or the center of cluster.

Steps of k-fuzzy mean algorithm [13]:

- For the first clusters initial value for k, m, and U should be estimated.
- The center of clusters should be calculated by second formula.
- The dependence matrix should be calculated by in second step.

If $||U^{l+1}-U^{l}|| \leq \varepsilon$ the algorithm is finished, visa versa go to second step.

3.2 The TW-Fuzzy-k-means Clustering Algorithm

Input: The number of clusters k and two positive real parametersλ,η

Output: Optimal values **of** U, Z, V and W

randomly choose K cluster centres Z^0**:**

For t=1 to T **do**

$w_t^0 \leftarrow 1/T$

For all j ∈ G_t **do**

$v_j^0 \leftarrow 1/|G_t|$

End for

End for

r ← 0

Repeat

Update U^{r+1}

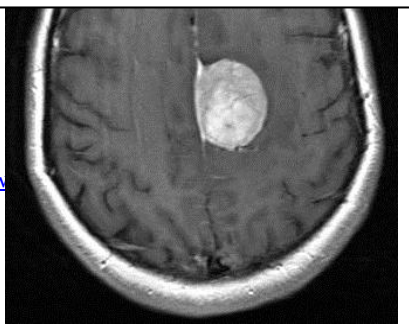
Update Z^{r+1}

Update V^{r+1}

Update W^{r+1}

r ←r+1

until: the objective function obtained its local minimum value;



4. EXEPERIMENT RESULTS

The experiments on the medical images have been carried out in MATLAB v7.10 TWv-Fuzzy - K-means segmentation is a clustering based segmentation algorithm. In clustering based segmentation changing in the distance metric will change the output. Euclidean distance is the default distance used in the algorithm, replacing it with the cosine distance gives better segmented areas in the medical images. In the Figure 2 we can see the original medical images. Figure 3 shows the cluster index images by the applying variable weight is 7 in Figure 2. Now compare it with Figure 4, which are cluster index images by applying variable weighting is 10. We can see that segmentation of areas is good in Figure 5 than in other figures. The Figure 5 has variable weighting in 15. The Figure 6 is another resulted image an applying weight is 20. Comparing those images the Figure 5 is better than another. It has variable weighted is 15. Now we analyze various images to apple TWv-Fuzzy-k-means with weight 15, the table1 has resulted images. Table 1 shows various image analysis results.

Figure 2. The Original Medical Image

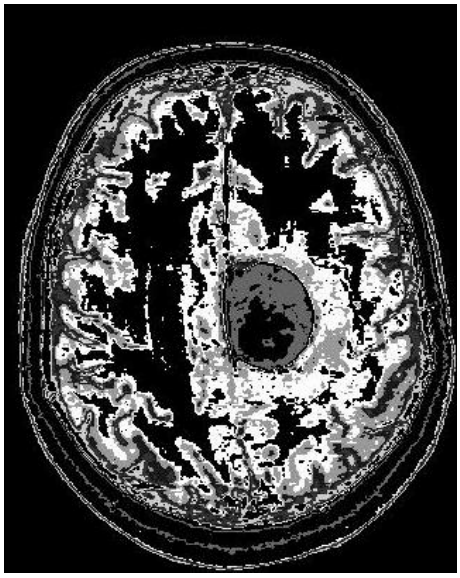


Figure 3: medical image has weighed is 7

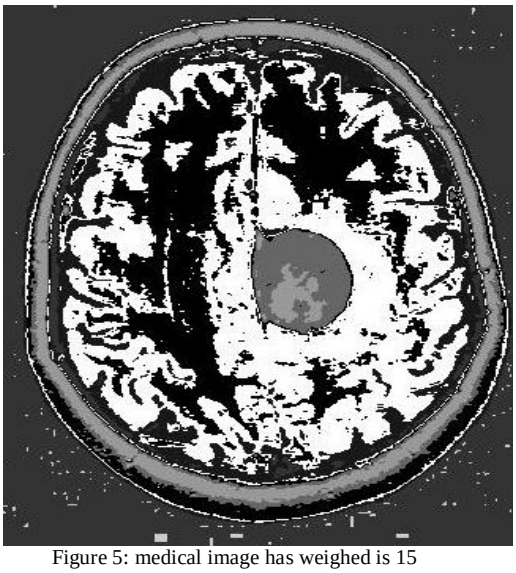


Figure 5: medical image has weighed is 15

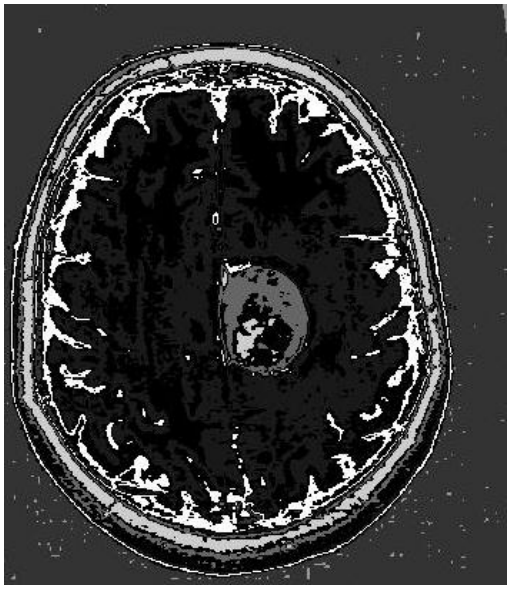


Figure 4: medical image has weighed is 10

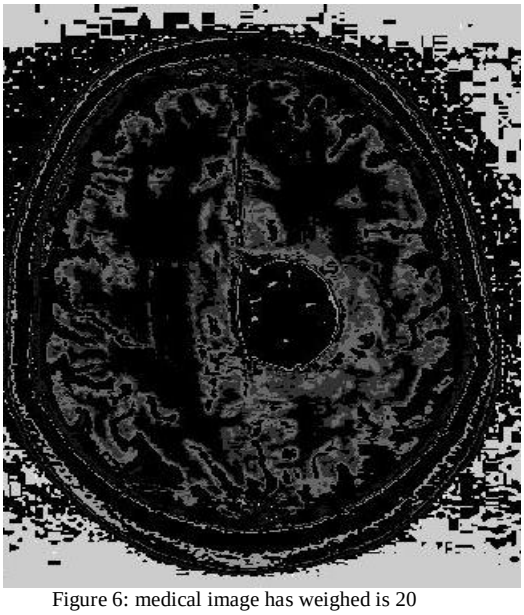
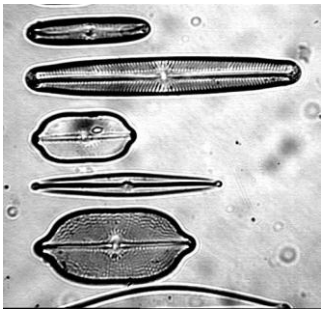
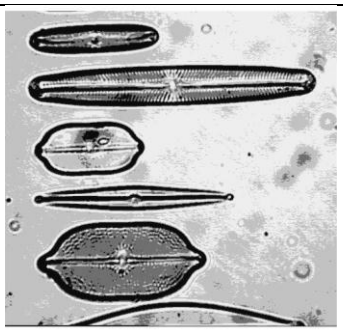
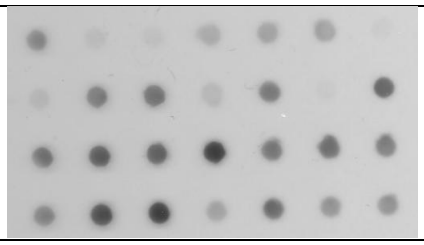
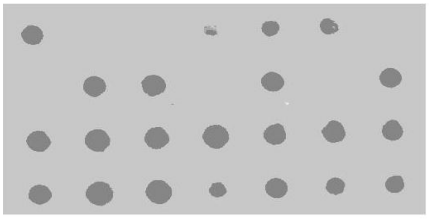


Figure 6: medical image has weighed is 20

Table 1: Analyzing multiple images with algorithm TWv-Fuzzy-k-means with weight 15

Image name	Original	Resulted image Weighted at 15
LENA		
Boat		
Bridge		
Diatoms		
Dot blot		

5. CONCLUSION

This paper presents a new clustering algorithm named the Two Weighted variable Fuzzy-K-Means algorithm for segmentation purposes. TWv-Fuzzy-*k*-means can compute weights for views and individual variables simultaneously in the clustering process. With the weights effect of low-quality views and noise variables can be reduced. Therefore, TWv-Fuzzy-*k*-means can obtain better clustering results than individual variable weighting clustering algorithms from multi-view data. We discussed the difference of the weights between TWv-Fuzzy-*k*-means. For medium values weighted of Fuzzy k-means algorithms give good results. For larger and smaller values of Weight, the segmentation is very coarse; many clusters appear in the images at discrete places. The conclusion of this paper sees the proposed algorithm outperforming the conventional FCM, AFKM and MKM algorithms by successfully producing better segmented images. The proposed TWvFKM also successfully preserves important features on digital images. Thus, it is recommendable for this algorithm to be applied in the post image processing in consumer electronic products such as the digital camera for general applications and the CCD camera which is extensively used with the microscope in capturing microscopic images, especially in segmenting medical images.

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Ballpark Figure Algorithms for Data Broadcast in Wireless Networks

K.S.Narmatha
Department of Computer Science and Engineering,
Bharathidasan University, Tiruchirappalli,
Tamil Nadu, India

E.GeorgeDharmaPrakash Raj
Department of Computer Science and Engineering,
Bharathidasan University, Tiruchirappalli,
Tamil Nadu, India

Abstract: In wireless system allocation is a necessary purpose and show industry expensive dependability in message protocol design. In multihop wireless networks, equally, imposition by a node by reason of immediate transmissions as its neighbors makes it nontrivial to graph a minimum-latency transmit algorithm, which is known to be NP-complete. A simple ballpark figure algorithm for the one-to-all transmit problem that improves all previously documented guarantees for this problem. In All-to-all transmit problem where every node sends its own consequence to all complementary nodes. In the all-to-all transmit problem, we current two algorithms with ballpark figure ratios of 20 and 34, civilizing the greatest result. A communication wants to be transmitted establishment its resource to all the previous nodes in the network. There may be different messages to be broadcasted from several sources. Two or more nodes broadcast a communication to an ordinary neighbor at the same time; the frequent node will not collect any of this communication. We say that collide has occurred at the ordinary node. So any message protocol for wireless networks must dispute with the distress of difficulty in the wireless intermediate.

Keywords: Adhoc network; Ballpark algorithm; Transmit algorithm; wireless scheduling;

1. INTRODUCTION

Wide broadcasting is a necessary development in wireless networks, in which a message requirements to be transmitted from its resource to all the further nodes in the network. There may be different communication to be broadcasted from multiple sources. some network protocols rely on broadcasting, for example, in sequence dissemination, package/source improvement, or direction-finding in multihop wireless networks demanding that type applications of multihop wireless networks consist of not a success discharge and release operations forces message, and exclusive of interruption entity detection using sensors, the propose of low-latency broadcasting process is required to meet thorough end-to-end intermission supplies for higher-level applications. Imposition is an innovative qualified problem in wireless networks. When two or more nodes broadcast a communication to a wide-ranging neighbour at the equivalent time, the regular node will not recognize any of this communication. In such a case, we say that crash has occurred at the regular node. Invasion group may be continuous better than the broadcast range, in which case a node may not collect a communication from its source if it's within the interruption range of a different node sending a message. The design of low-latency broadcasting system is necessary to meet tough end-to-end impediment requests for higher-level applications. When two or more nodes broadcast a communication to a regular neighbor at the equivalent time, the regular node will not collect some of this communication. Interfering range may be constant larger than the broadcast range, in which case a node may not collect a communication from its receiver.

2. RELATED WORK

The algorithms for ONE-TO-ALL and ALL-TO-ALL broadcasting problems. In one-to-all broadcast, there is a source that sends a message to all other nodes in the network. In all-to-all transmit each node sends its individual communication to all supplementary nodes .constant the one-to-all broadcasting problem is known to be NP-complete. For in cooperation problems, we increase ballpark figure algorithms, which develop the preceding consequences. For ONE-TO-ALL transmit problem, we convenient a simple ballpark figure algorithm that achieves a ballpark solution, thereby recovering the ballpark figure assurance. Our algorithm is based on following two ideas that lead to the development: 1) dispensation the nodes acquisitively in no growing order of the quantity of receivers, and 2) allowing nodes to broadcast more than once. The latter is principally counter-intuitive as one would be expecting that the latency would enhance if a node transmits less than once. Note that in the difficult of their algorithm gives an ballpark figure assurance that is greater than 400.

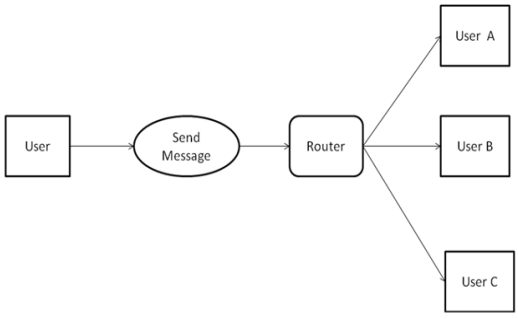

Fig 1.One to All Broadcast

ALL-TO-ALL BROADCAST problem and current two algorithms (called CDA and ICDA) with ballpark figure guarantees of 20 and 34, correspondingly, thereby recovering the ballpark figure guarantee of 27. Our enhanced product is due to well-organized development technique to collect data and then perform pipelined broadcasting. In ICDA, all nodes are scheduled to contribute in transmissions as before time as

feasible. Constant although its hypothetical bound is weaker than that of CDA, untried results prove that it afford improved presentation.

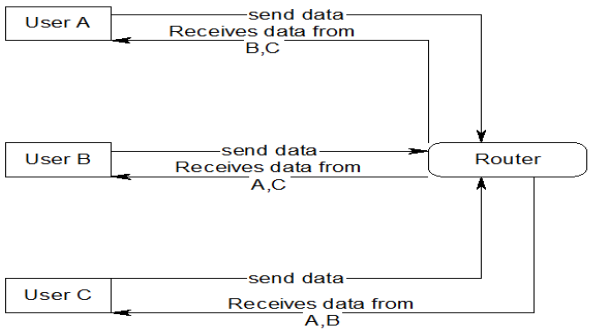

Fig 2.All to All Broadcast

We then reflect on the all-to-all transmit problem where every node sends its own communication to each and every one further nodes. Civilizing the most excellent consequence accessible in the text, we current two algorithms with ballpark figure ratios of 20 and 34. Algorithms construct greatly enhanced in observe than the worst-case guarantees provided in the hypothetical investigation and complete it gives 37 percent presentation development greater than obtainable schemes.

3. SYSTEM MODULE

3.1 Ad Hoc-Networking

Ad-hoc network is a local area network (LAN) that is built spontaneously as devices connect. Instead of relying on a base station to coordinate the flow of messages to each node in the network, the individual network nodes forward packets to and from each other. In Latin, ad hoc literally means "for this," meaning "for this special purpose" and also, by extension, improvised. In the Windows operating system, ad-hoc is a communication mode (setting) that allows computers to directly communicate with each other without a router.

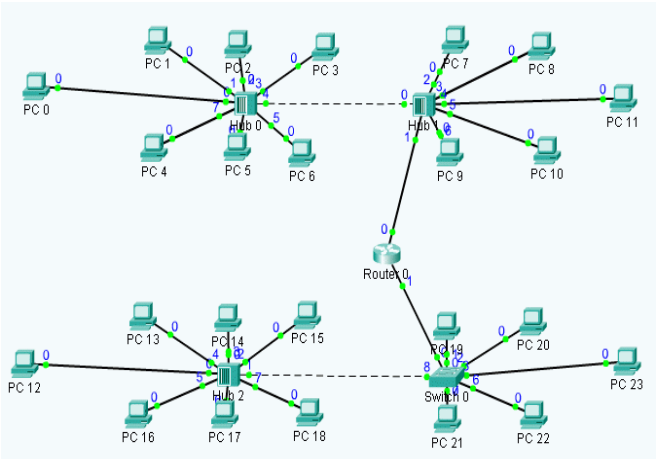

Fig 3.System Module

3.2 Ballpark Figure Algorithm

Ballpark figure algorithms are algorithms used to find ballpark solutions to optimization problems. Ballpark figure algorithms are often connected with NP-hard inconvenience; because it is improbable that around be capable to increasingly be well-organized polynomial time exact algorithms solving NP-hard problems, one settles for polynomial decentralized type of wireless networkable time sub-optimal solutions. Unlike heuristics, which usually only find realistically high-quality solutions realistically quick, one requirements demonstrable solution value and demonstrable run time limits. if possible, the ballpark figure is best possible up to a small constant reason (for instance within 5% of the optimal solution). ballpark figure algorithms are progressively more being used for effort where demand polynomial-time algorithms are recognized but are too high-priced due to the contribution range. A usual example for a ballpark figure algorithm is the one for peak envelop in graphs: find an discovered frame and include *equally* endpoints to the peak envelop, pending nobody wait. It is comprehensible that the consequential envelop is on generally two times because outsized as the best possible one. This is a even reason ballpark figure algorithm with a reason of 2

3.3 Transmit Algorithm

Transmit algorithms are typically executed concurrently, with separate parts of the algorithm being run simultaneously on independent processors, and having limited information about what the other parts of the algorithm are doing. One of the main challenges in initial and implementing disseminated algorithms is profitably coordinating the performance of the autonomous parts of the algorithm in the features of workstation failures as well as changeable exchanges links. The preference of a correct disseminated algorithm to work out a specified difficulty depends scheduled equally the quality of the difficulty, and quality of the method the algorithm will run scheduled such as the category with possibility of workstation or connection failures, the kind of inter-process message that can be performed, and the intensity of time organization involving disconnect processes.

3.4 Wireless Scheduling

How capacity is shared between users in a network .A set of rules that specify which user is allowed to transmit and which user is allowed to receive at each time-slot. In real-life systems we have to assume a delay because the scheduler.

Collects path estimates

Takes a development result

Notify the particular customer

Assumes that a wonderful path estimate is accessible at time $t+\tau$

4. EXPRIMENT RESULT

Fig 4.login window

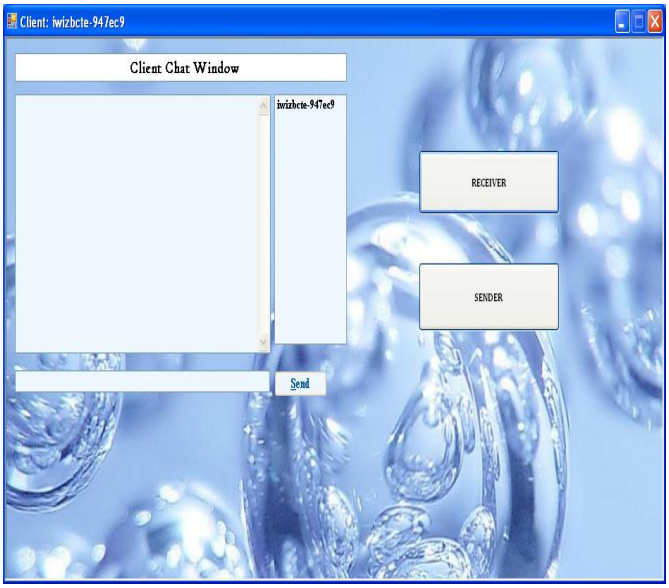

Fig5.ClientChatwindow

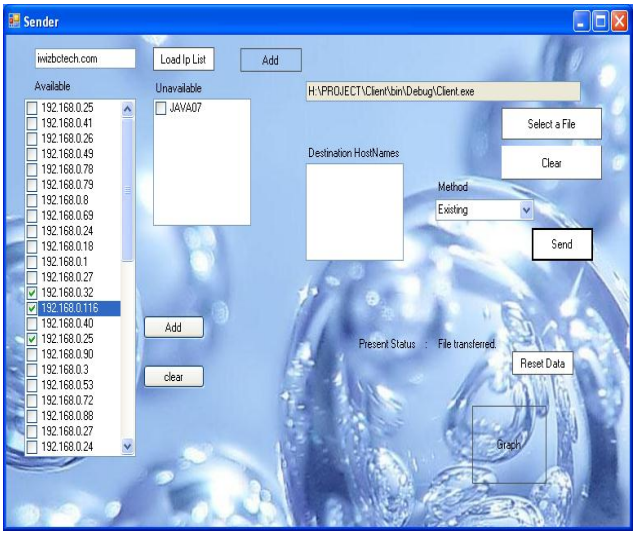

Fig 6.Sender select the path

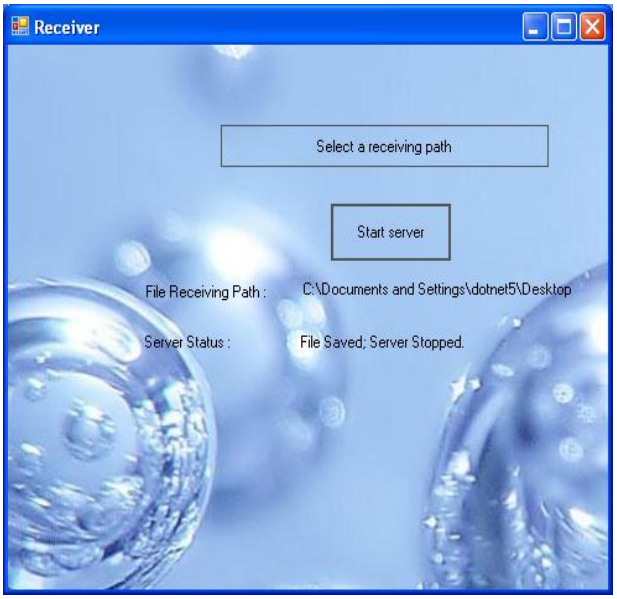

Fig 7.Select the Receiving path of sender

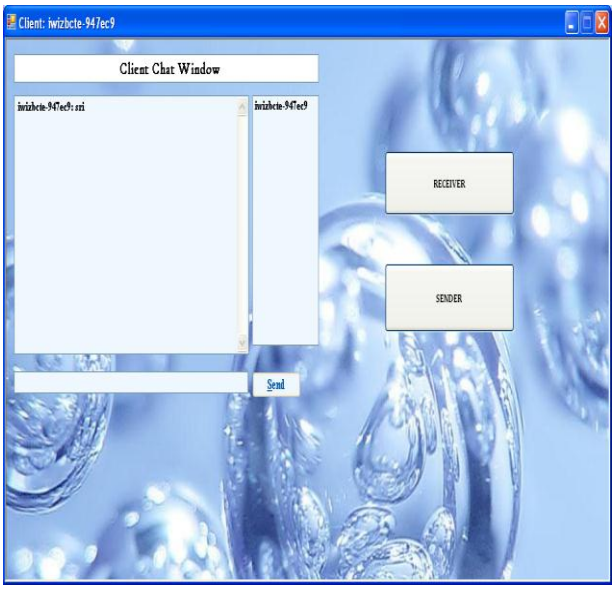

Fig 8.Chat window on receiver message

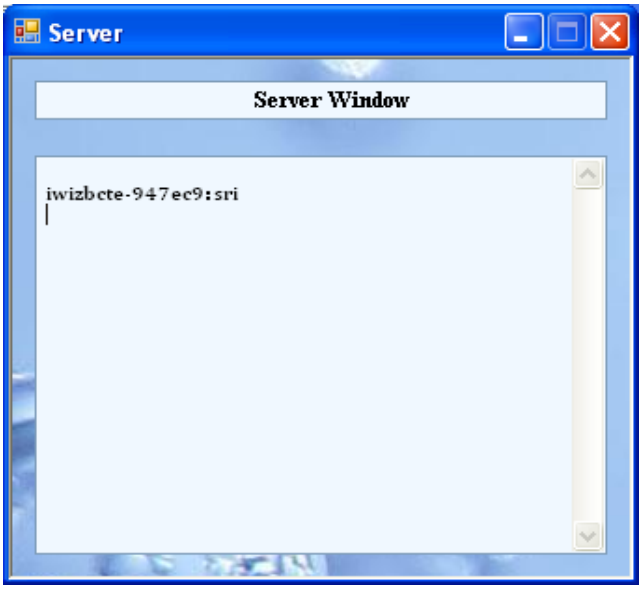

Fig 9.Receving the message on Server Window

5. CONCLUSION

The Ballpark figure algorithms for broadcasting in multihop wireless networks. The algorithm for ONE-TO-ALL BROADCASTING gives a ballpark solution, and the algorithms for ALL-TO-ALL BROADCASTING give ballpark figure ratios of 20 and 34. Our model results show that in run through, these future schemes complete much better than the hypothetical bounce and accomplish up to 37 percent latency presentation development more than existing schemes.

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Test Driven Development with Continuous Integration: A Literature Review

Sheikh Fahad Ahmad
Deptt. of Computer Science & Engg.
Integral University
Lucknow, India

Mohd. Rizwan Beg
Deptt. of Computer Science & Engg.
Integral University
Lucknow, India

Mohd. Haleem
Deptt. of Computer Applications
Integral University
Lucknow, India

Abstract: When a software product is composed of hundreds of components with complicated dependency relationship among them, change in one component can affect lots of other components' behaviour. Test Driven Development (TDD) is an approach for developing programs incrementally by first writing tests and then writing enough code to satisfy them. Continuous integration is a process that provides rapid and automatic feedback on the security of the applications that are undergoing development. Test-driven development (TDD) and continuous integration (CI) has changed the way software is tested. Software testing was often a separate process at the end of a project. It is now being worked on during the entire development period. TDD and CI rely on unit tests. This paper provides a literature study on two closely related software development approaches viz. Test Driven Development and Continuous Integration.

Keywords: *t*est driven development; continuous integration; extreme programming; agile development; pair programming

1. INTRODUCTION

Extreme Programming (XP) is one of the key components of the set of "relatively light" adaptive software development methods commonly known as agile practices. Agile practices have prompted an amount of excitement and debate in industry and education, e.g., [1]. In the Test-Driven Development process, the code that is written is determined by the tests that an engineer writes. The developer first write the test, then write the code it is meant to test. This approach is, to a great extent, counterintuitive. Developers tend to think of tests as the thing that proves that code works, but Test Driven Development requires that engineers think of code as the thing that makes the tests pass. In XP, TDD is one of the several interrelated principles that developers use to write software [2]. Continuous integration is used in most industrial projects that are developed using agile methods. In such a system, developers keep their code and accompanying unit tests in a version control server, which is continuously monitored for changes by a continuous integration server. When changes are detected, the continuous integration server executes a build script for the project. Typically the build script retrieves the latest versions of all the code and test classes, compiles the code and tests, then runs the tests. If code fails to compile or a test fails, the build is said to have failed, otherwise it is said to have succeeded. This build result is then published to the developers – usually sent by email and/or via a build results intranet webpage.

2. TEST DRIVEN DEVELOPMENT

Test Driven Development (TDD) is a technique for developing software that uses automated tests to guide the design of the target software. There are three aspects of TDD that characterize the development method: features, customer tests, and developer tests.

Features are essentially high-level requirements that the customer identifies and prioritizes. An XP team typically adopts the term "user story" to represent a feature or a task associated with implementing the feature. The project team's job is to develop software that satisfies the high-level requirements that the features represent. In a typical TDD project the work is conducted in a highly iterative fashion with only a small number of features being actively developed in any given time period.

A *customer test* characterizes one of the features of the target system. These tests get the label "customer tests" from the fact that in a typical XP project, the customer identifies and describes the test cases that make up these tests. Even for simpler target system features it typically takes several customer tests to fully characterize the feature's associated requirements. While customer tests map approximately to the tests at the traditional acceptance test level, the customer identifies and automates them (with the help of a test programmer or a tool) before the target feature actually exists, so the word "test" in their label is slightly misleading [3]. When they are first built, they characterize the target feature, so their role is for 'specification' as opposed to 'verification' or 'validation'. Once the team completes the target feature, however, these tests do perform traditional verification and validation and are used in regression testing.

A *developer test* – the third aspect of TDD to consider is a test that a developer identifies and automates as they design and construct the software. A developer typically works on one customer test at a time and starts by first writing one or more tests that specify a desired design characteristic. The focus of the design effort is to specify the modules that satisfy that one customer test. Again the use of the word "test" to describe the resulting test-like artefacts is misleading since they are specification-oriented as opposed to verification or validation-oriented. As with customer tests, developer tests are automated so that they can be executed many times over the course of the development project. Both sets of automated tests are also used for regression testing.

2.1 TDD METHODOLOGY

On the surface, TDD is a very simple methodology that relies on two main concepts: unit tests and refactoring. TDD is basically composed of the following steps:

• Writing a test that defines how a small part of the software should behave.

• Making the test run as easily and quickly as possible. Design of the code is not a concern; the sole aim is just getting it to work.

• Cleaning up the code. A step back is taken and any duplication or any other problems that were introduced to get the test to run is refactored and removed.

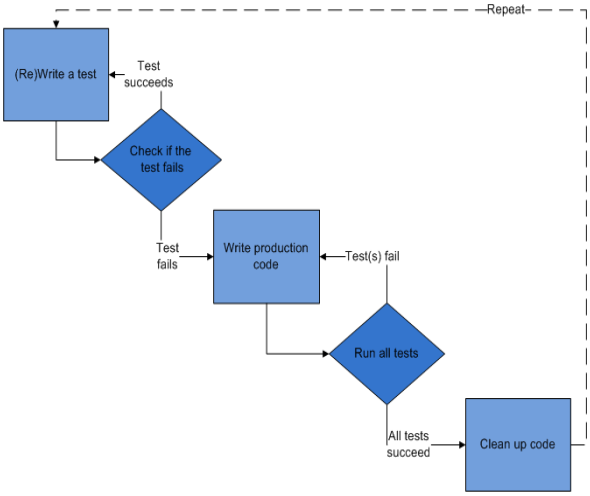

Figure. 1 TDD Cycle [4]

TDD is an iterative process, and these steps are repeated a number of times until satisfaction with the new code is achieved. TDD doesn't rely on a lot of up-front design to determine how the software is structured. The way TDD works is that requirements, or use cases, are decomposed into a set of behaviours that are needed to fulfil the requirement. For each behaviour of the system, the first thing done is to write a unit test that will test this behaviour. The unit test is written first so that a well-defined set of criteria is formed that can be used to tell when just enough code to implement the behaviour has been written. One of the benefits of writing the test first is that it actually helps better define the behaviour of the system and answer some design questions. George and Williams also has a hypothesis that code written in TDD is easier to maintain and have better design than using traditional software development methods [6].

2.2 TDD PRINCIPLES

The process of test-driven development is to write unit tests before the programmer writes any code. After the test is written the goal is to make it succeed. After the test has succeeded the programmer refactors the code to remove any duplication inside the code and between the code and the test. New code should only be written to refactor2 the existing code or to make a test pass. One should never write a new test if another test is already failing. A simpler way to look at the test-driven development cycle is "red/green/refactor"
Kent Beck [5] refers to this as the TDD mantra:
Red: Write a test before writing new code. The test will fail and be "red".
Green: Make the test succeed, turn green, taking as many shortcuts as necessary.
Refactor: Remove any duplication in the code necessary to make the test go green.

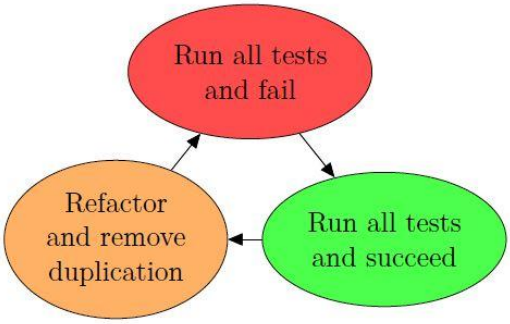

Figure. 1 Simplified test-driven development cycle, red-green-refactor

2.3 BENEFITS OF TEST DRIVEN DEVELOPMENT

Test Driven Development contributes to software development practice from many aspects such as requirements definition, writing clean and well designed code, and change and configuration management. The promises of TDD can be summarized as follows:

1. Simple, Incremental Development: TDD takes a simple, incremental approach to the development of software. One of the main benefits to this approach is having a working software system almost immediately. The first iteration of this software system is very simple and doesn't have much functionality, but the functionality will improve as the development continues. This is a less risky approach than trying to build the entire system all at once, hoping it will work when all the pieces are put together.

2. Simpler Development Process: Developers who use TDD are more focused. The only thing that a TDD developer has to worry about is getting the next test to pass. The goal is focusing the attention on a small piece of the software, getting it to work, and moving on rather than trying to create the software by doing a lot of up-front design. Thousands of decisions have to be made to create a piece of software. To make all those decisions correctly before starting writing the code is a complex challenge to undergo many times. It is much easier to make those decisions as developing the code.

3. Constant Regression Testing: The domino effect is well known in software development. Sometimes a simple change to one module may have unforeseen consequences throughout the rest of the project. This is why regression testing is important. Regression testing is like self-defence against bugs. It's usually done only when a new release is sent to quality assurance (QA). By then it's sometimes hard to trace which code change introduced a particular bug and makes it harder to fix. TDD runs the full set of unit tests every time a change is made to the code, in effect running a full regression test every time a minor change is made. This means any change to the code that has an undesired side effect will be detected almost immediately and be corrected, which should prevent any regression surprises when the software is handed over to

QA. The other benefit of constant regression testing is having a fully working system at every iteration of development. This allows the development team to stop development at any time and quickly respond to any changes in requirements.

4. Improved Communication: Communicating the ideas needed to explain how a piece of software should work is not always easy with words or pictures. Words are often imprecise when it comes to explaining the complexities of the function of a software component. The unit tests can serve as a common language that can be used to communicate the exact behaviour of a software component without ambiguities.

5. Improved Understanding of Required Software Behaviour: The level of requirements on a project varies greatly. Sometimes requirements are very detailed and other times they are vague. Writing unit tests before writing the code helps developers focus on understanding the required behaviour of the software. As writing a unit test, pass/fail criteria for the behaviour of the software is being added. Each of these pass/fail criteria adds to the knowledge of how the software must behave. As more unit tests are added because of new features or new bugs, the set of unit tests come to represent a set of required behaviours of higher and higher fidelity.

6. Centralization of Knowledge: Humans all have a collective consciousness that stores ideas they all have in common. Unfortunately, programming is mostly a solitary pursuit. Modules are usually developed by a single individual, and a lot of the knowledge that went into designing the module is usually stuck in the head of the person who wrote the code. Even if it's well documented, clean code, it's sometimes hard to understand some of the design decisions that went into building the code. With TDD, the unit tests constitute a repository that provides some information about the design decisions that went into the design of the module. Together with the source code, this provides two different points of view for the module. The unit tests provide a list of requirements for the module. The source code provides the implementation of the requirements. Using these two sources of information makes it a lot easier for other developers to understand the module and make changes that won't introduce bugs.

7. Better Encapsulation and Modularity: Encapsulation and modularity help managing the chaos of software development. Developers cannot think about all the factors of a software project at one time. A good design will break up software into small, logical, manageable pieces with well defined interfaces. This encapsulation allows developers concentrate on one thing at a time as the application is built. The problem is that sometimes during the fog of development one may stray from the ideas of encapsulation and introduce some unintended coupling between classes. Unit tests can help detect non-encapsulated modules. One of the principles of TDD says that the unit tests should be easy to run. This means that the requirements needed to run any of the unit tests should be minimized. Focusing on making testing easier will force a developer making more modular classes that have fewer dependencies.

8. Simpler Class Relationships: A well designed piece of software will have well defined levels that build upon each other and clearly defined interfaces between the levels. One of the results of having software that has well defined levels is that it's easier to test. The corollary to this is also true. If code is designed by writing tests, the focus will be very narrow, so the tests will tend not to create complex class relationships. The resulting code will be in the form of small building blocks that fit neatly together. If a unit test is hard to write, then this usually means there is a problem in the design of the code. Code that is hard to test is usually bad code. Since the creation of the unit tests help point out the bad code, this allows to correct the problem and produce better designed, more modular code.

9. Reduced Design Complexity: Developers try to be forward looking and build flexibility into software so that it can adapt to the ever-changing requirements and requests for new features. Developers are always adding methods into classes just in case they may be needed. This flexibility comes at the price of complexity. It's not that developers want to make the software more complex, it's just that they feel that it's easier to add the extra code up front than make changes later. Having a suite of unit tests allows to quickly tell if a change in code has unforeseen consequences. This will give the developer the confidence to make more radical changes to the software. In the TDD process, developers will constantly be refactoring code. Having the confidence to make major code changes any time during the development cycle will prevent developers from overbuilding the software and allow them to keep the design simple. The approach to developing software using TDD also helps reduce software complexity. With TDD the goal is only adding the code to satisfy the unit tests. This is usually called developing by intention. Using TDD, it's hard to add extra code that isn't needed. Since the unit tests are derived from the requirements of the system, the end result is just enough code to have the software work as required.

3. CONTINUOUS INTEGRATION

Continuous Integration is a process where software is built at every change. This means that when a change made by developer has been detected in source code, an automated build will be triggered on a separate build machine. The build contains several predefined steps like compiling, testing, code inspection and deployment - among other things. After the build has been finished a build report will be sent to specified project members. The build report tells the result of each build step with detailed information about possible errors that may have occurred. Fowler [7] describes CI as “Continuous Integration is a software development practice where members of a team integrate their work frequently; usually each person integrates at least daily - leading to multiple integrations per day. Each integration is verified by an

automated build (including test) to detect integration errors as quickly as possible. Many teams find that this approach leads to significantly reduced integration problems and allows a team to develop cohesive software more rapidly". Continuous integration was conceived to avoid the indeterminately long integration processes common in large software projects. Integration is among the last phases in a software development project where all the different parts of the software are joined together and put under integration tests to verify that they can interact with each other as planned [8].

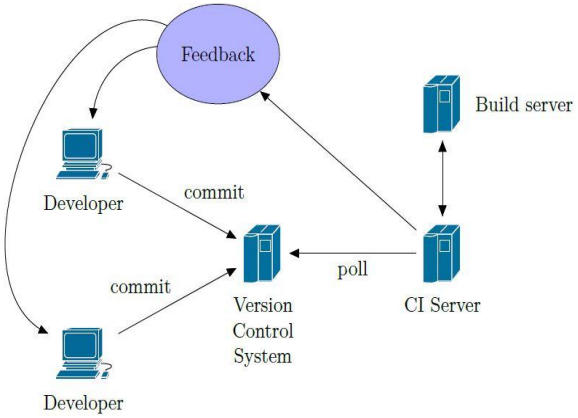

Fig 3: Continuous integration Cycle [9]

4. CONTINUOUS INTEGRATION BUILD PROCESS

The following section will discuss the practices of continuous integration from Fowler's article [8].

4.1 CODE REPOSITORY

A code repository is maintained by using a version control system where each developer can commit code into the project, revert to an earlier stage or merge conflicting changes. For CI to work the repository needs to be used actively by the developers - committing after every change in the software. The code repository should contain everything the build machine needs to build the software.

4.2 AUTOMATED BUILD

The entire build process should be automated to a simple process that does not require user interaction. There are several tools available for creating build scripts. For Java, Maven [10] and Ant [11] are often used, for .NET Nant [12] and MSBuild [13] are available. There are also language independent tools available, like FinalBuilder [14], which can build and test software from almost any source.

4.3 TESTING THE BUILD

The build should be self-testing using a set of unit tests. Unit testing is a method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures, are tested to determine if they are fit for use.

4.4 CODE COMMITS

Each developer should commit changes to the main repository at least once a day. Every time a commit is made, a build should be checked out into the integration environment and go through all the tests. The integration environment should resemble the production environment as closely as possible.

4.5 BUILD TIME

For a continuous integration process to be effective, the build must be fully automated and not be too time consuming. A CI build should never last more than 10 minutes according to the extreme programming guidelines. If it does, the tests should be optimized until they take less than ten minutes [15]. This is because the programmer should still have the changes made to the code fresh in his mind in case the build fails. If the programmer has started working on a new task, it will be harder to look back at the last problem and find the bug.

4.6 FEEDBACK

Finally, it is important that the entire team can get feedback from the integration tests when they want it. Some use lights or lava-lamps showing if the build is currently integration correctly or not. In addition websites can give deeper insight in where the problem lies and show statistics of how well the build is working over time. E-mail notifications are also a nice way to be notified of a builds success, but they should be targeted to the developer(s) that sent the build, not the entire team.

5. Benefits Of Continuous Integration

SQM are composed of software metrics and SQFs. According to Duvall [16], integrating software is not an issue in small, one person, projects, but when multiple persons or even teams start to work together in one project, integrating software becomes a problem, because several people are modifying pieces of code which ought to work together. To verify that different software components work together raises the need to integrate earlier and more often. The following sections describe what kind of benefits Duvall has been able to identify.

1. Reduce risks: By integrating many times a day, risks can be reduced. Problems will be noticed earlier and often only a short while after they have been introduced. This is possible because CI integrates and runs tests and inspections automatically after each change.

2. Reduce repetitive processes: CI automates code compilation, testing, database integration, inspection, deployment and feedback. Doing these steps automatically saves time, cost and effort. By automating the process, it is also made sure that all steps are done exactly the same way every time. All this frees people to do more thought-provoking, higher-value work and helps to avoid making mistakes in repetitive tasks.

3. Generate deployable software: One of the goals of agile software development is to deploy early and often. CI helps to achieve this by automating the steps to produce deployable software. Deployable and working software is the most obvious benefit of CI from an outside perspective, because customer or end user is not usually interested if CI was used as part of QA. It is also the most tangible asset, as software which works and is deployed, is the final output of CI.

4. Enable better project visibility: The fact that CI runs often provides the ability to notice trends and make decision based on real information. Without CI, the information must be gathered manually and this takes a lot of time and effort. A CI system can provide just-in-time information on the recent build status and quality metrics such as test coverage or number coding convention violations.

5. Greater product confidence: By having CI in place, the project team will know that certain actions are always made against the code base. CI will act as a safety net to spot errors early and often and that will result in greater confidence for the team to do their job. Even bigger changes can be made with confidence.

6. CONCLUSION AND FUTURE WORK

This study provided substantial evidence that Test-Driven Development is, indeed, an effective tool for improving the quality of source code. Every time a programmer writes code that interacts with a class, she is given a reminder of that class's responsibilities. Test-Driven Development, because it requires writing the test for the responsibility as well as the implementation of that responsibility, faces programmers with this reminder twice as often before the code is written. Subramaniam and Hunt [17] argue that writing tests first forces programmers to look at their classes as users of the class's interface, rather than as implementers of that class. This perspective shift provides constant opportunity for the programmer to be confronted by the question of how cohesive a code change is. Software quality is hard to measure, but considering the increased test coverage and that tests are always run with latest version of all dependencies, it is safe to say that possible problems are noticed sooner than what they used to. Additionally problems were also fixed sooner. However it can also be said that the observed improvement may have not been achieved only by having all the features of CI, but also because the mindset in the team changed by the motivation they got from using CI.

This paper provides a basis for researchers and practitioners for better understanding of the abovementioned software development approaches for their purposes. In the next phase, this study can be used to develop a new software development framework based on Test Driven Development and Continuous Integration which can be validated by employing the technique on a software project.

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Literature Survey on Image Deblurring Techniques

Minu Poulose
Nehru College of Engineering
and Research Center
Thrissur, India

Abstract: Image restoration and recognition has been of great importance nowadays. Face recognition becomes difficult when it comes to blurred and poorly illuminated images and it is here face recognition and restoration come to picture. There have been many methods that were proposed in this regard and in this paper we will examine different methods and technologies discussed so far. The merits and demerits of different methods are discussed in this concern

Keywords: Face recognition, blur kernel, Point Spread Function (PSF), Local Phase Quantization, Linear Ternary Patterns,L1 norm

1. INTRODUCTION

Images can be generally classified into two types. They are constrained domain images and unconstrained domain images. These classifications allow the image to be considered in a restricted environment where the illumination and pose is preset. Here there is no disturbance of light and pose or any other problem and the image is ready to recognize. These types of images are known as the constrained images. But there are some images where nothing is preset. There can be illumination and posing problems. These are the unconstrained domain images. These images can be those taken with a distant camera or those images of a moving object taken with a static camera. All these images are the unconstrained images. Here there can be recognition problems. There we need to restore the image and then only we can recognize. A blurred image can be considered as a convolution function of a sharp image and a blur kernel or PSF. So in order to retrieve the sharp image we need to split the image into its blur kernel and sharp image. But the problem here is the estimation of the blur kernel. This unknown blur kernel estimation is known as the deconvolution. Most of the deblurring techniques make use of these concepts.

The rest of the paper is organized as follows: Section 2 gives a literature review on certain modern deblurring schemes highlighting its strengths and weaknesses. Section 3 compares the different schemes based on certain design criteria's. Finally concluding remarks are given

2. LITERATURE REVIEW

In this section we will be describing the approaches that were used in deblurring the image like subspace analysis [1], with noisy pairs [4], the general blind deconvolution methods [2], deconvolution with statistics, using local phase quantization, linear ternary patterns, set theoretic characterization etc.

2.1 Deblurring using Subspace Analysis [1]

Here in this method there is a training set which consists of blurred images. From this set more knowledge can be derived. Then a feature space is constructed so that the blurred faces with the same point spread function are quite similar. In the training phase, a model of each point spread function or blur kernel is computed in the feature space. For the blur kernel inference we compare a query image of blur kernel which is not known with each model and selects the closest one.

The given query image is deblurred using the blur kernel corresponding to that particular model and then it can easily be recognized. In short this algorithm, inferred PSF using learned models of facial appearance variation under different amounts of blur. Then the inferred PSFs were used to sharpen both query and target images.
This method can also be used for recognizing textual character, hand and body postures under blur. The disadvantage with this method is that it may not work well for other objects consisting of uniform texture like a plastic cup. This approach has not yet been proven for images blurred with multi unknown factors or with severe blur such as camera shake

2.2 Blind Image Deconvolution Method [2]

There are basically two type of deconvolution methods. They are projection based blind deconvolution and maximum likelihood restoration. In the first approach it simultaneously restores the true image and point spread function. This begins by making initial estimates of the true image and PSF. The technique is cylindrical in nature. Firstly we will find the PSF estimate and it is followed by image estimate. This cyclic process is repeated until a predefined convergence criterion is met. The merit of this method is that it appears robust to inaccuracies of support size and also this approach is insensitive to noise. The problem here is that it is not unique and this method can have errors associated with local minima.

In the second approach the maximum likelihood estimate of parameters like PSF and covariance matrices. As the PSF estimate is not unique other assumptions like size, symmetry etc of the PSF can be taken into account. The main advantage is that it has got low computational complexity and also helps to obtain blur, noise and power spectra of the true image. The drawback with this approach is of algorithm being converging to local minima of the estimated cost function.

2.3 Deblurring with Blur Estimation Algorithm [3]

In general the focal deblurring process is done with modeling as Gaussian low pass filtering. So the problem of blur estimation will include the estimation of the blur kernel. Here the input image (blurred) is first re-blurred by Gaussian blur kernels having different blur radius. After that the difference ratios between the different re-blurred images are used for determining the unknown blur radius. With the edge model it can be seen that the blur radius can easily be

measured from the difference ratio and is not dependent of edge amplitude or position. The maximum of difference ratio can be seen at the edge positions. Here the advantage with this approach includes robust estimation in areas having multiple neighboring edges and this method also does not require detection of edge position and angle.

2.4 Deblurring with noisy image pairs [4]

In this approach the image is deblurred with the help of noisy image. As a first step both the images the blurred and noisy image are used to find an accurate blur kernel. It is often very difficult to get blur kernel from one image. Following that a residual deconvolution is done and this will reduce artifacts that appear as spurious signals which are common in image deconvolution. As the third and final step the remaining artifacts which are present in the non-sharp images are suppressed by gain controlled deconvolution process. The main advantage of this approach is that it takes both the blurred and noisy image and as a result produces high quality reconstructed image. With these two images an iterative algorithm has been formulated which will estimate a good initial kernel and reduce deconvolution artifacts. There is no special hardware is required. There are also disadvantages with this approach like there is a spatial point spread function that is invariant.

2.5 Removing Blur with Image Statistics

In most cases the blurred image is deblurred with a single blur kernel. But when an image having motion in different direction is considered then it can cause serious problems. As a result different kernels need to be considered. Here in this approach a single frame is considered for the whole image with the help of segmentation. It can be seen that the statistics of the derivatives are very much changed under different blur kernels. This algorithm searches for mixture model that can best define the distribution observed in the image. It results in two blur kernels and then by taking smooth layers assignment the likelihood is maximized. The output produced is a real world image with rich texture. But it has also got some limitations like the use of box filters, unknown direction of the blur, failure to describe the blur size etc. The blur patterns in real images can also turn much complex. Taking features other than simple derivative is seen improving the performance.

2.6 Deblurring with Linear Ternary Pattern [6]

Linearly binary patterns can be called as an extension of LBP features and are also invariant to small misalignments of pixels. This method mainly has 3 divisions. Firstly to eliminate the effects of illumination problem a pre-evaluating chain is presented without eliminating the essential features required for face recognition. Then the local ternary pattern is selected and it is less sensitive to blur effects. Here we can see that the local distance transform based on similarity is better than the local histogramming. When this method is compare with other approaches Multiscale Retinex (MSR [10]), Logarithmic Total Variation (LTV [8]) this method proves much better. So far this method has not been used along with subspace analysis. It can be incorporated to improve this method's performance.

2.7 Using Local Phase Quantization [7]

Phase is a property of the images which is invariant to blur. So using this property local phase quantization method has been proposed. Like the linear binary pattern used for recognition histogram of the linear phase quantization can used. It is very simple to implement and fast executing. There the challenge is the various lightning conditions. But this can be eliminated to greater extent with normalization of illumination. Here only phase information is used and so the changes are not affected. Accuracy of this method is found to be much higher than the LBP patterns. It is much better than images whose textures are not blurred.

2.8 Face Recognition with set theoretic method [8]

Here in the set theoretic approach both blur and illumination problem are taken into account. Instead of taking blind deconvolution as such here we can see that that the different characteristics of blur are included. Also the image is taken as a convex set. Using the Direct Recognition of blurred faces algorithm we can remove the blurring of the images. In the algorithm a sharp image gallery is blurred with a blur kernel applying different conditions. Then the distances between the blurred images are compared with the artificially blurred image and that having minimum distance is taken as the corresponding image. Followed by that the illumination challenges are taken into account. Here the illumination coefficient for image when considered at different planes are considered and is incorporated in the algorithm. Now together with the removal of blur illumination problems are also removes. It is easy to implement, not complex and returns much better result than the other previous approaches. Also here L1 norm distance is taken for making the algorithm robust to pixel misalignments.

3. COMPARISON OF DIFFERENT DEBLURRING TECHNIQUES

Different methods were discussed so far. To have a clear picture, see table 1.

Table 1. Comparison Table

Aspect / Method	Accuracy	Different Type of blurs
SubSpace Analysis	Medium	Low
Blind Image Deconvolution	Medium	Medium
Image Statistics	High	Medium
Local Phase Quantization	High	Medium
Set theoretic Approach	High	High

In the first approaches In most of the deblurring approaches it uses the most common technique called the blind image

deconvolution. Here the unknown blur kernel is rough estimated and recognition is done on that basis. In the subspace analysis [1] the different texture blur could be easily recognized. But it also had the problem of not solving the images with uniform textures. Blind image deconvolution techniques though like a probability process if blur kernel is found correctly then it is one of the most reliable technique. Earlier techniques like using linear binary pattern, linear ternary patterns, linear phase quantization etc were used. These methods had advantages of being robust to misalignments in the pixel value.

4. CONCLUSION

From the above analysis we can see that though the subspace analysis [1] and blind image deconvolution [2] finds result to some extent it is prone to errors and is more or less like a probability method. In the local phase quantization technique it is accurate but not robust to different types of blurs and lighting problems can make the deblurring difficult. In the Set theoretic approach we can see that it is more accurate and different blur conditions are added on to make deconvolution method much less complex than the other approaches

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A Multiparametric Reliable AODV Protocol using Alternate Routing in MANET's using NS-2

Sonal Beniwal
Department of Computer Science and Engineering.
BPSMV, Khanpur Kalan
Sonepat,India

Pinki
Department of Computer Science and Engineering.
BPSMV, Khanpur Kalan,
Sonepat,India

Rashmi Jatain
Department of Computer Science and Engineering
UIET,MDU
Rohtak,India

Abstract: In this paper, we design and formulate a trust-based routing protocol for secure transactions, such as military and disaster relief operations, banking in mobile ad hoc networks (MANETs). The proposed approach is showing the idea of a trust model in the network layer of MANET.AODV is ad hoc on demand distance vector, this protocol starts the route specially when some node claims to send data. In AODV whenever a link breaks an error message is sent indicating the link and packet sending is dropped. In our proposed scheme a packet is sent through alternative path. In this approach a trust node is made with neighbors. Simulation results shows that proposed scheme has less packet loss and packet ratio delivered is more.

Keywords:*MANET,Ad hoc, AODV, Routing Algorithm, Reverse Route*

1. INTRODUCTION

A mobile ad hoc network (MANET)is a kind of wireless network without centralized administration or fixed network infrastructure in which nodes communicate over relatively bandwidth constrained wireless links and perform routing discovery and routing maintenance in a self-organized way. The topology of the MANET may change uncertainly and rapidly due to the high mobility of the independent mobile nodes, and because of the network decentralization, each node in the MANET will act as a router to discover the topology. Nowadays the MANET enables many promising applications in the areas of emergency operations, disaster relief efforts. The Mobile Ad hoc network is one of most commonly used wireless network. As the number of user in this network increases it also suffer from most of the network problems like congestion, packet loss, intrusion etc. In case of multicast such kind of problem is quite common. AODV is the most efficient on demand protocol used in Mobile Adhoc network. This protocol support efficient transmission in Multicast and broadcast communication. It create a loop free efficient routing. But because of some attack or the congestion it provide higher loss. There is the requirement of some improvement over the existing AODV protocol to provide the secure and efficient communication over the network.
The Ad-hoc On-Demand Distance Vector (AODV) routing protocol is designed for use in ad-hoc mobile networks. AODV is a reactive protocol: the routes are created only when they are needed. It uses traditional routing tables, one entry per destination, and sequence numbers to determine whether routing information is up-to-date and to prevent routing loops. An important feature of AODV is the maintenance of time-based states in each node: a routing entry not recently used is expired. In case of a route is broken the neighbours can be notified. Route discovery is based on query and reply cycles, and route information is stored in all intermediate nodes along the route in the form of route table entries. The following control packets are used: routing request message (RREQ) is broadcasted by a node requiring a route to another node, routing reply message (RREP) is unicaste back to the source of RREQ, and route error message (RERR) is sent to notify other nodes of the loss of the link. HELLO messages are used for detecting and monitoring links to neighbors.

AODV is a relative of the Bellmann-Ford distant vector algorithm, but is adapted to work in a mobile environment. AODV determines a route to a destination only when a node wants to send a packet to that destination. Routes are maintained as long as they are needed by the source. Sequence numbers ensure the freshness of routes and guarantee the loop-free routing.

The objective of this paper is route maintenance using alternative path at each node. Study and analysis of different Routing Protocol in Mobile Network. Implement the TAODV protocol to identify reliable route based on trust level analysis. Implementation of proposed Protocol in NS2 environment Analysis of proposed system using XGraph in terms of throughput and packet loss.[2,6]

The remaining paper is described as section2 describes the work related to AODV .The proposed scheme is described in section3.Section4 represents the experimental results.Section5 represents the conclusion and then references.

2. RELATED WORK

Debdutta Barman Roy propose a new Intrusion Detection System (IDS) based on Mobile Agents. The approach uses a set of Mobile Agent (MA) that can move from one node to another node within a network. This as a whole reduces network bandwidth consumption by moving the computation for data analysis to the location of the intrusion. Besides, it has been established that the proposed method also decreases the computation overhead in each node in the network. [1]

Shailender Gupta defined a work on selfish node detection. A selfish node is one that tries to utilize the network resources for its own profit but is reluctant to spend its own for others. If such behaviour prevails among large number of the nodes in the network, it may eventually lead to disruption of network. This paper studies the impact of selfish nodes concentration on the quality of service in MANETs. [2]

Md. Amir Khusru Akhtar presented a mathematical model to detect the selfish node. In this paper Author are presenting the mathematical model to detect selfish nodes using the probability density function. The proposed model works with existing routing protocol and the nodes that are suspected of having the selfishness are given a Selfishness test. This model formulates this problem with the help of prior probability and continuous Bayes' theorem.[3]

. Li Zhao performed a work to detect misbehaviour on data and mitigate adverse effects, Author propose and evaluate a Multipath Routing Single path transmission (MARS) scheme. The MARS combines multipath routing, single path data transmission, and end-to-end feedback mechanism together to provide more comprehensive protection against misbehaviour from individual or cooperating misbehaving nodes. [5]

Zougagh Hicham performed a comparative study of intrusion detection in adhoc nework. In recent years, the use of mobile ad hoc network (MANETs) has been widespread in many applications. Due to its deployment nature, MANETs are more vulnerable to malicious attack. The absolute security in the mobile ad hoc network is very hard to achieve because of its fundamental characteristics, such as dynamic topology, open medium, absence of infrastructure, limited power and limited bandwidth. In this article Author classify the architecture for IDS that have so far been introduced for MANETs, and then existing intrusion detection techniques in MANETs presented and compared. Author then provide some directions for future researches. [6,7,8]

Michael Wayne Probus performed a work on selfish node isolation. This thesis will focus on the topic of Selfish Nodes within a Mobile Ad-Hoc Networks (MANET), specifically sensor networks due to their lower power and bandwidth. The approach used is a reputation based algorithm to isolate the selfish nodes from communication by using past history to determine how reliable the node is. The reputation of each node is determined by their behavior within the network. As a node continuously acts selfishly, their reputation is decreased, until finally meeting the minimum threshold; therefore they are determined to be malicious. [11,12]

3. PROPOSED WORK

In this chapter basic AODV protocol is defined along with its properties and the problem. The AODV protocol itself gives the concept of network reconfiguration to provide the network stability. The AODV protocol is capable to identify the broken link over the network. As the broken link is identified, it find the compromising path to perform the rerouting for network communication .In this chapter the proposed model is also defined with TAODV procol.In our proposed work we are providing an early decision about the node stability:

1.Here each node will inform the node regarding the broken link earlier because of this the route can be changed earlier.

2.A timeout based flooding will be performed by each node periodically. If some node is not responding for n number of trails then the decision will be taken that node is a bad node.

3.The bad node will be marked as the inactive node in routing table and while communicating the earlier decision will be taken regarding this.

4.As the bad node is identified an agent will be set as neighbour to the bad node. The agent will keep watch on this bad link or the node.

5.As the bad link get repaired the agent will inform the node to perform communication from the initial path. [9,10]

In this present work we have improved the communication by representing the node as an intelligent node. In this present work the first time communication performed by the network is same as of existing AODV.It means it will detect the attack or the broken link in same way as of actual AODV. But once the attack is detected it will enable the immediate previous node to attack as the manager node that will track the attack position or the attack node periodically. Till there is attack in the network it will not allow the communication on that route. It means it will identify the preventive path to communicate from the alternate path or the node. As that manager node identify that the broken link or attack is repaired dynamically, it will start the communication from this previous path.

The proposed system will give the following benefits.

1.It not only dynamically reconfigure the network as the attack found, it will also identify the dynamic repairing of the network. If the network is repaired dynamically it will move back to the previous effective path.

2.The nodes are taken as intelligent node and converted to manager node as the attack found on their immediate communication path or the node.

4.SIMULATION AND RESULTS

Hardware Used :

Processor : Pentium 5
Processor Speed : 1.5 GHZ
Memory(RAM) : 256 MB
Hard disk : 40 GB

Software Used :

Operating system : Linux 8.0
Language : OTcl
Software : NS 2.35

4.1.1 NS2 Overview

NS is a discrete event network simulator where the timing of events is maintained by a scheduler and able to simulate various types of network such as LAN and WPAN according to the programming scripts written by the user. It provides substantial support for simulation of TCP, routing and multicast protocols over wired and wireless networks. It consists of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. The network animator (NAM) is graphical software which is used to visualize the simulations. NS2 fully simulates a layered

network from the physical radio transmission channel to high-level applications.

NS2 is an object-oriented simulator written in C++ and OTcl (an object oriented extension of Tcl). The simulator supports a class hierarchy in C++ and a similar class hierarchy within the OTcl interpreter. There is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compile hierarchy. The reason to use two different programming languages is that OTcl is suitable for the programs and configurations that demand frequent and fast change while C++ is suitable for the programs that have high demand in speed. NS2 is highly extensible. It not only supports most commonly used IP protocols but also allows the users to extend or implement their own protocols. The latest NS2 version supports the four ad hoc routing protocols, including DSR. It also provides powerful trace functionalities, which are very important in our project since information need to be logged for analysis. The full source code of NS2 can be downloaded and compiled for multiple platforms such as UNIX, Windows etc.

4.1.2. Performance Metrics

a) **Packet Lost** : The total no. of packets dropped by the node when there exist no route to destination.[13 ,14, 15]

b) **Packet Delay** : It is the average time a Packet takes to reach from source to destination.

c) **Bytes Transmitted** : The rate of successfully transmitted Bytes in the netwok during simulation.

4.1.3. Network Parameters

[1] Area	**[2] 784x569**
[3] Routing Protocol	**[4] AODV**
[5] MAC protocol	**[6] 802.11**
[7] Number of Nodes	**[8] 26**
[9] Queue Length	**[10] 50**
[11] Antenna	**[12] OmniAntenna**

4.2. Analysis Results:

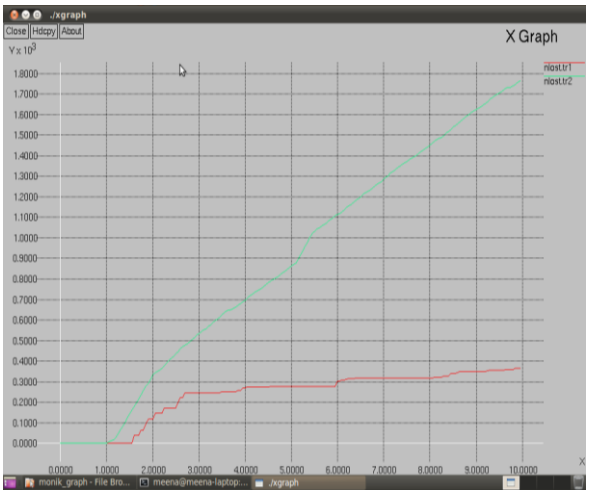

Figure 4.1:Packet Lost (Existing Vs Proposed Approach)

Here figure 4.1 is showing the comparative analysis of packet lost over the network. Here x axis represents the time and y axis represents the packet transmitted. As we can see after implementing the proposed approach the packet loss over the network is decreased.

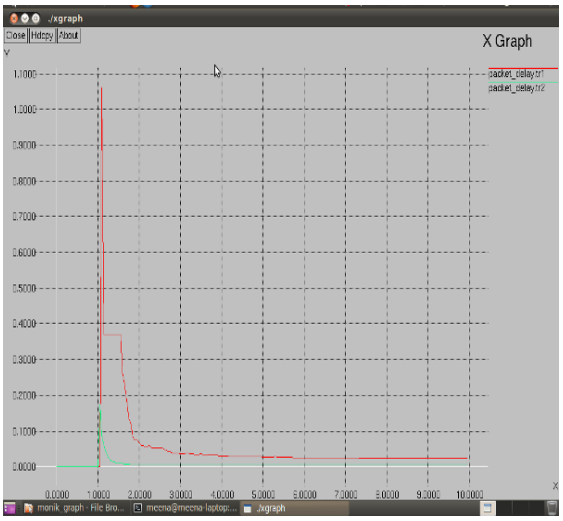

Figure 4.2 : Packet Delay (Existing Vs Proposed Approach)

Here figure 4.2 is showing the comparative analysis of Packet Delay over the network.Here x axis represents the time and y axis represents the Packet Delay of communication. As we can see after implementing the proposed approach the Packet Delay over the network is decreased.

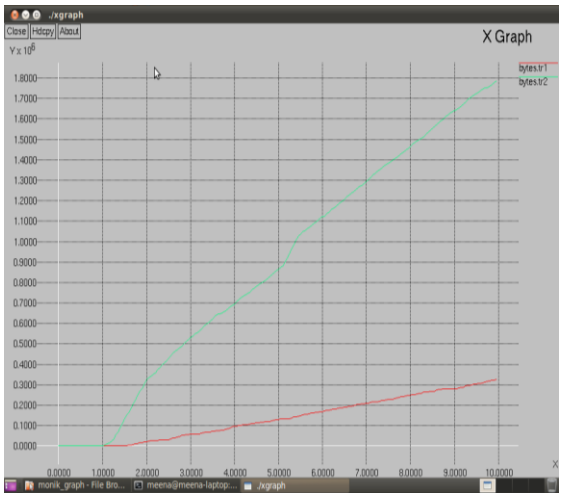

Figure 4.3 :Bytes transmitted (Existing Vs Proposed Approach)

Here figure 4.3 is showing the comparative analysis of bytes transmitted over the network. Here x axis represents the time and y axis represents the btes transmitted. As we can see after implementing the proposed approach the bytes transmitted over the network is increased.

5. CONCLUSION

In this present work we have shown the improvement over AODV protocol to ensure the stability with less delay. In this work we have provided the stability in case of broken link reconfiguration. It means as the broken link is detected the routing path is modified by the AODV protocol. But it does not define to on the previous path back when the link is been repaired. In this present work we have included the concept of manager node. The manager node is maintained just previous to the broken link node. The broken link node will keep a watch on the link and check for its reconfiguration after a short delay. As the link is repaired it will again change the communication path to the previous routing path. The presented work has provided the better stability within efficient time and without using any extra rersources.

6. FUTURE SCOPE

In this present work we deal with the AODV protocol, but in future we can use some other protocol to improve it respective to the network stability. In this work we deal basically with unicasting and the improvement can be done to check it for multicasting. We can also try the same approach on different scenarios also.

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AN INVERTED LIST BASED APPROACH TO GENERATE OPTIMISED PATH IN DSR IN MANETS – A REVIEW

Sunita
Department of Computer Science and Engineering
BPSMV, Khanpur Kalan
Sonepat,India

Kusum Lata
Department of Computer Science and Engineering
BPSMV, Khanpur Kalan,
Sonepat,India

Rashmi Jatain
Department of Computer Science and Engineering
UIET,MDU
Rohtak,India

Abstract: In this paper, we design and formulate the inverted list based approach for providing safer path and effective communication in DSR protocol.Some nodes in network can participate in network more frequenctly whereas some nodes are not participating. Because of this there is the requirement of such an approach that will take an intelligent decision regarding the sharing of bandwidth or the resource to a node or the node group. Dynamic source routing protocol (DSR) is an on-demand, source routing protocol , whereby all the routing information is maintained (continually updated) at mobile nodes.

Keywords:*MANET,Ad hoc, DSR, Routing Algorithm, Reverse Route*

1.INTRODUCTION

A Mobile ad hoc network is a group of wireless mobile computers (or nodes). In which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed.A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time, because the nodes are mobile.

Dynamic Source Routing (DSR)

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it establishes a route on-demand when a transmitting mobile node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device. Dynamic source routing protocol (DSR) is an on-demand, source routing protocol , whereby all the routing information is maintained (continually updated) at mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network .

An optimum path for a communication between a source node and target node is determined by Route Discovery process. Route Maintenance ensures that the communication path remains optimum and loop-free according the change in network conditions, even if this requires altering the route during a transmission. Route Reply would only be generated if the message has reached the projected destination node (route record which is firstly contained in Route Request would be inserted into the Route Reply).

Advantages and Disadvantages

DSR uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead.

The disadvantage of DSR is that the route maintenance mechanism does not locally repair a broken down link. The connection setup delay is higher than in table-driven protocols. Even though the protocol performs well in static and low-mobility environments, the performance degrades rapidly with increasing mobility. Also, considerable routing overhead is involved due to the source-routing mechanism employed in DSR. This routing overhead is directly proportional to the path length. In this work the main concern is about to find the frequency of node participation over the network. Lot of work is done in the same direction. Here we are presenting the improved inverted table mechanism to find the most frequent nodes over the network. The method is introduced by K.V.S.R.P.Varma in year 2010. This approach is used by him to idenfiy the similarity and frequency analysis in case of DNA sequencing. He performed the work to find the largest possible node sequence over the network. Lot of work is already done in terms of string extraction, string matching and pattern identification over the string. Frequent Item set Mining plays an essential role in many data mining tasks and applications, such as mining association rules, correlations, sequential patterns, classification and clustering. Frequent item set construction has been a major research area over the years and several algorithms have been proposed in the literature to address the problem of mining association rules.

We are performing the same kind of pattern discovery in case of Mobile pattern identification. For this the improved

inverted table approach is used. The complete work is divided in three basic steps.

I. Identification of Node Sequence

II. Build the Inverted Table for the specific Node Sequence.

III. Frequent Pattern Identification.

1. Identification of Node Sequence

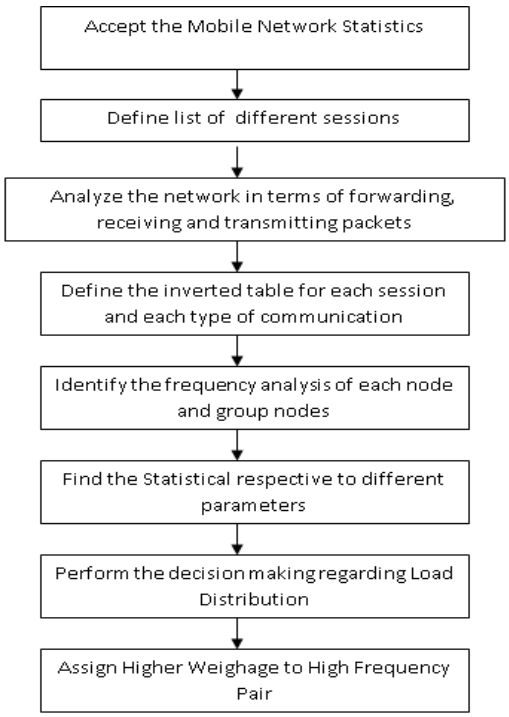
The node sequence is identified by analyzing the communication database of the complete network. We have collected this database from some secondary means that is used by some earlier researcher. The details about the database collection is given above in previous section.[20,27,29]

II. Build the Inverted Table

Inverted matrix is the numerical representation of a string. The rows of the matrix represent the various characters present in the string and are indexed in the order in which they appear in the string. In this proposed we have taken a sequence

III. Frequent Pattern Identification

As the inverted table built, it is capable to answer all the frequency oriented queries. We can find the occurrence of any of node or the node sequence by using inverted table. The main benefit of this approach is that the single inverted table is capable to answer all the user query in terms of node sequence of any length.



SIGNIFICANCE OF WORK

In this work presented work a to find the frequent communicating nodes over the network The proposed system can be implemented on a wired or wireless network. The proposed system is also independent to the network type. It can be mobile network or the wireless lan. . It is the intelligent system that uses the artificial intelligent system approach along with statistical analysis to derive the fair and quick results about the study of allocation of resources to the available nodes. It can search out the users that are doing more utilization of the bandwidth or the time slic. The proposed work we return a reliable and efficient communication over the network.

We focus on one important class of optimizations, index compression. Inverted index compression is used in all major engines, and many techniques have been proposed [26, 29]. Informally, an inverted index for a collection of documents is a structure that stores, for each term (word) occurring somewhere in the collection, information about the locations where it occurs. In particular, for each term t, the index contains an inverted list It consisting of a number of index postings. Each posting in It contains information about the occurrences of t in one particular document d, usually the ID of the document (the docID), the number of occurrences of t in d (the frequency), and possibly other information about the locations of the occurrences within the document and their contexts. The postings in each list are usually sorted by docID. For example, an inverted list It of the form {56, 1,34}{198, 2,14,23} might indicate that term t occurs once in document 56, at word position 34 from the beginning of the document, and twice in document 198 at positions 14 and 23. We assume postings have docIDs and frequencies but do not consider other data such as positions or contexts.Many techniques for inverted index compression have been studied in the literature; see [26, 29] for a survey and [1, 2, 3, 30, 27, 14] for very recent work. Most techniques first replace each docID (except the first in a list) by the difference between it and the preceding docID, called d-gap, and then encode the d-gap using some integer compression algorithm. Using d-gaps instead of docIDs decreases the average value that needs to be compressed, resulting in a higher compression ratio. Of course, these values have to be summed up again during decompression, but this can usually be done efficiently. Thus, inverted index compression techniques are concerned with compressing sequences of integOptimizing other methods We now present a few minor optimizations of some other methods that we used in our experimental evaluation.[23,24]

GammaDiff: This is a variation of Gamma coding that stores an integer x by encoding the unary part of the Gamma code (that is, 1+⌊logx⌋) as the difference between 1+⌊logx⌋and the number of bits required to represent the average of all gaps in the list. The motivation is that when docIDs areclustered, the differences between d-gaps and their average gap may be smaller than the gaps. S16-128: As S9 and S16 only have 9 or 16 possible cases for encoding numbers, sometimes they have to choose a wasteful case when a better one might exist. Now suppose we have a sequence of numbers consisting mainly of small values. In this case, a version of S16 called S16-128 can

do slightly better by providing more cases for small numbers and fewer for larger numbers.

Optimized IPC: Recall that the key step of interpolative coding (IPC) is to encode a number x in the range < lo, hi >, where lo and hi are respectively the lowest and highest possible values of x. The original IPC encodes the offset o = x−lo using a b-bit number, where b = ⌈r⌉ and r = hi−lo+ 1 is the number of possible values of the offset. we apply it to blocks of a certain size. As it turns out, this also improves compression if we choose a good block size. In particular, block sizes of the form 2b−1 appear to work best, and thus we usually choose blocks of size 127.

Frequency Compression

In this section, we first discuss the effect of docID reordering on frequencies, and then propose more effective compression algorithms. In particular, we show that reordered frequencies can be transformed in such a way that their entropy is lowered significantly, leading to better compression.[35 ,37]

5.1 Effect of Reordering on Frequencies

Frequency values by themselves are not changed at all by reordering, and thus reassigning docID by sorting URLs does not affect the distribution of frequencies. However, such an ordering results in more local clusters of similar values. This can be shown by comparing the compressed size of context sensitive and context-free methods.

CONCLUSION

The proposed work is about the prevention of Selfish Node attack. The proposed work is about to improve the DSR protocol in terms of security. As in case of multicast network because of lot of communication the network suffer from some attack that results the packet loss over the network. The proposed work is about to minimize this packet loss over the network. The work will increase the throughput with this improved DSR protocol. The system is providing better throughput and less packet loss over the network. The system is implemented in a wireless network with DSR protocol. In this system an improved inverted list approach is defined to perform the analysis among neighboring nodes and to provide the communication from effective path

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Enhancing Web-Security with Stronger Captchas

Dilip Kumar Kushwaha
Department of MCA
BBDIT, Ghaziabad, India

Harleen Kaur
FMIT, JAMIA HAMDARD
New Delhi, India

KM Priyanka
Department of MCA
BBDIT, Ghaziabad, India

Abstract:. Captcha are used widely over the World Wide Web to prevent automated programs in order to scrape a data from websites. Captcha is a challenge response test used to ensure that the response is generated by a person not by a computer. Users are asked to read and type a string of distorted characters in order to ensure that the user is human or not. Automation is real problem for web application. Automated attacks can exploit many services:

1. Blogs 2. Forums 3. Phishing 4. Theft of data

Registration Websites use CAPTCHA (completely automated public turing test to tell computers and human apart) systems to prevent the bot programs from wasting their resources. Today is the Era of where technologies are changes very rapidly. So spammers are hackers are also trying something new to cracking captcha. That's why it is necessary to developing an advanced technology to generating a captcha. Just like simply generating a Captcha Images from text, or rotating an object within images.

Keywords: CAPTCHA, Spammers, Hackers, Bot, Images generation, Rotation of Object

1. INTRODUCTION:

Completely Automated Public Turing Test To Tell Computers and Humans Apart.

Captcha (Completely automated public turing test to tell computers and human aparts) are used widely over the World Wide Web to prevent automated programs to in order to a data from websites.

A CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart) is a Challenge-response system test designed to differentiate humans from automated programs.

A CAPTCHA differentiates between human and bot by setting some task that is easy for most humans to perform but is more difficult and time-consuming for current bots to complete.

CAPTCHAs are often used to stop bots and other automated programs from using blogs to affect search engine rankings, signing up for e-mail accounts to send out spam or take part in on-line polls.

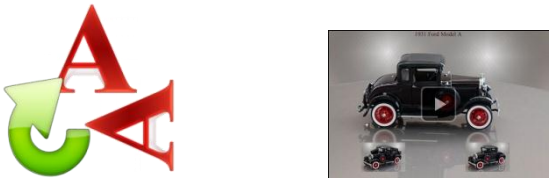

Figure 1.Some Captcha Images

There are many problems in generating a captcha just like simple captcha are easy to crack, difficult in reading a captcha. Sometimes Captcha are difficult to read (***for old age person, for different language person***). Suppose a person using a service to open an email account, that person does not know the English language but the captcha is generated in English language, so the person are unable to understand the captcha, means the captcha are generated in static manner. This is the problem associated with Captcha.

So I can solve this problem by generating Captcha in dynamic manner.

Generating captcha in dynamic manner means according to the situation likes a old age person using web services OR a person who knows different language. But sometimes the CAPTCHA test is difficult for human users to read because the users have different ages, languages, etc. In this paper we propose a solution for this problem. The registration system can select a kind of CAPTCHA system among different available CAPTCHA systems regarding to the user's needs such as user language and disabilities.

For example if a user is illiterate, then he/she easily detect images, so for this purpose I generate a images of text, or increasing the complexity of captcha by rotating objects within images.

2.Brief History:

Turing [1] in 1950 proposed a test for AI in which a computer must fool a panel of humans into believing the machine is human. Blum, Ahn, Langford(2000)[2] proposed a class of ATT(called human interactive proof HID), which Hopper(2001)[3] describes as a protocol " that allows a human to prove something to a computer.

Hopper and Blum (2001)[4] propose a HIP called secure Human Identification Protocol or Humanoid, in which computer must verify a human membership in a group without requiring a password , biometric data, electronic key or any other physical evidence.

Blum,Ahn,Langford (2000)[5] propose a "Completely Automated Public Turing Test To Tell Humans and Computer Apart" in which the computer must be able to generate and grade " A test that most hum can pass."

Example: EzGimpy-deter to spam attacks. First used by yahoo(2001)[6].

3.TYPES OF CAPTCHA:

3.1 Text based-a CAPTCHA features an image file of slightly distorted alphanumeric characters.(GIMPY)

3.2 Graphics based- Pix," presents the user with six images of a single subject, such as babies or horses, and asks them to define the subject of the pictures.

3.3 Audio based-To accomodate the visually-impaired, some CAPTCHAs use audio files.

3.4 Logic based-Which of ten, 8, 29, sixty four, 83 or fifty four is the smallest?

3.5 Math based- 4+5=?

4. APPLICATION OF CAPTCHA:

Automated attacks can exploit many services:

- Blogs
- Forums
- Phishing
- Theft of data

Registration Websites use CAPTCHA systems to prevent the bot programs from wasting their resources.

5. REALTED WORK

CAPTCHA was first introduced in 1997 when Andrei Broder devised the CAPTCHA method. In the same year, Altavista web site used this method to distinguish between computer programs and human user. In this method, a distorted English word was shown to the user and the user was asked to type it

Figure. 2

5.1 OCR-Based CAPTCHA Methods

In OCR-based methods [7], the image of a word with distortion and various pictorial effects is shown to the user and he/she asked
to type that word. Due to presence of various pictorial effects, the computer will encounter problems in the recognition of these words and only a human user can recognize the word. But these methods usually result in dissatisfaction of users. On the other hand, efforts have been made for attacking these methods . Examples of these methods include Gimpy, Handwritten CAPTCHA, and Persian/Arabic CAPTCHA.

5.2. Non-OCR-Based CAPTCHA Methods

In contrast, we can point to Non-OCR-based methods which are easier to work with than OCR-based ones. Examples of these methods include PIX, Text-to-Speech method, and Drawing CAPTCHA. Various methods have been proposed for breaking up the CAPTCHA. It can be done with the help of the segmentation and character recognition techniques. This can be done with the help of the Neural Network using divide and conquer approach. To provide defense against such techniques resistance method for CAPTCHA have also been proposed that includes Font tricks, Noise, Color model and Overlap.

6. PROBLEM STATEMENT:

The aim of this paper is to propose a method for generating image based on Text or rotating object within images to make difficult for automatic program to detect the captcha.

6.1 Proposed Solution for Generating Image Captcha:

6.2 Generating image based on Text:

For this purpose I will use image processing operations to convert simple text into image. The steps involved in the proposed method are as follows:

Step 1: Set Image type (JPEG).

Step 2: Create new image in buffer.

Step 3: Set background image white.

Step 4: Set Gradient font of text to be converted to graphics image.

Step 5: Write text in a image

Step 6: Release resources and write the output to output stream.

These steps are shown in figure 5.

6.3 Algorithm for Captcha Image Generation from simple text:gure

```
imagecaptcha(inputstring)
{
BufferedImage image;
image=texttoimage(inputstring);
return image;
}
```

6.4 Algorithm for Image generation:

```
Image texttoimage (inputstring)
{
response.setContentType ("image/jpeg");
ServletOutputStream output=response.getOutputStream();

BufferedImage image1 = new BufferedImage (300, 50,
BufferedImage.TYPE_BYTE_INDEXED);
Graphics2D graphics1 = image1.createGraphics ();
// Set back ground of the generated image to white
graphics1.setColor (Color.WHITE);
graphics1.fillRect (0, 0, 300, 50);
// set gradient font of text to be converted to image
GradientPaint gradientPaint1 = new GradientPaint (10, 5,
Color.BLUE, 20, 10, Color.LIGHT_GRAY, true);
graphics1.setPaint (gradientPaint1);
Font font = new Font("Times New Roman", Font.ITALIC,
35);
graphics1.setFont (font);
// write input string in the image
graphics1.drawString (inputstring, 5, 30);
// release resources used by graphics context
graphics1.dispose ();
// encode the image as a JPEG data stream
JPEGCodec.createJPEGEncoder (output).encode (image1);
// close the stream
output.close ();
}
```

7.Results:

Above algorithm generates images by text as shown below:

Figure3: Final output

This algorithm makes difficult for automatic program to Bypass the captcha.

Following graphs illustrate more time taken by automatic program to bypass the captcha for form filling. In the chart shown below, I show the time taken by automatic programs to bypass the captcha with using and without using this software and also shows the relative study for the same as follows (for approx 10 cases):

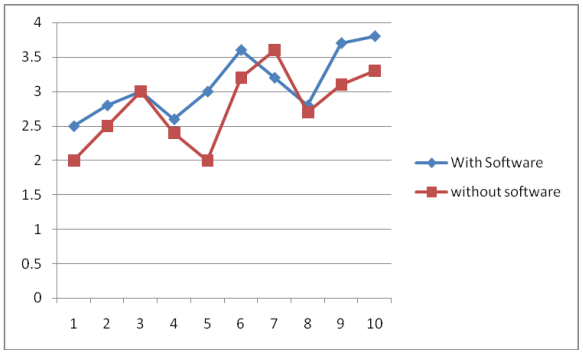

Figure 4:comparative study

8. FUTURE SCOPE:

The security analysis shows that this new design can prevent attacks efficiently from existing algorithms as well as possible ones using multiple frames. In short, this project will be a good guide for the design of next generation CAPTCHA. Our future research will be on how to design a more practical and safer dynamic CAPTCHA and the improvement in performance of the websites when these CAPTCHAs are used (Generally when these type of CAPTCHAs are used the performance decreases as the generation requires time for execution) .

9.CONCLUSION:

In this project we implemented a practical and safe image CAPTCHA from text, ensuring it not only extremely hard to recognize, but easy to identify for humans as well. It also makes full use of disadvantages of computers in recognizing images from a complicated background, making it still very difficult for computer programs to break.
CAPTCHAs are an effective way to counter bots and reduce spam. This proposed problem gives us the solution for dynamic Captcha. Applications are varied– from stopping bots to character recognition & pattern matching. Some issues with current implementations represent challenges for future improvements

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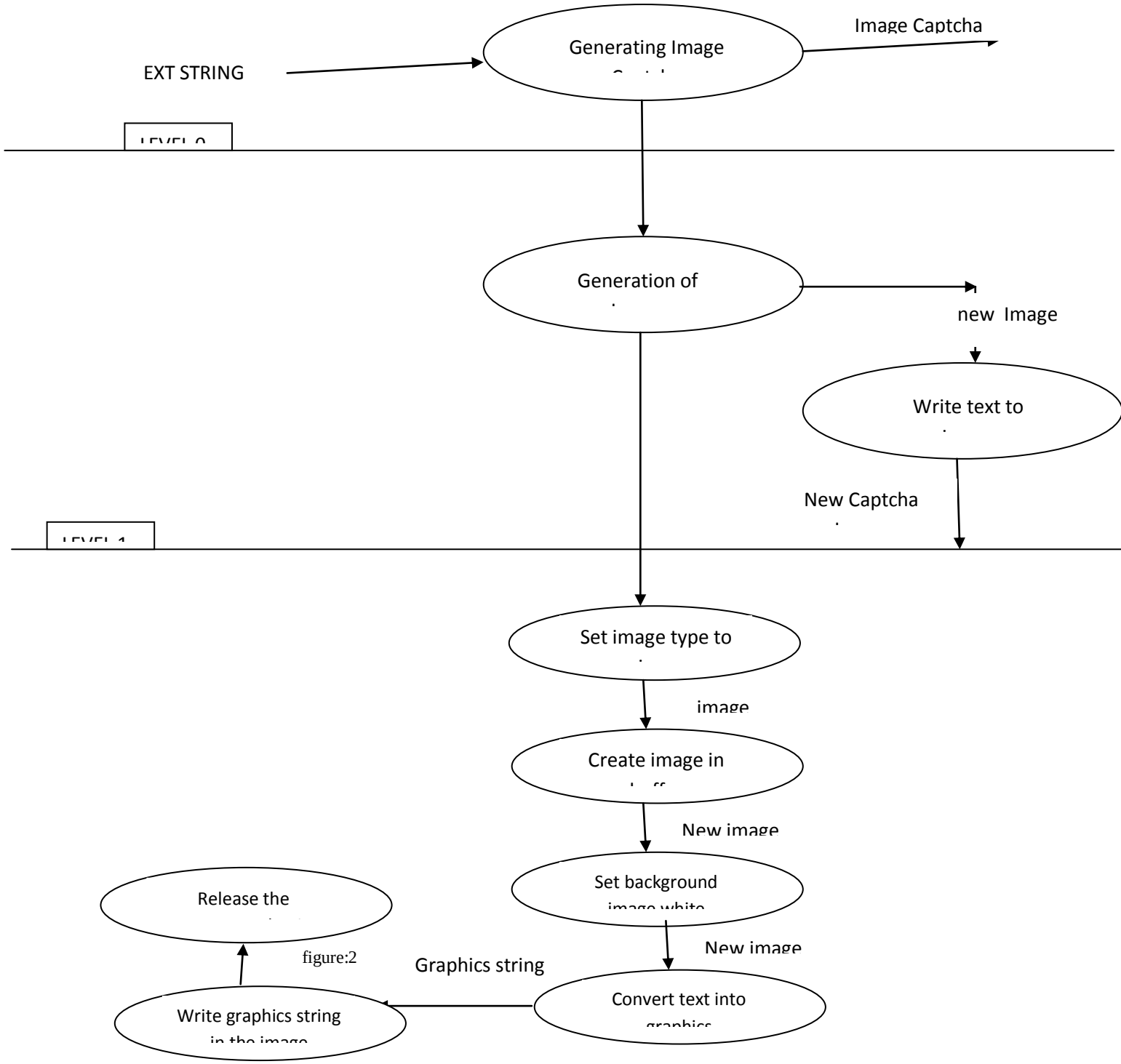

Figure 5: DFD for image generation from captcha

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AN INVERTED LIST BASED APPROACH TO GENERATE OPTIMISED PATH IN DSR IN MANETS

Sunita
Department of Computer Science and Engineering.
BPSMV, Khanpur Kalan
Sonepat,India

Kusum Lata
Department of Computer Science and Engineering
BPSMV, Khanpur Kalan,
Sonepat,India

Sophia Dhankhar
Department of Computer Science and Applications
DCSA Department
Rohtak,India

Abstract: In this paper, we design and formulate the inverted list based approach for providing safer path and effective communication in DSR protocol.Some nodes in network can participate in network more frequenctly whereas some nodes are not participating. Because of this there is the requirement of such an approach that will take an intelligent decision regarding the sharing of bandwidth or the resource to a node or the node group.Dynamic source routing protocol (DSR) is an on-demand, source routing protocol , whereby all the routing information is maintained (continually updated) at mobile nodes.DSR uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead.

Keywords:MANET,Ad hoc, DSR, Routing Algorithm, Reverse Route

1. INTRODUCTION

A Mobile ad hoc network is a group of wireless mobile computers (or nodes). In which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed.A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time, because the nodes are mobile. The network is decentralized, where all network activity, including discovering the topology and delivering messages must be executed by the nodes themselves. Hence routing functionality will have to be incorporated into the mobile nodes.[1,2]

MANET is a kind of wireless ad-hoc network and it is a self-configuring network of mobile routers (and associated hosts) connected by wireless links – the union of which forms an arbitrary topology. The routers, the participating nodes act as router, are free to move randomly and manage themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet Problems in Ad Hoc Networks.[7]

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh networks. It is similar to in that it establishes a route on-demand when a transmitting mobile node requests one. AODV However, it uses source routing instead of relying on the routing table at each intermediate device. Dynamic source routing protocol (DSR) is an on-demand, source routing protocol ,whereby all the routing information is maintained (continually updated) at mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network .

An optimum path for a communication between a source node and target node is determined by Route Discovery process. Route Maintenance ensures that the communication path remains optimum and loop-free according the change in network conditions, even if this requires altering the route during a transmission. Route Reply would only be generated if the message has reached the projected destination node (route record which is firstly contained in Route Request would be inserted into the Route Reply).[3,4]

The objective of this paper is Implementation of Wireless Network in the Real Environment. Design an algorithm using inverted list approach to identify the selfish node and to perform the communication effectively.Implementation of proposed system on to the network under DSR prootcol.Analyze the work over the network.[5]

The remaining paper is described as section2 describes the work related to DSR .the proposed scheme is described in section3.Section4 represents the experimental results.Section5 represents the conclusion and then references.[6]

2. RELATED WORK

Debdutta Barman Roy propose a new Intrusion Detection System (IDS) based on Mobile Agents. The approach uses a set of Mobile Agent (MA) that can move from one node to another node within a network. This as a whole reduces network bandwidth consumption by moving the computation for data analysis to the location of the intrusion. Besides, it has been established that the proposed method also decreases the computation overhead in each node in the network. [8]

Shailender Gupta defined a work on selfish node detection. A selfish node is one that tries to utilize the network resources for its own profit but is reluctant to spend its own for others. If such behaviour prevails among large number of the nodes in the network, it may eventually lead to disruption of network. This paper studies the impact of selfish nodes concentration on the quality of service in MANETs. [9]

Md. Amir Khusru Akhtar presented a mathematical model to detect the selfish node. In this paper Author are presenting the mathematical model to detect selfish nodes using the probability density function. The proposed model works with existing routing protocol and the nodes that are suspected of having the selfishness are given a Selfishness test. This model formulates this problem with the help of prior probability and continuous Bayes' theorem.[10]

Li Zhao performed a work to detect misbehaviour on data and mitigate adverse effects, Author propose and evaluate a Multipath Routing Single path transmission (MARS) scheme. The MARS combines multipath routing, single path data transmission, and end-to-end feedback mechanism together to provide more comprehensive protection against misbehaviour from individual or cooperating misbehaving nodes. [11]

Zougagh Hicham performed a comparative study of intrusion detection in adhoc nework. In recent years, the use of mobile ad hoc network (MANETs) has been widespread in many applications. Due to its deployment nature, MANETs are more vulnerable to malicious attack. The absolute security in the mobile ad hoc network is very hard to achieve because of its fundamental characteristics, such as dynamic topology, open medium, absence of infrastructure, limited power and limited bandwidth. In this article Author classify the architecture for IDS that have so far been introduced for MANETs, and then existing intrusion detection techniques in MANETs presented and compared. Author then provide some directions for future researches. [12]

Michael Wayne Probus performed a work on selfish node isolation. This thesis will focus on the topic of Selfish Nodes within a Mobile Ad-Hoc Networks (MANET), specifically sensor networks due to their lower power and bandwidth. The approach used is a reputation based algorithm to isolate the selfish nodes from communication by using past history to determine how reliable the node is. The reputation of each node is determined by their behavior within the network. As a node continuously acts selfishly, their reputation is decreased, until finally meeting the minimum threshold; therefore they are determined to be malicious. [13,14,15]

3. PROPOSED WORK

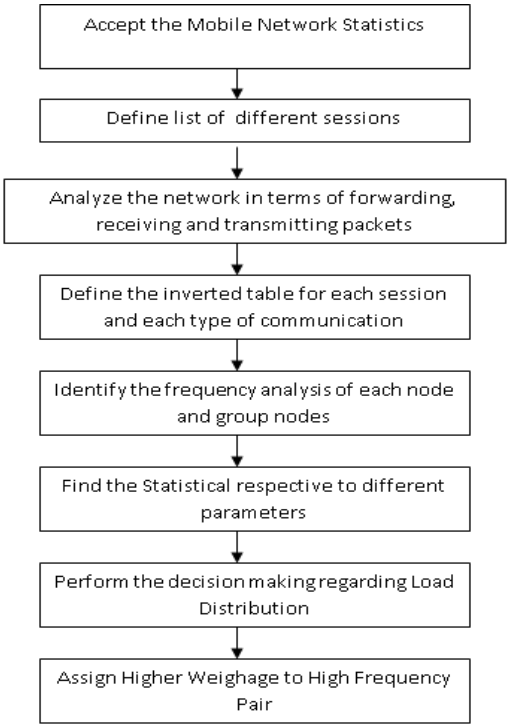
3.1 Significance of Work

In this work presented work a to find the frequent communicating nodes over the network The proposed system can be implemented on a wired or wireless network. The proposed system is also independent to the network type. It can be mobile network or the wireless lan. . It is the intelligent system that uses the artificial intelligent system approach along with statistical analysis to derive the fair and quick results about the study of allocation of resources to the available nodes

3.2 Research Design

The proposed work is about to find the most frequent moving pattern over the network so that we can find the nodes or the nodes pair that should get the maximum concern respective to the resource allocation.It means the node participating regularly over the network should get more resources. Here the term resource defines the time slice or the bandwidth of the network.

The complete Research Design is given as



In this work the main concern is about to find the frequency of node participation over the network. Lot of work is done in the same direction. Here we are presenting the improved inverted table mechanism to find the most frequent nodes over the network. The method is introduced by K.V.S.R.P.Varma in year 2010. This approach is used by him to idenfiy the similarity and frequency analysis in case of DNA sequencing. He performed the work to find the largest possible node sequence over the network.

Lot of work is already done in terms of string extraction, string matching and pattern identification over the string. Frequent Item set Mining plays an essential role in many data mining tasks and applications, such as mining association rules, correlations, sequential patterns, classification and clustering. Frequent item set construction has been a major research area over the years and several algorithms have been proposed in the literature to address the problem of mining association rules.

4.SIMULATION AND RESULTS

4.1Simulator Study– The Network Simulator (NS2)

In simulation, we can construct a mathematical model to reproduce the characteristics of a phenomenon, system, or process often using a computer in order to information or solve problems. Nowadays, there are many network simulators that can simulate the MANET. In this section we will introduce the most commonly used simulators. We will

compare their advantages and disadvantages and choose one to as platform to implement reactive/proactive protocol and conduct simulations in this thesis.

4.1.1 NS2 Overview

Ns-2 is a discrete event simulator targeted at networking research. It provides substantial ssupport for simulation of TCP, routing and multicast protocols over wired and wireless networks. It consists of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. The network animator (nam) is use to visualize the simulations. Ns-2 fully simulates a layered network from the physical radio transmission channel to high-level applications.

Version 2 is the most recent version of ns (ns-2) . The simulator was originally developed by the University of California at Berkeley and VINT project the simulator was recently extended to provide simulation support for ad hoc network by Carnegie Mellon University (CMU Monarch Project homepage, 1999).

Ns-2 is an object-oriented simulator written in C++ and OTcl. The simulator supports aclass hierarchy in C++ and a similar class hierarchy within the OTcl interpreter. There is a one-to-one correspondence between a class in the interpreted hierarchy and one in thecompile hierarchy. The reason to use two different programming languages is that OTclis suitable for the programs and configurations that demand frequent and fast change while C++ is suitable for the programs that have high demand in speed. Ns-2 is highly extensible. It not only supports most commonly used IP protocols but also allows the users to extend or implement their own protocols. It also provides powerful trace functionalities, which are very important in our project since various information need to be logged for analysis. The full source code of ns-2 can be downloaded and compile for multiple platforms such as UNIX, Windows and Ubuntu.

4.2. Analysis Results

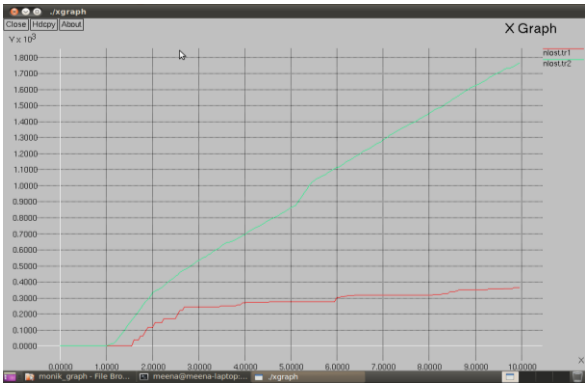


Figure 4.1:Packet Lost (Existing Vs Proposed Approach)

Here figure 4.1 is showing the comparative analysis of packet lost over the network. Here x axis represents the time and y axis represents the packet transmitted. As we can see after implementing the proposed approach the packet loss over the network is decreased.

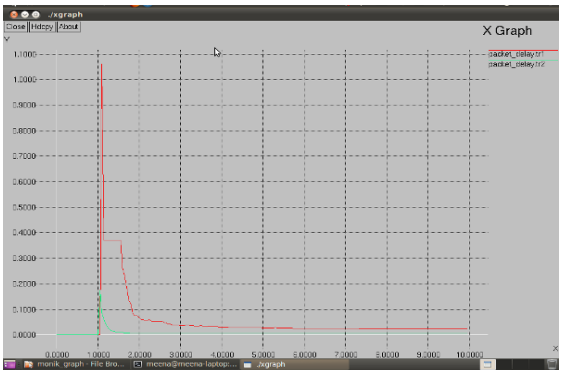


Figure 4.2 : Packet Delay (Existing Vs Proposed Approach)

Here figure 4.2 is showing the comparative analysis of Packet Delay over the network. Here x axis represents the time and y axis represents the Packet Delay of communication. As we can see after implementing the proposed approach the Packe t Delay over the network is decreased.

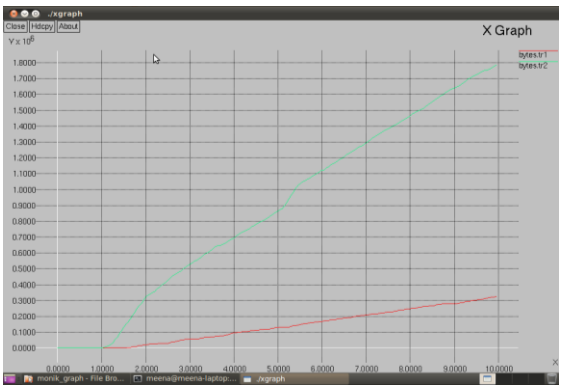


Figure 4.3 :Bytes transmitted (Existing Vs Proposed Approach)

Here figure 4.3 is showing the comparative analysis of bytes transmitted over thenetwork. Here x axis represents the time and y axis represents the btes transmitted. As we can see after implementing the proposed approach the bytes transmitted over the network is increased.

5. CONCLUSION

The proposed work is about the prevention of Selfish Node attack. The proposed work is about to improve the DSR protocol in terms of security. As in case of multicast network because of lot of communication the network suffer from some attack that results the packet loss over the network. The proposed work is about to minimize this packet loss over the network. The work will increase the throughput with this

improved DSR protocol. The system is providing better throughput and less packet loss over the network. The system is implemented in a wireless network with DSR protocol. In this system an improved inverted list approach is defined to perform the analysis among neighboring nodes and to provide the communication from effective path. Here we have proposed a new algorithm for the above said task. The implementation is performed in ns2 and analysis is presented using xgraph.

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The Effective QR Code Development using VB.NET

Neeraj Bhargava
Dept. of Computer Sciences, School of Engineering and System Sciences, MDS University,
Ajmer, India.

Ritu Bhargava
Department of MCA,
Govt. Women Engineering College,
Ajmer, India

Manish Mathuria
Dept. of Computer Engineering and Information Technology, Govt. Engineering College,
Ajmer, India

Khushboo Mantri
Dept. of Computer Science of Engineering & System Sciences
MDS University,
Ajmer, India

Abstract: Product is not in range to the local public until they have not required information about the product. The QR (Quick Response) code provides a medium, so the consumer can qualified the product. QR code is very popular because of its capability of handle information with the resistant environment. But sometimes, QR code fails due to its manufacturing constraints and the limitation of the storing space. The objective of research is to analyze and conclude the feature characteristics of QR code with the development of effective QR code using VB. NET functionality. It considered that innovators are interest in the use of barcodes to encode more information per area unit than regular, black and-white barcodes. The QR code is nothing but an image that require a special digital QR Code Reader application. This research paper also discuss about the structure, symbology and properties of barcodes.

Keywords: QR code, VB.Net, QR Code Reader.

1. INTRODUCTION

QR codes are two-dimensional bar codes that can contain any alphanumeric text and often feature URLs that direct users to sites where they can learn about an object or place (a practice known as "mobile tagging"). Decoding software on tools such as android phones interprets the codes, which represent considerably more information than a one-dimensional code of similar size. The codes are increasingly found in places such as product labels, billboards, and buildings, inviting users (android mobile) to pull out their mobile phones and uncover the encoded information. Codes can provide tracking information for products in industry, routing data on a mailing label, or contact information on a business card. Small in size, the code pattern can be hidden or integrated into an esthetically attractive image in newspapers, student mark sheet, confidential paper, magazines, or clothing etc. [1].

QR Code (abbreviated from Quick Response Code) is the trademark for a type of matrix barcode (or two-dimensional code) first designed for the automotive industry. More recently, the system has become popular outside the industry due to its fast readability and large storage capacity compared to standard UPC barcodes. The code consists of black modules (square dots) arranged in a square pattern on a white background [2].

The information encoded can be made up of four standardized kinds ("modes") of data (numeric, alphanumeric, byte/binary, Kanji), or through supported extensions, virtually any kind of data. Unlike the old bar code that was designed to be mechanically scanned by a narrow beam of light, the QR code is detected as a 2-dimensional digital image by a semiconductor image sensor and is then digitally analyzed by a programmed processor. The processor locates the three distinctive squares at the corners of the image, and normalizes image size, orientation, and angle of viewing. The small dots are then converted to binary numbers and validity checked with an error-correcting code [2].

2. QR CODEAPPLICATIONS

QR codes are popular in Japan, where they are used for commercial tracking, logistics, inventory control, and advertising. Their popularity is climbing in Europe, the United States, and Canada as people increasingly use mobile phones to access 3G networks. In England, a grant-funded venture led by Andy Rams den at Bath University investigates ways to use QR codes in academic settings. In physical learning spaces, QR codes might indicate what types of learning take placein each area or provide a link to schedulingsoftware that offers the opportunity to reserve a room [2].

QR codes might also be effective repositories of data in problem-solving. In early years QR code generally useful in industries for advertisement, packaging, etc. The dissemination of the smart phones has putted Barcode Reader in everyone's pocket. As a result, the QR code has become a focus of advertising strategy, since it provides quick and effortless access to the brand's website. QR Codes are now used over a much wider range of applications, including commercial tracking, entertainment and transport ticketing, product/loyalty marketing, e-learning using ICT, and in-store product labeling. It can also be used in storing personal information for use by government [3].

3. THE BACKGROUND OF QR CODE DEVELOPMENT

In 1970, IBM developed UPC symbols consisting of 13 digits of numbers to enable automatic input into computers. These UPC symbols are still widely used for Point-Of-Sale (POS) system. In 1974, Code 39 which can encode (symbolize) approx. 30 digits of alphanumeric characters was developed. Then in the early 1980s, multistage symbol codes whereapprox. 100 digits of characters can be stored such as Code 16K and Code 49 were developed. As information rapidly developed in the recent years, requests had mounted for symbols which can store more information and represent languages other than English. To enable this, a symbol with even higher density than multistage symbols was required. As a result, QR Code, which can contain 7,000 digits of characters at maximum including Kanji Characters?(Chinese characters used in Japan) was developed in 1994.The history until realizing high-capacity and high-density symbols can be described as illustrated in Figure 1 when seeing them from the technology's aspect. Firstly, Interleaved 2 of 5 and Coda bar which can encode (symbolize) numbers were developed,

followed by the development of Code 39 which can encode alphanumerical characters. Along withthe information developments, it had become necessary to have full ASCII encoded, and this resulted in the development of Code 128. Then, multistage symbols were developed where these linear symbols were arranged in several stages. Toyota Motor's Kanban Code is the world's first multistage symbol. As computers became popular, these codes developed into multi-row symbols where multistage codes were extended and into matrix symbols where data were arranged in matrix. The printing areas for matrix symbols are the smallest among all, and is seen as highly prospective as the main symbol for the future.QR Code is a matrix symbol which has been developed as the one enabling all of high capacity PDF417, high density printing of data matrix, and high speed reading of maxi code based on the research made on their characteristics. Two-dimensional symbols generally contain much more data amount when compared with linear symbols (approx.100 times more), and therefore require much longer data processing time and more complex process. Therefore, QR Code has had much consideration for its finder pattern to enable high-speed reading [4].

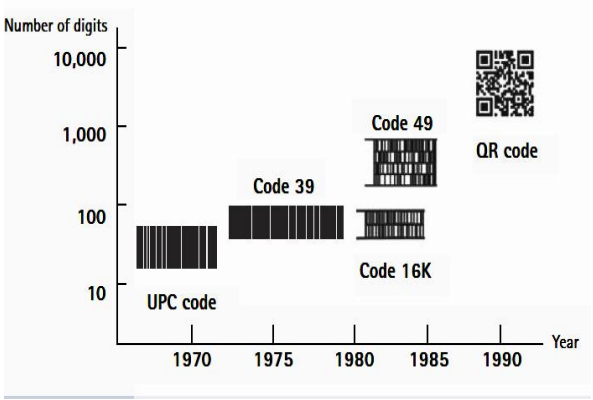

Figure 1: The History of Symbols

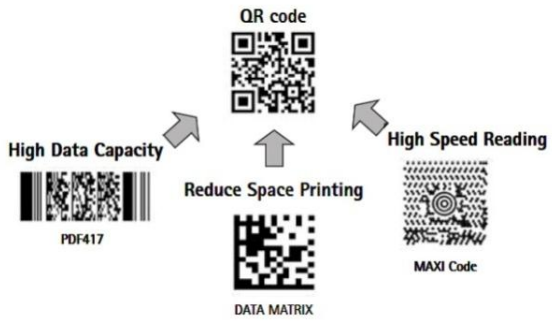

Figure 2: The Development of QR code

4. CHARACTERISTICS OF THE QR CODE

Additional to the characteristics for two-dimensional symbols such as large volume data (7,089 numerical characters at maximum), high-density recording (approx. 100 times higher in density than linear symbols), and high-speed reading, QR Code has other superiority in both performance and functionalities aspects.

4.1. All-Direction (360°) High-Speed Reading

Reading matrix symbols will be implemented by using a CCD sensor (area sensor). The data of the scan line captured by the sensor will be stored into the memory. Then, by using the software, the details will be analyzed, finder patterns identified, and the position/size/angle of the symbol detected, and the decoding process will be implemented.

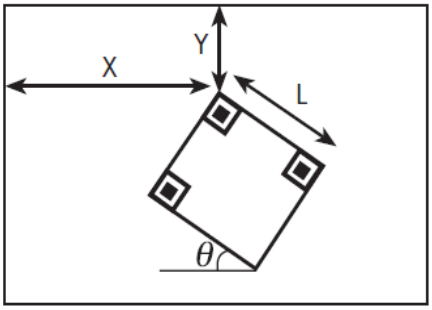

Figure 3: Resistant to Distorted Symbols

Symbols often get distorted when attached onto a curved surface or by the reader being tilted (angled between the CCD sensor face and the symbol face). To correct this distortion, QR Code has alignment patterns arranged with a regular interval within the range of the symbol. The variance between the Centre positions of the alignment pattern estimated from the outer shape of the symbol and the actual Centre position of the alignment pattern will be calculated to have the mappings (for identifying the Centre position of each cell) corrected. This will make the distorted linear/non-linear symbols readable.

Figure 4: Correcting Distorted Symbol

4.2. Data Restoration Functionality (Resistant to Smudged or Damaged Symbols)

QR Code has four different error correction levels (7%, 15%, 25%, and 30% per symbol area). The error correction functionality is implemented according to each of the smudge/damage, and is utilizing Reed-Solomon code which is highly resistant to burst errors. Reed-Solomon codes are arranged in the QR Code data area. By this error correction functionality, the codes can be read correctly even when they are smudged or damaged up until the error correction level.

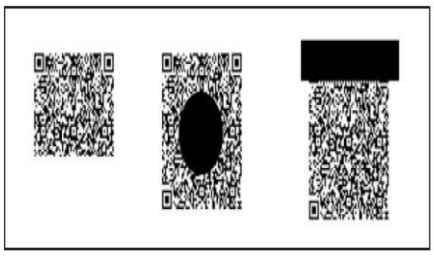

Figure5: Smudged/Damaged Symbols

4.3. The Confidentiality of the Code

By making the relationship between the character type and the stored data unique for a special usage, QR Code can be easily encrypted. Unless the conversion table between the character

type and the stored data is deciphered, no one will be able to read the QR Code [7].

5. THE QR CODE STRUCTURE

The figure is version 1 (type 2) and the module is 21 X 21 cells, vertical 21 cells and horizontal 21 cells. This version is specified from 1 to 40, increased by 4 cells per one version up. The maximum version is 40 and the size is 177 X 177 modules. Fig. 6 is a case of the QR code version 1 modules that are arranged in a grid pattern of black and white squares. In this QR code symbol [8][9][10], there are three position detection patterns (Finder patterns) in the upper left corner, bottom left and top right corner. Then the timing pattern is placed between every one of these position detection patterns. Additionally, alignment patterns are introduced in the version 7 or higher. Then Table I shows the main specifications of the QR code. There are four modes available,

(1) Number mode,

(2) Alphanumeric mode,

(3) 8 bit byte mode and

(4) Kanji and kana characters mode.

QR Code has finder patterns, alignment patterns, timing patterns, and a quiet zone.

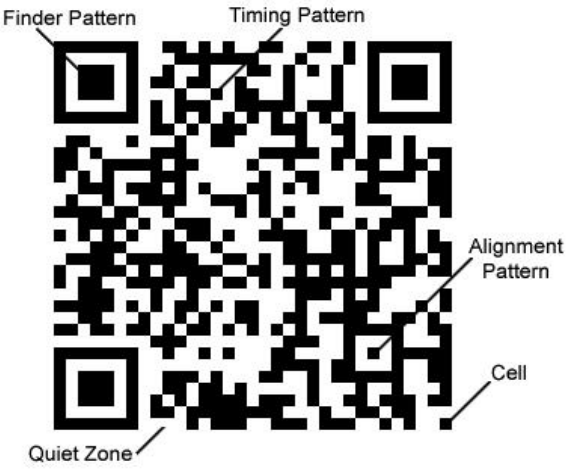

Figure6: QR Code Structure

5.1 Finder Pattern

A pattern for detecting the position of the QR Code. By arranging this pattern at the three corners of a symbol, the position, the size, and the angle of the symbol can be detected. This finder pattern consists of a structure which can be detected in all directions (360°).

5.2 Alignment Pattern

A pattern for correcting the distortion of the QR Code.It is highly effective for correcting nonlinear distortions. The central coordinate of the alignment pattern will be identified to correct the distortion of the symbol. For this purpose, a black isolated cell is placed in the alignment pattern to make it easier to detect the central coordinate of the alignment pattern.

5.3 Timing Pattern

A pattern for identifying the central coordinate of each cell in the QR Code with black and white patterns arranged alternately. It is used for correcting the central coordinate of the data cell when the symbol is distorted or when there is an error for the cell pitch. It is arranged in both vertical and horizontal directions.

5.4 Quiet Zone

A margin space necessary for reading the QR Code.This quiet zone makes it easier to have the symbol detected from among the image read by the CCD sensor. Four or more cells are necessary for the quiet zone.

5.5 Data Area

The QR Code data will be stored (encoded) into the data area. The grey part in Figure 11 represents the data area. The data will be encoded into the binary numbers of '0' and '1' based on the encoding rule. The binary numbers of '0' and '1' will be converted into black and white cells and then will be arranged. The data area will have Reed-Solomon codes incorporated for the stored data and the error correction functionality [4].

6. THE SPECIFICATIONS OF THE QR CODE

TABLE1.THE SPECIFICATIONS OF THE QR CODE ARE AS DESCRIBED

Item	Specifications	
Error	Rs Code	Data
	BCH Code	Format Information
		Version Information
Characters	Number	10 bit coding per 3 number digits
	Alphanumeric	11 bit coding per 2 characters
	8 bit byte	8 bit coding
	Kanji	13 bit coding per 2 characters
Version	1	21 x 21 modules
	2	25 x 25 modules
	40	177 x 177 modules
Error Correcting Level	L	About 7%
	M	About 15%
	Q	About 25%
	H	About 30%
Finder Pattern	1:1:3:1:1	3 co-centric squares
		7x7, 5x5, 3x3 modules
Alignment Pattern	1:1:1:1:1	3 Co-centric squares
		Higher version 2
		5x5, 3x3, 1x1 modules

7. OBJECTIVE

The objective of this article is to represent an easy way to generate QR code into VB.NET. It is an upgrade to the last version of VB (version 6.0) that conforms to the .NET platform. It is a programming language that directly supported programmable graphical user interfaces using language-supplied objects. Here the provided code will make possible for a general user to simply type text in a vb.net form window

and he will get a QR Code image. He can also save this image in jpeg format to the specified location or disk on his personal computer.

8. PREVIOUS WORK

8.1. QR Code Data Representation for Mobile Augmented Reality

In this position paper, they introduced using QR code for MAR applications. Since QR code can self-contain much information, we aimed to use this capacity to include metadata for MAR application covering from code metadata, content metadata and tracking metadata. Yet there are many issues to resolve, such as how to distinguish normal QR code from AR-enabled QR code. Also similar visual codes need to be compared in tracking aspect for better performance in MAR and we can extend our proposed idea to other visual codes as well [11].

8.2. Generating SMS (Short Message Service) in the form of Quick Response Code (QR-code)

This article shows how a QR-code can be generated from a simple SMS. Developers began trying to expand on the current amount of bars within the barcode and how their positioning resides to allow further data capacities. The need for smaller barcodes also was another defining factor in QR-Codes development [12].

8.3. QR Code Security

In this paper they outlined the dangers of possible attacks utilizing manipulated QR Codes. Since QR Codes gain increasing popularity through their use for marketing purposes, we expect that this kind of attack will receive more and more attention by the hacking community in the future. In addition to phishing, a multitude of other attack methods, both against humans and automated systems, might be performed using QR codes. This especially holds true if proper input sanitization is not performed prior to processing the contained data [13].

8.4. QR Codes in Education

In this paper, they provided a holistic view of using QR codes in industry and in education. We demonstrated three broad areas to apply QR codes in school education. First, we must categorically prepare enough mobile devices for the activities. We definitely cannot expect students at the junior levels to carry the right mobile devices to schools. Second, despite it is quite easy to operate a mobile device equipped with a QR code reader, we noticed some students highly tilted the devices when they snapped the codes. Third, if the mobile devices are equipped with Wi-Fi access and the activities do have the wireless coverage, the cost for communication would be minimal. In this paper and there are many creative ideas waiting for us to explore. Also, this paper can be served as the first step for the readers to investigate this exciting topic of mobile learning [14].

8.5. The Expectations of Quick Response (QR) Codes in Print Media: An Empirical Data Research Anthology

QR Codes have only recently gained popularity in the United States commercial markets starting in 2010 and are still a relatively new tool as of early 2012. For this reason, little scholarly research has investigated awareness or the effectiveness of QR codes in a marketing sense. This study had to rely heavily on research and information collected from trade magazines, popular press mediums, past research studies conducted for different purposes, and information posted on professional social networking sites, such as LinkedIn[15].

8.6. Research on Distortion Correction of QR Code Images

In this paper, an algorithm for the distorted QR code image correction is presented. The gradient-based HT is modified when finding out the vertices of QR code symbol. It is achieved by 1) calculating the adaptive parameters G and k and getting the 8 longest lines (see Algorithm 1) and 2) finding out the four vertices of QR code symbol (see Algorithm 2). As a result, the QR code symbol can be corrected [16].

9. METHODOLOGY

As we describe in this article you must vb.net as well as OnBarcode.BarcodeGenerator.DotnetSuite. After this you can use the below code to generate QR Code through vb.net. You may set the properties of QR Code like data, ECL, size as per your requirement. You can also save this QR Code picture on your disk. the code for this is given below.

```
Dim qrcodeAsOnBarcode.Barcode.QRcode
 qrcode= NEW OnBarcode.Barcode.Qrcode
if combobox1.selectedIndex=0 Then
 qrcode.data= ” ME VCARD()” + vbCrLf_
+ “N:” + Textbox1.Text + VbCrLf_
+ “ORG:” + Textbox2.Text + VbCrLf_
+ “PHONE:” + Textbox5.Text + VbCrLf_
+ “EMAIL:” + Textbox6.Text + VbCrLf_
+ “ADD1:” + Textbox7.Text + VbCrLf_
+ “URL:” + Textbox9.Text + VbCrLf_
+ “NOTE:” + Textbox10.Text + VbCrLf_
+ “END_MECARD”
EndIf
If ComboBox3.SelectedIndex = 0 Then
qrcode.ECL=OnBarcode.Barcode.
QRCodeECL.H
ElseIf ComboBox3.SelectedIndex = 1 Then
qrcode.ECL=OnBarcode.Barcode.
QRCodeECL.L
ElseIf ComboBox3.SelectedIndex = 2 Then
qrcode.ECL=OnBarcode.Barcode.
QRCodeECL.M
ElseIf ComboBox3.SelectedIndex = 3 Then
qrcode.ECL=OnBarcode.Barcode.
QRCodeECL.Q
EndIf
```

```
qrcode.BackColor = Color.AliceBlue
If ComboBox2.SelectedIndex = 0 Then
Then
qrcode.BarcodeHeight = 10
qrcode.BarcodeWidth = 10
qrcode.BottomMargin = 1
qrcode.TopMargin = 1
qrcode.LeftMargin = 1
qrcode.RightMargin = 1
ElseIf ComboBox2.SelectedIndex = 1 Then
qrcode.BarcodeHeight = 20
qrcode.BarcodeWidth = 20
qrcode.BottomMargin = 2
qrcode.TopMargin = 2
qrcode.LeftMargin = 2
qrcode.RightMargin = 2
ElseIf ComboBox2.SelectedIndex = 2 Then
qrcode.BarcodeHeight = 30
qrcode.BarcodeWidth = 30
qrcode.BottomMargin = 3
qrcode.TopMargin = 3
qrcode.LeftMargin = 3
qrcode.RightMargin = 3
EndIf
qrcode.drawBarcode("vbnet-qrcode.png")
Dim qrcodeBitmap As Bitmap
qrcodeBitmap = qrcode.drawBarcode
Form1.PictureBox1.Image = qrcodeBitmap
IfNot TextBox10.Text = ""Then
qrcodeBitmap.Save("d:/qrcode1/" + TextBox10.Text +
".jpeg")
EndIf
EndSub
```

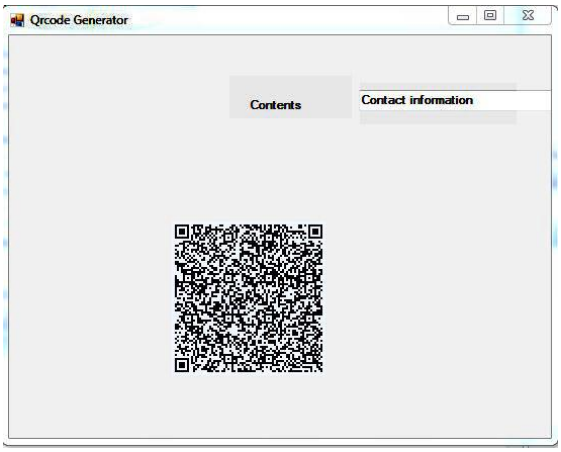

Figure 7: QR CodeGenerator

10. CONCLUSION

In this article we describe how to generate a QR code in VB.NET.A general user can generate his own QR code in a user friendly environment of vb.net and a programmer can generate software for this by following the steps given in this article.

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An Efficient Framework for Predicting and Recommending M-Commerce Patterns Based on Graph Diffusion Method

R.Priyadharshini
SNS College of Technology
Coimbatore, India

M.Kalimuthu
SNS College of Technology
Coimbatore, India

Abstract: Mobile Commerce, also known as M-Commerce or mCommerce, is the ability to conduct commerce using a mobile device. Research is done by Mining and Prediction of Mobile Users' Commerce Behaviors such as their purchase transactions. The problem of PMCP-Mine algorithm has been overcome by the efficient framework based graph diffusion method. The main objective is to construct the graph based diffusion method. Graph is constructed for the items purchased by the Mobile users and then finding the frequently purchased item. By using ranking method, we are ranking the items based on the transactions. Then, by analyzing the mobile users behavior and recommending the ranked items. This framework produces more efficient and accurate item recommendation than the MCE framework.

Keywords: Mining, Prediction, Mobile Commerce, diffusion method

1. INTRODUCTION

With the rapid advance of wireless communication technology and the increasing popularity of powerful portable devices, mobile users not only can access worldwide information from anywhere at any time but also use their mobile devices to make business transactions easily, e.g., via digital wallet [1]. Meanwhile, the availability of location acquisition technology, e.g., Global Positioning System (GPS), facilitates easy acquisition of a moving trajectory, which records a user movement history. At developing pattern mining and prediction techniques that explore the correlation between the moving behaviors and purchasing transactions of mobile users to explore potential M-Commerce features. Owing to the rapid development of the web 2.0 technology, many stores have made their store information, e.g., business hours, location, and features available online.

Collecting and analysing user trajectories from GPS-enabled devices. When a user enters a building, the user may lose the satellite signal until returning outdoors. By matching user trajectories with store location information, a users' moving sequence among stores in some shop areas can be extracted. The mobile transaction sequence generated by the user is {(A,{i1}), (B,Ø), (C,{i3}), (D,{i2}), (E,Ø),(F,{i3,i4}), (I,Ø),(K,{i5})}. There is
an entangling relation between moving patterns and purchase patterns since mobile users are moving between stores to shop for desired items.

The moving and purchase patterns of a user can be captured together as mobile commerce patterns for mobile users. To provide this mobile ad hoc advertisement, mining mobile commerce patterns of users and accurately predicts their potential mobile commerce behaviors obviously are essential operations that require more research.

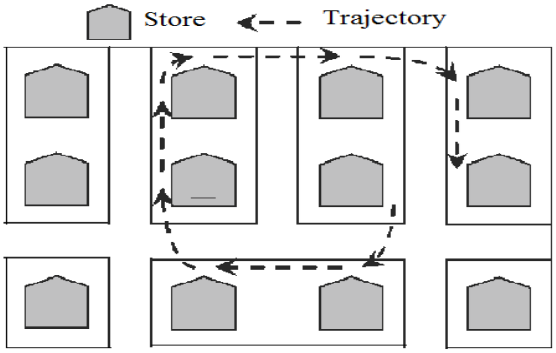

Fig 1 Example of Mobile Transaction Sequence

To capture and obtain a better understanding of mobile users' mobile commerce behaviors, data mining has been widely used for discovering valuable information from complex data sets. They do not reflect the personal behaviors of individual users to support M-Commerce services at a personalized level. Mobile Commerce or M-Commerce, is about the explosion of applications and services that are becoming accessible from Internet-enabled mobile devices. It involves new technologies, services and business models. It is quite different from traditional e-Commerce. Mobile phones impose very different constraints than desktop computers.

2. PROBLEM DEFINITION

In the MCE framework, false positive rate is very low and this framework is not more efficient for recommendation. In the graph diffusion framework, the problem is overcome. This framework is more efficient and accurate than the MCE framework.

3. LITERATURE SURVEY

Chan Lu, Lee and S. Tseng developed the Mobile Commerce Explorer Framework for mining and prediction of mobile users' movements and purchases [1]. Agrawal and Swami presented an efficient algorithm [2] that generates all significant association rules between items in the database.

Han, Pei and Yin proposed a novel frequent-pattern tree (FP-tree) structure, which is an extended prefix-tree [3] structure for storing compressed, crucial information about frequent patterns, and develop an efficient FP-tree based mining method, FP-growth, for mining the complete set of frequent patterns by pattern fragment growth.

Hao, Irwin and Michael proposed a novel framework, in which a tree structured graph is constructed for the purchased items by the user. Then based on the log history, finds the suitable item for the mobile users. Then finding the similarity between the log based item and graph based item. If similar the same item will be recommended. If not similar, then the log history based item will be recommended.

4. EXISTING SYSTEM

A novel framework for the mobile users' commerce behaviors has been implemented for mining and prediction of mobile users'. MCE framework has been implemented with three components: 1) Similarity Inference Model (SIM) for measuring the similarities among stores and items, 2) Personal Mobile Commerce Pattern Mine (PMCP-Mine) algorithm for efficient discovery of mobile users' Personal Mobile Commerce Patterns (PMCPs), 3) Mobile Commerce Behavior Predictor (MCBP) for prediction of possible mobile user behaviors. In the MCE framework, only frequently moved locations and frequently purchased items are considered. The modules proposed in framework are:

4.1 Mobile Network Database

The mobile network database maintains detailed store information which includes locations.

4.2 Mobile User Data Base

The Mobile User database maintains detailed mobile user information which include network provider.

4.3 Applying Data Mining Mechanism

System has an "offline" mechanism for Similarity inference and PMCPs mining, and an "online" engine for mobile commerce behavior prediction. When mobile users move between the stores, the mobile information which includes user identification, stores, and item purchased are stored in the mobile transaction database. In the offline data mining mechanism, develop the SIM model and the PMCP Mine algorithm to discover the store/item similarities and the PMCPs, respectively. Similarity Inference Model for measuring the similarities among stores and items. Personal Mobile Commerce Pattern-Mine (PMCP-Mine) algorithm is used for efficient discovery of mobile users' Personal Mobile Commerce Patterns.

4.4 Behavior prediction engine

In the online prediction engine, implemented a MCBP (Mobile Commerce Behavior Predictor) based on the store and item similarities as well as the mined PMCPs. When a mobile user moves and purchases items among the stores, the next steps will be predicted according to the mobile user's identification and recent mobile transactions. The framework is to support the prediction of next movement and transaction. Mobile Commerce Behavior Predictor for prediction of possible mobile user behaviors.

4.5 Similarity Inference Model

A parameter-less data mining model, named Similarity Inference Model, to tackle this task of computing store and item similarities. Before computing the SIM, derive two databases, namely, SID and ISD, from the mobile transaction database. An entry SIDpq in database SID represents that a user has purchased item q in store p, while an entry ISDxy in database ISD represents that a user has purchased item x in store y. Deriving the SIM to capture the similarity score between stores/items. For every pair of stores or items, SIM assigns them a similarity score. In SIM, used two different inference heuristics for the similarity of stores and items because some stores, such as supermarkets, may provide various types of items.

By applying the same similarity inference heuristics to both of stores and items, various types of items may be seen as similar since different supermarkets are seen as similar. Based on our heuristics, if two stores provide many similar items, the stores are likely to be similar; if two items are sold by many dissimilar stores, the stores are unlikely to be similar. Since the store similarity and item similarity are interdependent, computing those values iteratively. For the store similarity, consider that two stores are more similar if their provided items are more similar. Given two stores sp and sq, compute their similarity SIM (sp; sq) by calculating the average similarity of item sets provided by sp and sq. For every item sold in sp (and, respectively, sq), first find the most similar item sold in sq (and, respectively, sp). Then, the store similarity can be obtained by averaging all similar item pairs. Therefore, SIM (sp; sq) is defined as

$$sim\,(s_p,s_q)= \frac{\sum_{\varphi \epsilon \Gamma_{sp}} MaxSim(\varphi,\Gamma_{sq}) + \sum_{\Upsilon \epsilon \Gamma_{sq}} MaxSim(\Upsilon,\Gamma_{sp})}{|\Gamma_{sp}|+|\Gamma_{sq}|}$$

Where MaxSim(e,E) = Maxe'ϵE sim(e,e') represents the maximal similarity between e and the element in E. Γsp and Γsq are the sets of items sold in sp and sq, respectively. On the other hand, for the item similarity, consider that two items are less similar if the items are sold by many dissimilar stores. Given two items ix and iy, compute the similarity sim(ix,iy) by calculating the average dissimilarity of store sets that provide ix and iy. For every store providing ix (and, respectively, iy), first find similarity by averaging all dissimilar store pairs.

4.6 Personal Mobile Commerce Pattern-Mine Algorithm

The PMCP-Mine algorithm is divided into three main phases: 1) Frequent-Transaction Mining: A Frequent-Transaction is a pair of store and items indicating frequently made purchasing transactions. In this phase, first discover all Frequent-Transactions for each user. 2) Mobile Transaction Database Transformation: Based on the all Frequent-Transactions, the original mobile transaction database can be reduced by deleting infrequent items. The main purpose is to increase the database scan efficiency for pattern support counting. 3) PMCP Mining: This phase is mining all patterns of length k from patterns of length k-1 in a bottom-up fashion.

4.7 Mobile Commerce Behavior Predictor

MCBP measures the similarity score of every PMCP with a user's recent mobile commerce behavior by taking store and item similarities into account. In MCBP, three ideas are considered: 1) the premises of PMCPs with high similarity to the user's recent mobile commerce behavior are considered as prediction knowledge; 2) more recent mobile commerce behaviors potentially have a greater effect on next mobile commerce behavior predictions and 3) PMCPs with higher support provide greater confidence for predicting users' next mobile commerce behavior. Based on the above ideas, propose a weighted scoring function to evaluate the

scores of PMCPs. For all PMCPs, calculate their pattern score by the weighted scoring function. The consequence of PMCP with the highest score is used to predict the next mobile commerce behavior.

4.8 Performance Comparison

Conduct a series of experiments to evaluate the performance of the proposed framework MCE and its three components, i.e., SIM, PMCP-Mine, and MCBP under various system conditions. The experimental results show that the framework MCE achieves a very high precision in mobile commerce behavior predictions. Besides, the prediction technique MCBP in our MCE framework integrates the mined PMCPs and the similarity information from SIM to achieve superior performs in terms of precision, recall, and F-measure. The experimental results show that the proposed framework and three components are highly accurate under various conditions.

5. PROPOSED SYSTEM

5.1 Construction of data source for user transaction and purchase transaction

A tree structured graph is constructed for the purchased items by the mobile users. Then the tree constructed for the items. A mobile database is a database that can be connected to by a mobile computing device over a mobile network. The client and server have wireless connections. A cache is maintained to hold frequent data and transactions so that they are not lost due to connection failure. A database is a structured way to organize information. This could be a list of contacts, price information or distance travelled. While those same analysts can't tell us exactly which applications will be the most popular, it is clear that a large percentage will require the use of a database of some sort. Many applications such as databases would require the ability to download information from an information repository and operate on this information even when out of range or disconnected. An example of this is a mobile workforce. In this scenario, a user would require access to update information from files in the home directories on a server or customer records from a database. This type of access and work load generated by such users is different from the traditional workloads seen in client–server systems of today. With the advent of mobile databases, now users can load up their smart phones with mobile databases to exchange mission-critical data remotely without worrying about time or distance. Mobile databases let employees enter data on the fly. Information can be synchronized with a server database at a later time.

5.2 Building the data source into diffused graph

Proposed a parameter-less data mining model, named Similarity Inference Model based on diffusion graph, to tackle this task of grouping store and item similarities. Before grouping, derive two databases, namely, user and purchase transaction, from the mobile transaction database. Derive the diffusion graph through node formation to capture the similarity nodes with calculation measures of score between data's. Based on heuristics, if two stores provide many similar items, they are likely to be similar; if two items are sold by many dissimilar stores, they are unlikely to be similar. Since the store similarity and item similarity are interdependent, compute them iteratively. Given two stores sp and sq, compute their similarity sim (sp; sq) by calculating the average similarity of item sets provided by sp and sq. For every item sold in sp (and, respectively, sq), first find the most similar item sold in sq (and, respectively, sp). Then, the store similarity can be obtained by averaging all similar item pairs.

5.3 A Ranking based Multi-Correlation tensor factorization model on mining web graphs

In this model, measures the similarity score of every transaction with a user's recent mobile commerce behavior by taking store and item similarities into account. Three ideas are considered in this model: 1) the premise of user node with high similarity to the user's recent mobile commerce behavior are considered as prediction knowledge; 2) more recent mobile commerce behaviors potentially have a greater effect on next mobile commerce behavior predictions; 3) ranking based multi-correlation tensor factorization model with higher support provide greater confidence for predicting user's next mobile commerce behavior.

5.4 User specific topic modelling through novel diffusion method which propagates similarities

User-specific Topic Modelling through novel diffusion method which Propagates similarities between different nodes (user transaction and Purchase transaction) and generates recommendations to map the purchase relevance and user preference into the same user-specific topic space. In addition to the ternary interrelations, also collect multiple intra-relations among users; assume that two items with high affinities should be mapped close to each other in the learnt factor subspaces. In the following, first introduce how to construct the tag affinity graph, and then incorporate them into the tensor factorization framework. To serve the ranking based optimization scheme, build the affinity graph based on the semantic relevance and context relevance. The context relevance of tag is simply encoded by their weighted co-occurrence in the image collection.

6. CONCLUSION

A novel framework namely MCE was proposed for mining and prediction of mobile users' movements and transactions in mobile commerce environments. In the MCE framework were designed with three major techniques: 1) SIM for measuring the similarities among stores and items; 2) PMCP-Mine algorithm for efficiently discovering mobile users' PMCPs; and 3) MCBP for predicting possible mobile user behaviors. To best knowledge, it is the first work that facilitates mining and prediction of personal mobile commerce behaviors that may recommend stores and items previously unknown to a user. To evaluate the performance of the proposed framework and three proposed techniques, conducted a series of experiments.

The experimental results show that the framework MCE achieves a very high precision in mobile commerce behavior predictions. Besides, the prediction technique MCBP in MCE framework integrates the mined PMCPs and the similarity information from SIM to achieve superior performs in terms of precision, recall, and F-measure. The experimental results show that the proposed framework and three components are highly accurate under various conditions. To overcome the problems of many numbers of items recommended in the MCE framework. The Similarity recommendation framework is more efficient than MCE framework system.

7. FUTURE ENHANCEMENT

For the future work, we plan to explore more efficient mobile commerce pattern mining algorithm, design more efficient similarity inference models, and develop profound prediction strategies to further enhance the MCE framework. In addition, we plan to apply the MCE framework to other applications, such as object tracking sensor networks and location based services, aiming to achieve high precision in predicting object behaviors.

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On the Adjacency Matrix and Neighborhood Associated with Zero-divisor Graph for Direct Product of Finite Commutative Rings

Kuntala Patra
Department of Mathematics
Gauhati University
Guwahati - 781014, India

Priyanka Pratim Baruah
Department of Mathematics
Girijananda Chowdhury Institute of Management and Technology
Guwahati - 781017, India

Abstract: The main purpose of this paper is to study the zero-divisor graph for direct product of finite commutative rings. In our present investigation we discuss the zero-divisor graphs for the following direct products: direct product of the ring of integers under addition and multiplication modulo p and the ring of integers under addition and multiplication modulo p^2 for a prime number p, direct product of the ring of integers under addition and multiplication modulo p and the ring of integers under addition and multiplication modulo $2p$ for an odd prime number p and direct product of the ring of integers under addition and multiplication modulo p and the ring of integers under addition and multiplication modulo $p^2 - 2$ for that odd prime p for which $p^2 - 2$ is a prime number. The aim of this paper is to give some new ideas about the neighborhood, the neighborhood number and the adjacency matrix corresponding to zero-divisor graphs for the above mentioned direct products. Finally, we prove some results of annihilators on zero-divisor graph for direct product of A and B for any two commutative rings A and B with unity

Keywords: Zero-divisor, Commutative ring**,** Adjacency matrix, Neighborhood, Zero-divisor graph, Annihilator.

AMS Classification (2010): 05Cxx; 05C25; 05C50.

1. INTRODUCTION

The idea of zero-divisor graph of a commutative ring was first introduced by I. Beck [2] in 1988. D. F. Anderson and P.S. Livinsgston [1] redefined the concept of zero-divisor graph in 1999. F. R. DeMeyer, T. Mckenzie and K. Schneider [3] extended the concept of zero-divisor graph for commutative semi-group in 2002. The notion of zero-divisor graph had been extended for non-commutative rings by S. P. Redmond [9] in 2002. Recently, P. Sharma, A. Sharma and R. K. Vats [10] have discussed the neighborhood set, the neighborhood number and the adjacency matrix of zero-divisor graphs for the rings $Z_p \times Z_p$ and $Z_p[i] \times Z_p[i]$, where p is a prime number.

In this paper R_1 denotes the finite commutative ring such that $R_1 = Z_p \times Z_{p^2}$ (p is a prime number), R_2 denotes the finite commutative ring such that $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number) and R_3 denotes the finite commutative ring such that $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number). Let R be a commutative ring with unity and $Z(R)$ be the set of zero-divisors of R; that is $Z(R) = \{x \in R: xy = 0 \text{ or } yx = 0 \text{ for some } y \in R^* = R - \{0\}\}$.Then *zero-divisor graph* of R is an *undirected graph* $\Gamma(R)$ with vertex set $Z(R)^* = Z(R) - \{0\}$ such that distinct vertices x and y of $Z(R)^*$ are adjacent if and only if $xy = 0$. The neighborhood (or open neighborhood) $N_G(v)$ of a vertex v of a graph G is the set of vertices adjacent to v. The closed neighborhood $N_G[v]$ of a vertex v is the set $N_G(v) \cup \{v\}$. For a set S of vertices, the neighborhood of S is the union of the neighborhoods of the vertices and so it is the set of all vertices adjacent to at least one member of S. For a graph G with vertex set V, the union of the neighborhoods of all the vertices is neighborhood of V and it is denoted by $N_G(V)$. The neighborhood number $n_G(V)$ is the cardinality of $N_G(V)$. If the graph G with vertex set V is connected, then $N_G(V)$ is the vertex set V and the cardinality of $N_G(V)$ is equal to the cardinality of V. If $\Gamma(R)$ is the zero-divisor graph of a commutative ring R with vertex set $Z(R)^*$ and since zero-divisor graph is always connected [1], we have $N_{\Gamma(R)}(Z(R)^*) = Z(R)^*$ and $|N_{\Gamma(R)}(Z(R)^*)| = |Z(R)^*|$. Throughout this paper $\Delta(G)$ denotes the maximum degree of a graph G and $\delta(G)$ denotes the minimum degree of a graph G. The adjacency matrix corresponding to zero-divisor graph G is defined as $A = [a_{ij}]$, where $a_{ij} = 1$, if $v_i v_j = 0$ for any vertex v_i and v_j of G and $a_{ij} = 0$, otherwise.

In this paper, we construct zero-divisor graphs for the rings R_1, R_2 and R_3. We obtain the neighborhood and the adjacency matrices corresponding to zero-divisor graphs of R_1, R_2 and R_3. Some properties of adjacency matrices are also obtained. We prove some theorems related to neighborhood and adjacency matrices corresponding to zero-divisor graphs of R_1, R_2 and R_3. Finally, we prove some results of annihilators on zero-divisor graph of $A \times B$, for any two commutative rings A and B with unity.

2. CONSTRUCTION OF ZERO -DIVISOR GRAPH FOR $R_1 = Z_p \times Z_{p^2}$ (p IS A PRIME NUMBER):

First, we construct the zero-divisor graph for the ring $R_1 = Z_p \times Z_{p^2}$ (p is a prime number) and analyze the graph. We start with the cases $p = 2$ and $p = 3$ and then generalize the cases.

Case1: When $p = 2$ we have $R_1 = Z_2 \times Z_4$.
The ring R_1 has 5 non-zero zero-divisors. In this case $V = Z(R_1)^* = \{(1,0), (0,1), (0,2), (0,3), (1,2)\}$ and the zero-divisor graph $G = \Gamma(R_1)$ is given by:

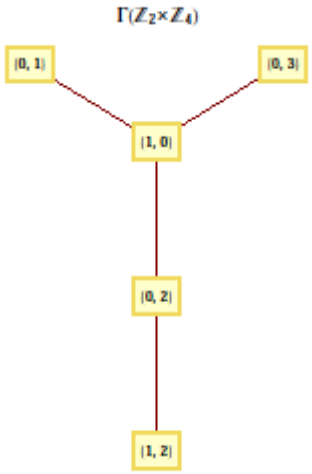

Fig: 1

The closed neighborhoods of the vertices are $N_G[(1,0)] = \{(1,0), (0,1), (0,2),(0,3)\}$, $N_G[(0,1)] =\{(1,0),(0,1)\}$, $N_G[(0,2)] = \{(1,0), (1,2), (0,2)\}$, $N_G[(0,3)] = \{(1,0),(0,3)\}$ and $N_G[(1,2)] = \{(0,2),(1,2)\}$. The neighborhood of V is given by $N_G(V) =\{(1,0), (0,1), (0,2), (0,3), (1,2)\}$. The maximum degree is $\Delta(G) = 3$ and minimum degree is $\delta(G) = 1$. The adjacency matrix for the zero-divisor graph of $R_1 = Z_2 \times Z_4$ is

$$M_1 = \begin{bmatrix} 0 & A_{1\times 3} & 0 \\ A^T{}_{3\times 1} & O_{3\times 3} & B_{3\times 1} \\ 0 & B^T{}_{1\times 3} & 0 \end{bmatrix}_{5\times 5}$$ where, $A_{1\times 3} = [1\ 1\ 1]$,

$B_{3\times 1} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$, $A^T{}_{3\times 1}$ is the transpose of $A_{1\times 3}$, $B^T{}_{1\times 3}$ is the transpose of $B_{3\times 1}$ and $O_{3\times 3}$ is the zero matrix.

Properties of adjacency matrix M_1:

(i) The determinant of the adjacency matrix M_1 corresponding to $G = \Gamma(R_1)$ is 0.
(ii) The rank of the adjacency matrix M_1 corresponding to $G = \Gamma(R_1)$ is 2.
(iii) The adjacency matrix M_1 corresponding to $G = \Gamma(R_1)$ is symmetric and singular.

Case2: When $p = 3$ we have $R_1 = Z_3 \times Z_9$.
The ring R_1 has 14 non-zero zero-divisors. In this case $V = Z(R_1)^* = \{(1,0), (2,0), (1,3), (1,6), (2,3), (2,6), (0,1), (0,2), (0,3), (0,4), (0,5),(0,6),(0,7),(0,8)\}$ and the zero-divisor graph $G = \Gamma(R_1)$ is given by:

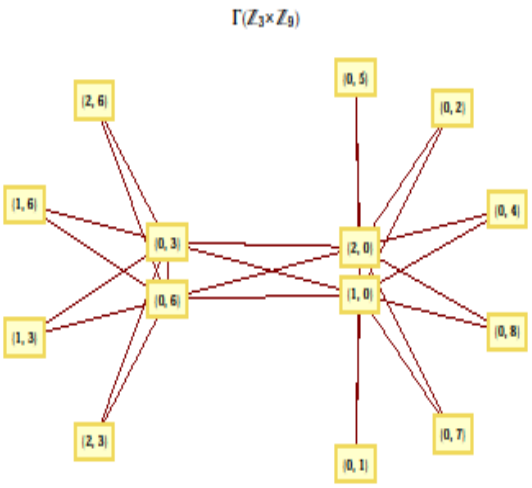

Fig: 2

The closed neighborhoods of the vertices are $N_G[(1,0)] = \{(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (1,0)\}$, $N_G[(2,0)] =\{(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8),(2,0)\}$, $N_G[(1,3)] = \{(0,3),(0,6),(1,3)\}$, $N_G[(1,6)] = \{(0,3), (0,6),(1,6)\}$, $N_G[(2,3)] = \{(0,3),(0,6),(2,3)\}$, $N_G[(2,6)] = \{(0,3), (0,6),(2,6)\}$, $N_G[(0,1)] = \{(1,0),(2,0),(0,1)\}$, $N_G[(0,2)] = \{(1,0), (2,0),(0,2)\}$, $N_G[(0,3)] = \{(1,0), (2,0), (1,3), (1,6), (2,3), (2,6), (0,6),(0,3)\}$, $N_G[(0,4)] =\{(1,0),(2,0),(0,4)\}$, $N_G[(0,5)] =\{(1,0), (2,0),(0,5)\}$, $N_G[(0,6)] = \{(1,0), (2,0), (1,3), (1,6), (2,3), (2,6), (0,3),(0,6)\}$, $N_G[(0,7)] =\{(1,0), (2,0), (0,7)\}$, $N_G[(0,8)] =\{(1,0), (2,0), (0,8)\}$. The neighborhood of V is given by $N_G(V) = \{(1,0), (0,2), (1,3), (1,6), (2,3), (2,6), (0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8)\}$. The maximum degree is $\Delta(G) = 8$ and minimum degree is $\delta(G) = 2$. The adjacency matrix for the zero-divisor graph of $R_1 = Z_3 \times Z_9$ is $M_1 = \begin{bmatrix} O_{6\times 6} & A_{6\times 5} & B_{6\times 3} \\ A^T{}_{5\times 6} & O_{5\times 5} & C_{5\times 3} \\ B^T{}_{3\times 6} & C^T{}_{3\times 5} & O_{3\times 3} \end{bmatrix}_{14\times 14}$ where $A_{6\times 5} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$,

$B_{6\times 3} = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, $C_{5\times 3} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$, $O_{6\times 6}$, $O_{5\times 5}$, $O_{3\times 3}$ are the zero matrices and $A^T{}_{5\times 6}$, $B^T{}_{3\times 6}$, $C^T{}_{3\times 5}$ are the transposes of $A_{6\times 5}$, $B_{6\times 3}$, $C_{5\times 3}$ respectively.

Properties of adjacency matrix M_1:

(i) The determinant of the adjacency matrix M_1 corresponding to $G = \Gamma(R_1)$ is 0.
(ii) The rank of the adjacency matrix M_1 corresponding to $G = \Gamma(R_1)$ is 2.
(iii) The adjacency matrix M_1 corresponding to $G = \Gamma(R_1)$ is symmetric and singular.

Generalization for $R_1 = Z_p \times Z_{p^2}$ (p is a prime number):

Lemma 2.1: The number of vertices of $G = \Gamma(Z_{p^2})$ *is* $p - 1$ and $G = \Gamma(Z_{p^2})$ *is* K_{p-1}, where p is a prime number [4]

Proof: The multiples of p less than p^2 are $p, 2p, 3p,\ldots\ldots, (p-1)p$. These multiples of p are the only non-zero zero-divisors of Z_{p^2}. If $G = \Gamma(Z_{p^2})$ is the zero-divisor graph of Z_{p^2}, then the vertices of $G = \Gamma(Z_{p^2})$ are the non-zero zero-divisors of Z_{p^2}. So, the vertex set of $G = \Gamma(Z_{p^2})$ is $Z(Z_{p^2})^*$ and $p, 2p, 3p,\ldots\ldots,(p-1)p$ are the vertices of $G = \Gamma(Z_{p^2})$. Hence, the number of vertices of $G = \Gamma(Z_{p^2})$ is $p - 1$. Also, in $G = \Gamma(Z_{p^2})$, every vertex is adjacent to every other vertex. This gives $G = \Gamma(Z_{p^2})$ *is* K_{p-1}.

Theorem 2.2: Let R_1 be a finite commutative ring such that $R_1 = Z_p \times Z_{p^2}$ (p is a prime number). Let $G = \Gamma(R_1)$ be the zero-divisor graph with vertex set $Z(R_1)^*$. Then number of vertices of $G = \Gamma(R_1)$ is $2p^2 - p - 1$, $\Delta(G) = p^2 - 1$ and $\delta(G) = p - 1$.

Proof: Let R_1 be a finite commutative ring such that $R_1 = Z_p \times Z_{p^2}$ (p is a prime number). Let $R_1^* = R_1 - \{0\}$. Then R_1^* can be partitioned into disjoint sets A, B, C, D and E such that $A = \{(u, 0) : u \in Z_p^*\}$, $B = \{(0, v) : v \in Z_{p^2}^*$ and $v \notin Z(Z_{p^2})^*\}$, $C = \{(0, w) : w \in Z_{p^2}^*$ and $w \in Z(Z_{p^2})^*\}$, $D = \{(a, b) : a \in Z_p^*, b \in Z_{p^2}^*$ and $b \in Z(Z_{p^2})^*\}$ and $E = \{(c, d) : c \in Z_p^*, d \in Z_{p^2}^*$ and $d \notin Z(Z_{p^2})^*\}$. Clearly, all the elements in A, B, C are non-zero zero-divisors. Let $(a, b) \in D$ and $(0, w) \in C$. Here $b, w \in Z(Z_{p^2})^*$. So, p/b and p/w. This gives p^2/bw. Therefore, $(a, b)(0, w) = (0, 0)$. Hence, every element of D is a non-zero zero-divisor. But product of any two elements of E is not equal to zero. Also, product of any element of E with any element of A, B, C and D is not equal to zero because, $cu \neq 0$ for $c, u \in Z_p^*$, $dv \neq 0$ for $d, v \in Z_{p^2}^*$ and $d, v \notin Z(Z_{p^2})^*$, $dw \neq 0$ for $d, w \in Z_{p^2}^*$ and $d \notin Z(Z_{p^2})^*$, $w \in Z(Z_{p^2})^*$ and $ca \neq 0$ for $c, a \in Z_p^*$ respectively. So, no element of E is a non-zero zero-divisor. Let $G = \Gamma(R_1)$ be the zero-divisor graph with vertex set $Z(R_1)^*$.Then $Z(R_1)^*$ can be partitioned into four disjoint sets A, B, C and D. Now using the **Lemma 2.1** we have $|A| = |Z_p^*| = p - 1$, $|B| = |Z_{p^2}^*| - |Z(Z_{p^2})^*| = (p^2 - 1) - (p - 1) = p^2 - 1 - p + 1 = p^2 - p$, $|C| = |Z(Z_{p^2})^*| = p - 1$, $|D| = |Z_p^*||Z(Z_{p^2})^*| = (p - 1)(p - 1) = p^2 - 2p + 1$.
Therefore, $|Z(R_1)^*| = |A| + |B| + |C| + |D| = (p - 1) + (p^2 - p) + (p - 1) + (p^2 - 2p + 1) = 2p^2 - p - 1$.

So, the number of vertices of $G = \Gamma(R_1)$ is $2p^2 - p - 1$.

Let $s = (u, 0)$ be any vertex of A.
(i) Every vertex of A is adjacent to every vertex of B. So, s is adjacent to $p^2 - p$ vertices of B.
(ii) Every vertex of A is adjacent to every vertex of C. So, s is adjacent to $p - 1$ vertices of C.
(iii) Any vertex of A is not adjacent to any vertex of D as $ua \neq 0$ for $u, a \in Z_p^*$.
Therefore, $deg_G(s) = (p^2 - p) + (p - 1) = p^2 - 1$.

Let $t = (0, v)$ be any vertex of B.
(i) Every vertex of B is adjacent to every vertex of A. So, t is adjacent to $p - 1$ vertices of A.
(ii) Any vertex of B is not adjacent to any vertex of C as $vw \neq 0$ for $v, w \in Z_{p^2}^*$ and $v \notin Z(Z_{p^2})^*$, $w \in Z(Z_{p^2})^*$.
(iii) Any vertex of B is not adjacent to any vertex of D as $vb \neq 0$ for $v, b \in Z_{p^2}^*$ and $v \notin Z(Z_{p^2})^*$, $b \in Z(Z_{p^2})^*$.
Therefore, $deg_G(t) = p - 1$.

Let $x = (0, w)$ be any vertex of C.
(i) Every vertex of C is adjacent to every vertex of A. So, x is adjacent to $p - 1$ vertices of A.
(ii) Any two vertices of C are adjacent to each other. So, x is adjacent to $p - 2$ vertices of C.
(iii) Every vertex of C is adjacent to every vertex of D. So, x is adjacent to $p^2 - 2p + 1$ vertices of D.
(iv) Any vertex of C is not adjacent to any vertex of B as $wv \neq 0$ for $w, v \in Z_{p^2}^*$ and $w \in Z(Z_{p^2})^*$, $v \notin Z(Z_{p^2})^*$.
Therefore, $deg_G(x) = (p - 1) + (p - 2) + (p^2 - 2p + 1) = p^2 - 2$.

Let $y = (a, b)$ be any vertex of D.
(i) Every vertex of D is adjacent to every vertex of C. So, y is adjacent to $p - 1$ vertices of C.
(ii) Any vertex of D is not adjacent to any vertex of A as $au \neq 0$ for $u, a \in Z_p^*$.
(iii) Any vertex of D is not adjacent to any vertex of B as $bv \neq 0$ for $b, v \in Z_{p^2}^*$ and $b \in Z(Z_{p^2})^*$, $v \notin Z(Z_{p^2})^*$.
Therefore, $deg_G(y) = p - 1$.

Hence, we have $\Delta(G) = p^2 - 1$ and $\delta(G) = p - 1$.
Theorem 2.3: Let M_1 be of the adjacency matrix for the zero-divisor graph $G = \Gamma(R_1)$ of $R_1 = Z_p \times Z_{p^2}$ (p is a prime number). Then (i) determinant of M_1 is zero *(ii)* M_1 is symmetric and singular.

Proof: Let R_1 be a finite commutative ring such that $R_1 = Z_p \times Z_{p^2}$ (p is a prime number). Let $G = \Gamma(R_1)$ be the zero-divisor graph with vertex set $V = Z(R_1)^*$ and M_1 be the adjacency matrix for the zero-divisor graph of $R_1 = Z_p \times Z_{p^2}$.

(i) Since, at least two vertices of $G = \Gamma(R_1)$ are adjacent to same vertex of G, so M_1 contains at least two identical rows (eg. for $Z_2 \times Z_4$). Therefore, the determinant of the adjacency matrix M_1 is zero.

(ii) Clearly M_1 is symmetric. Since, the determinant of the adjacency matrix M_1 is zero, M_1 is singular.

Theorem 2.4: Let R_1 be a finite commutative ring such that $R_1 = Z_p \times Z_{p^2}$ (p is a prime number). Let $G = \Gamma(R_1)$ be the zero-divisor graph with vertex set $V = Z(R_1)^*$.Then $n_G(V) = 2\Delta(G) - \delta(G)$, where $n_G(V)$ is the neighborhood number, $\Delta(G)$ and $\delta(G)$ denote the maximum and minimum degree of G respectively.

Proof: Let R_1 be a finite commutative ring such that $R_1 = Z_p \times Z_{p^2}$ (p is a prime number). Let $G = \Gamma(R_1)$ be the zero-divisor graph with vertex set $V = Z(R_1)^*$. Since, $G = \Gamma(R_1)$ is connected [1], we have $n_G(V) = |N_G(V)| = |V| = |Z(R_1)^*|$. But from **Theorem 2.2**, we have $|Z(R_1)^*| = 2p^2 - p - 1$. Therefore, $n_G(V) = 2p^2 - p - 1$. This implies $n_G(V) = 2(p^2 - 1) - (p - 1)$. Also, $\Delta(G) = p^2 - 1$ and $\delta(G) = p - 1$ [from **Theorem 2.2**]. This gives $n_G(V) = 2\Delta(G) - \delta(G)$.

3. CONSTRUCTION OF ZERO -DIVISOR GRAPH FOR $R_2 = Z_p \times Z_{2p}$ (p IS AN ODD PRIME NUMBER):

Secondly, we construct the zero-divisor graph for the ring $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number) and analyze the graph. We start with the cases $p = 3$ and $p = 5$ and then generalize the cases.

Case1: When $p = 3$ we have $R_2 = Z_3 \times Z_6$.
The ring R_2 has 13 non-zero zero-divisors. In this case $V = Z(R_2)^* = \{(1,0),(2,0),(1,2),(1,3), (1,4), (2,2), (2,3), (2,4), (0,1), (0,2),(0,3),(0,4),(0,5)\}$ and the zero-divisor graph $G = \Gamma(R_2)$ is given by:

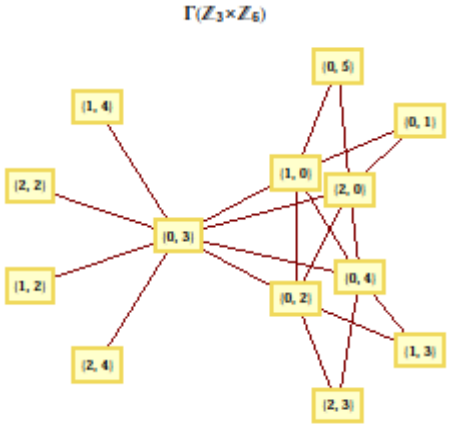

Fig: 3

The closed neighborhoods of the vertices are $N_G[(1,0)] = \{(0,1), (0,2), (0,3), (0,4), (0,5), (1,0)\}$, $N_G[(2,0)] = \{(0,1), (0,2), (0,3), (0,4),(0,5),(2,0)\}$, $N_G[(1,2)] = \{(0,3),(1,2)\}$, $N_G[(1,3)] = \{(0,2), (0,4), (1,3)\}$, $N_G[(1,4)] = \{(0,3), (1,4)\}$, $N_G[(2,2)] = \{(0,3), (2,2)\}$, $N_G[(2,3)] = \{(0,2),(0,4),(2,3)\}$, $N_G[(2,4)] = \{(0,3), (2,4)\}$, $N_G[(0,1)] = \{(1,0), (2,0), (0,1)\}$, $N_G[(0,2)] = \{(1,0), (2,0), (1,3), (2,3), (0,3), (0,2)\}$, $N_G[(0,3)] = \{(1,0), (2,0), (1,2),(1,4),(2,2),(2,4),(0,2),(0,4),(0,3)\}$, $N_G[(0,4)] = \{(1,0),(2,0),(1,3),(2,3),(0,3),(0,4)\}$, $N_G[(0,5)] = \{(1,0), (2,0), (0,5)\}$.The neighborhood of V is given by $N_G(V) = \{(1,0), (2,0), (1,2), (1,3), (1,4), (2,2), (2,3), (2,4), (0,1), (0,2), (0,3), (0,4), (0,5)\}$.The maximum degree is $\Delta(G) = 8$ and minimum degree is $\delta(G) = 1$. The adjacency matrix for the zero-divisor graph of $R_2 = Z_3 \times Z_6$ is $M_2 = \begin{bmatrix} O_{8\times8} & A_{8\times5} \\ A^T{}_{5\times8} & B_{5\times5} \end{bmatrix}_{13\times13}$,

where $A_{8\times5} = \begin{bmatrix} 1&1&1&1&1 \\ 1&1&1&1&1 \\ 0&0&1&0&0 \\ 0&1&0&1&0 \\ 0&0&1&0&0 \\ 0&0&1&0&0 \\ 0&1&0&1&0 \\ 0&0&1&0&0 \end{bmatrix}$, $B_{5\times5} = \begin{bmatrix} 0&0&0&0&0 \\ 0&0&1&0&0 \\ 0&1&0&1&0 \\ 0&0&1&0&0 \\ 0&0&0&0&0 \end{bmatrix}$,

$O_{8\times8}$ is the zero matrix and $A^T{}_{5\times8}$ is the transpose of $A_{8\times5}$.

Properties of adjacency matrix M_2:

(i) The determinant of the adjacency matrix M_2 corresponding to $G = \Gamma(R_2)$ is 0.
(ii) The rank of the adjacency matrix M_2 corresponding to $G = \Gamma(R_2)$ is 2.
(iii) The adjacency matrix M_2 corresponding to $G = \Gamma(R_2)$ is symmetric and singular.

Case2: When $p = 5$ we have $R_2 = Z_5 \times Z_{10}$.
The ring R_2 has 33 non-zero zero-divisors. In this case $V = Z(R_2)^* = \{(1,0),(2,0),(3,0),(4,0), (1,2), (1,4), (1,5), (1,6), (1,8), (2,2),(2,4),(2,5),(2,6),(2,8),(3,2),(3,4), (3,5), (3,6), (3,8), (4,2), (4,4), (4,5), (4,6), (4,8), (0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9)\}$ and the zero-divisor graph $G = \Gamma(R_2)$ is given by:

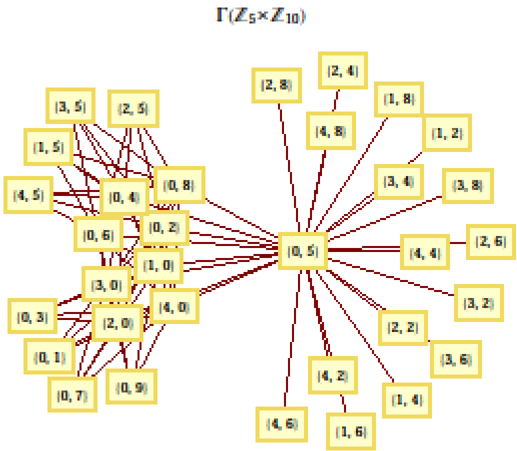

Fig: 4

The closed neighborhoods of the vertices are $N_G[(1,0)]$ = {(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (1,0)}, $N_G[(2,0)]$ = {(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (2,0)}, $N_G[(3,0)]$ = {(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (3,0)}, $N_G[(4,0)]$ = {(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (4,0)}, $N_G[(1,2)]$ = {(0,5), (1,2)}, $N_G[(1,4)]$ = {(0,5), (1,4)}, $N_G[(1,5)]$ = {(0,2), (0,4), (0,6), (0,8), (1,5)}, $N_G[(1,6)]$ = {(0,5), (1,6)}, $N_G[(1,8)]$ = {(0,5),(1,8)}, $N_G[(2,2)]$ = {(0,5),(2,2)}, $N_G[(2,4)]$ = {(0,5), (2,4)}}, $N_G[(2,5)]$ = {(0,2), (0,4), (0,6), (0,8), (2,5)}, $N_G[(2,6)]$ = {(0,5), (2,6)}, $N_G[(2,8)]$ = {(0,5),(2,8)}, $N_G[(3,2)]$ = {(0,5), (3,2)}, $N_G[(3,4)]$ = {(0,5), (3,4)}, $N_G[(3,5)]$ = {(0,2), (0,4), (0,6),(0,8),(3,5)}, $N_G[(3,6)]$ ={(0,5), (3,6)}, $N_G[(3,8)]$ = {(0,5), (3,8)}, $N_G[(4,2)]$ = {(0,5), (4,2)}}, $N_G[(4,4)]$ = {(0,5), (4,4)}, $N_G[(4,5)]$ = {(0,2), (0,4), (0,6), (0,8), (4,5)}, $N_G[(4,6)]$ = {(0,5), (4,6)}, $N_G[(4,8)]$ = {(0,5), (4,8)}, $N_G[(0,1)]$ = {(1,0), (2,0), (3,0), (4,0), (0,1)}, $N_G[(0,2)]$ = {(1,0), (2,0), (3,0), (4,0), (0,5), (1,5), (2,5), (3,5), (4,5), (0,2)}, $N_G[(0,3)]$ = {(1,0), (2,0), (3,0), (4,0),(0,3)}, $N_G[(0,4)]$ = {(1,0), (2,0), (3,0), (4,0), (0,5), (1,5), (2,5), (3,5), (4,5), (0,4)}, $N_G[(0,5)]$ = {(1,0), (2,0),(3,0), (4,0), (1,2), (1,4),(1,6), (1,8), (2,2), (2,4), (2,6), (2,8), (3,2), (3,4), (3,6), (3,8), (4,2), (4,4), (4,6), (4,8), (0,2), (0,4), (0,6), (0,8), (0,5)}, $N_G[(0,6)]$ = {(1,0),(2,0),(3,0), (4,0), (1,5),(2,5), (3,5), (4,5), (0,5),(0,6)}, $N_G[(0,7)]$ = {(1,0), (2,0), (3,0), (4,0), (0,7)}, $N_G[(0,8)]$ = {(1,0), (2,0), (3,0), (4,0), (1,5), (2,5), (3,5), (4,5), (0,5),(0,8)}, $N_G[(0,9)]$ = {(1,0), (2,0), (3,0), (4,0), (0,9)}.The neighborhood of V is given by $N_G(V)$ = {(1,0), (2,0), (3,0), (4,0), (1,2), (1,4), (1,5), (1,6), (1,8), (2,2), (2,4), (2,5), (2,6), (2,8), (3,2), (3,4),(3,5),(3,6),(3,8), (4,2), (4,4), (4,5),(4,6), (4,8), (0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9)}. The maximum degree is $\Delta(G)$ = 24 and minimum degree is $\delta(G)$ = 1. The adjacency matrix for the zero-divisor graph of

$$R_2 = Z_5 \times Z_{10} \text{ is } M_2 = \begin{bmatrix} O_{24\times 24} & A_{24\times 9} \\ A^T{}_{9\times 24} & B_{9\times 9} \end{bmatrix}_{33\times 33},$$

$$A_{24\times 9} = \begin{bmatrix}
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0
\end{bmatrix},$$

$$B_{9\times 9} = \begin{bmatrix}
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{bmatrix} \text{ and}$$

$O_{24\times 24}$ is the zero matrix and $A^T{}_{9\times 24}$ is the transpose of $A_{24\times 9}$.

Properties of adjacency matrix M_2:

(i) The determinant of the adjacency matrix M_2 corresponding to $G = \Gamma(R_2)$ is 0.
(ii) The rank of the adjacency matrix M_2 corresponding to $G = \Gamma(R_2)$ is 2.
(iii) The adjacency matrix M_2 corresponding to $G = \Gamma(R_2)$ is symmetric and singular.

Generalization for $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number):

Lemma 3.1: The number of vertices of $G = \Gamma(Z_{2p})$ is p and $G = \Gamma(Z_{2p})$ is $K_{1,\,p-1}$, where p is an odd prime number.

Proof: The multiples of 2 less than $2p$ are 2, 4, 6, ……, $2(p-1)$. The non-zero zero-divisors of Z_{2p} are p and 2, 4, 6, ……,$2(p-1)$. If $G = \Gamma(Z_{2p})$ is the zero-divisor graph of Z_{2p}, then the vertices of $G = \Gamma(Z_{2p})$ are the non-zero zero-divisors of Z_{2p}. So, the vertex set of $G = \Gamma(Z_{2p})$ is $Z(Z_{2p})^*$ and p and 2, 4, 6, ……,$2(p-1)$ are the vertices of $\Gamma(Z_{2p})$. Hence, the number of vertices of $G = \Gamma(Z_{2p})$ is p. Also, in $G = \Gamma(Z_{2p})$, p is adjacent to remaining vertices 2, 4, 6, ……,$2(p-1)$. This gives $G = \Gamma(Z_{2p})$ is $K_{1,\,p-1.}$

Theorem 3.2: Let R_2 be a finite commutative ring such that $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number). Let $G = \Gamma(R_2)$ be the zero-divisor graph with vertex set $Z(R_2)^*$. Then number of vertices of $G = \Gamma(R_2)$ is p^2+2p-2, $\Delta(G) = p^2-1$ and $\delta(G) = 1$.

Proof: Let R_2 be a finite commutative ring such that that $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number). Let $R_2^* = R_2 - \{0\}$. Then R_2^* can be partitioned into disjoint sets A, B, C, D and E such that $A = \{(u, 0) : u \in Z_p^*\}$, $B = \{(0, v) : v \in Z_{2p}^*$ and $v \notin Z(Z_{2p})^*\}$, $C = \{(0, w) : w \in Z_{2p}^*$ and $w \in Z(Z_{2p})^*\}$, $D = \{(a, b) : a \in Z_p^*, b \in Z_{2p}^*$ and $b \in Z(Z_{2p})^*\}$ and $E = \{(c, d) : c \in Z_p^*, d \in Z_{2p}^*$ and $d \notin Z(Z_{2p})^*\}$ respectively. Clearly, all the elements in A, B, C are non-zero zero-divisors. Let $(a, b) \in D$. Then (a, b) is of the form either (a, p) or (a, q), where $q = 2m$, $1 \le m \le p - 1$. Again let $(0, w) \in C$. Similarly, $(0, w)$ is of the form either $(0, p)$ or $(0, q)$, where $q = 2m$, $1 \le m \le p - 1$. Now p/p and $2/q$. This gives $2p/pq$. Therefore, $(a, p)(0, q) = (0, 0)$ and $(a, q)(0, p) = (0, 0)$. Hence, every element of D is a non-zero zero-divisor. But product of any two elements of E is not equal to zero. Also, product of any element of E with any element of A, B, C and D is not equal to zero because, $cu \neq 0$ for $c, u \in Z_p^*$, $dv \neq 0$ for d, $v \in Z_{2p}^*$ and d, $v \notin Z(Z_{2p})^*$, $dw \neq 0$ for d, $w \in Z_{2p}^*$ and $d \notin Z(Z_{2p})^*$, $w \in Z(Z_{2p})^*$ and $ca \neq 0$ for $c, a \in Z_p^*$ respectively. So, no element of E is a non-zero zero-divisor. Let $G = \Gamma(R_2)$ be the zero-divisor graph with vertex set $Z(R_2)^*$.Then $Z(R_2)^*$ can be partitioned into four disjoint sets A, B, C and D. Now using the **Lemma 3.1** we have $|A| = |Z_p^*| = p - 1$, $|B| = |Z_{2p}^*| - |Z(Z_{2p})^*| = (2p\text{-}1) - p = p - 1$, $|C| = |Z(Z_{2p})^*| = p$, $|D| = |Z_p^*||Z(Z_{2p})^*| = (p-1)p = p^2 - p$.

Therefore, $|Z(R_2)^*| = |A| + |B| + |C| + |D| = (p - 1) + (p - 1) + p + (p^2 - p) = p^2 + 2p - 2$
So, the number of vertices of $G = \Gamma(R_2)$ is $p^2 + 2p - 2$.

Let $s = (u, 0)$ be any vertex of A.
(i) Every vertex of A is adjacent to every vertex of B. So, s is adjacent to $p - 1$ vertices of B.
(ii) Every vertex of A is adjacent to every vertex of C. So, s is adjacent to p vertices of C.
(iii) Any vertex of A is not adjacent to any vertex of D as $ua \neq 0$ for $u, a \in Z_p^*$.
Therefore, $deg_G(s) = (p - 1) + p = 2p - 1$.

Let $t = (0, v)$ be any vertex of B.
(i) Every vertex of B is adjacent to every vertex of A. So, t is adjacent to $p - 1$ vertices of A
(ii) Any vertex of B is not adjacent to any vertex of C as $vw \neq 0$ for and $v, w \in Z_{2p}^*$ and $v \notin Z(Z_{2p})^*$, $w \in Z(Z_{2p})^*$
(iii) Any vertex of B is not adjacent to any vertex of D as $vb \neq 0$ for $v, b \in Z_{2p}^*$ and $v \notin Z(Z_{2p})^*$, $b \in Z(Z_{2p})^*$.
Therefore, $deg_G(t) = p - 1$

Let $x = (0, w)$ be any vertex of C. Then either $x = (0, p)$ or $x = (0, q)$, where $q = 2m$, $1 \le m \le p - 1$
(i) Every vertex of C is adjacent to every vertex of A. So, x is adjacent to $p - 1$ vertices of A.
(ii) Case 1: If $x = (0, p)$, then it is adjacent to $p - 1$ vertices of C.
Case 2: If $x = (0, q)$, then it is adjacent to only one vertex of C.
(iii) Case 1: If $x = (0, p)$, then it is adjacent to $|Z_p^*|^2 = (p - 1)^2$ vertices of D.
Case 2: If $x = (0, q)$, then it is adjacent to $|Z_p^*| = p - 1$ vertices of D.
(iv) Any vertex of C is not adjacent to any vertex of B as $wv \neq 0$ for $w, v \in Z_{2p}^*$ and $w \notin Z(Z_{2p})^*$, $v \in Z(Z_{2p})^*$.
Therefore, if $x = (0, p)$, then $deg_G(x) = (p - 1) + (p - 1) + (p - 1)^2 = p^2 - 1$ and if $x = (0, q)$, then $deg_G(x) = (p - 1) + 1 + (p - 1) = 2p - 1$.

Let $y = (a, b)$ be any vertex of D. Then either $y = (a, p)$ or $y = (a, q)$, where $a \in Z_p^*$ and $q = 2m$, $1 \le m \le p - 1$
(i) Case 1: If $y = (a, p)$, then it is adjacent to $p - 1$ vertices of C.
Case 2: If $y = (a, q)$, then it is adjacent to only one vertex of C.
(ii) Any vertex of D is not adjacent to any vertex of A as $au \neq 0$ for $u, a \in Z_p^*$
(iii) Any vertex of D is not adjacent to any vertex of B as $bv \neq 0$ for $b, v \in Z_{2p}^*$ and $b \in Z(Z_{2p})^*$, $v \notin Z(Z_{2p})^*$.
Therefore, if $y = (a, p)$, then $deg_G(y) = p - 1$ and if $y = (a, q)$, then $deg_G(y) = 1$.

Hence, we have $\Delta(G) = p^2 - 1$ and $\delta(G) = 1$.

Theorem 3.3: Let M_2 be of the adjacency matrix for the zero-divisor graph $G = \Gamma(R_2)$ of $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number). Then (i) determinant of M_2 is zero (ii) M_2 is symmetric and singular.

Proof: Follows from **Theorem 2.3.**

Theorem 3.4: Let R_2 be a finite commutative ring such that $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number). Let $G = \Gamma(R_2)$ be the zero-divisor graph with vertex set $V = Z(R_2)^*$.Then $n_G(V) = 2p + \Delta(G) - \delta(G)$, where $n_G(V)$ is the neighborhood number, $\Delta(G)$ and $\delta(G)$ denote the maximum and minimum degree of G respectively.

.**Proof:** Let R_2 be a finite commutative ring such that $R_2 = Z_p \times Z_{2p}$ (p is an odd prime number). Let $G = \Gamma(R_2)$ be the zero-divisor graph with vertex set $V = Z(R_2)^*$. Since, $G = \Gamma(R_2)$ is connected [1], we have $n_G(V) = |N_G(V)| = |V| = |Z(R_2)^*|$.
But from **Theorem 3.2**, we have $|Z(R_2)^*| = p^2 + 2p - 2$.
Therefore, $n_G(V) = p^2 + 2p - 2$.This implies $n_G(V) = 2p + (p^2 - 1) - 1$. Also $\Delta(G) = p^2 - 1$ and $\delta(G) = 1$ [from **Theorem 3.2**]. This gives $n_G(V) = 2p + \Delta(G) - \delta(G)$.

Remark: If $p = 2$, then $R_2 = Z_2 \times Z_4$. So, this case coincides with the ***case 1*** of **section 2**.

4. CONSTRUCTION OF ZERO -DIVISOR GRAPH FOR $R_3 = Z_p \times Z_{p^2-2}$ (FOR THAT ODD PRIME p FOR WHICH $p^2 - 2$ IS A PRIME NUMBER):

Thirdly, we construct the zero-divisor graph for the ring $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number) and analyze the graph. We start with the cases $p = 3$ and $p = 5$ and then generalize the cases.

Case1: When $p = 3$ we have $R_3 = Z_3 \times Z_7$.
The ring R_3 has 8 non-zero zero-divisors. In this case $V = Z(R_3)^* = \{(1,0), (2,0), (0,1), (0,2),(0,3), (0,4), (0,5),(0,6)\}$ and the zero-divisor graph $G = \Gamma(R_3)$ is given by:

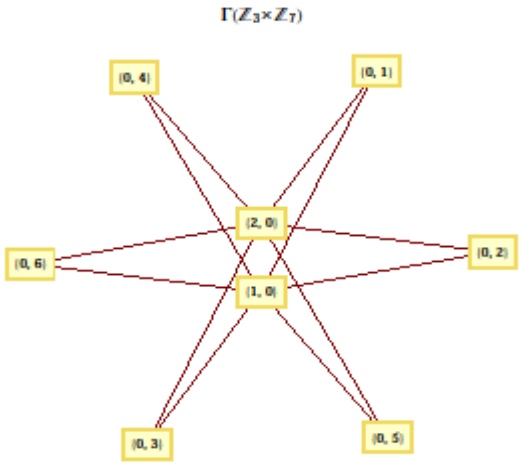

Fig: 5

The closed neighborhoods of the vertices are $N_G[(1,0)] = \{(0,1), (0,2), (0,3), (0,5), (0,6), (1,0)\}$, $N_G[(2,0)] = \{(0,1), (0,2), (0,3), (0,5),(0,6),(2,0)\}$, $N_G[(0,1)] = \{(1,0), (2,0), (0,1)\}$, $N_G[(0,2)] = \{(1,0), (2,0), (0,2)\}$, $N_G[(0,3)] = \{(1,0), (2,0), (0,3)\}$, $N_G[(0,4)] = \{(1,0), (2,0),(0,4)\}$, $N_G[(0,5)]=\{(1,0), (2,0),(0,5)\}$, $N_G[(0,6)] =\{(1,0),(2,0),(0,6)\}$. The neighborhood of V is given by $N_G(V) = \{(1,0), (2,0), (0,1), (0,2), (0,3), (0,4), (0,5),(0,6)\}$.The maximum degree is $\Delta(G) = 6$ and minimum degree is $\delta(G) = 2$. The adjacency matrix for the zero-divisor graph of $R_3 = Z_3 \times Z_7$ is $M_3 = \begin{bmatrix} O_{2\times2} & A_{2\times6} \\ A^T{}_{6\times2} & O_{6\times6} \end{bmatrix}_{8\times8}$ where all the entries of $A_{2\times6}$ is 1, $A^T{}_{6\times2}$ is the transpose of $A_{2\times6}$ and $O_{2\times2}$, $O_{6\times6}$ are the zero matrices.

Properties of adjacency matrix M_3:

(i) The determinant of the adjacency matrix M_3 corresponding to $G = \Gamma(R_3)$ is 0.
(ii) The rank of the adjacency matrix M_3 corresponding to $G = \Gamma(R_3)$ is 2.
(iii) The adjacency matrix M_3 corresponding to $G = \Gamma(R_3)$ is symmetric and singular.

Case2: When $p = 5$ we have $R_3 = Z_5 \times Z_{23}$.
The ring R_3 has 26 non-zero zero-divisors. In this case $V = Z(R_3)^* = \{(1,0), (2,0), (3,0), (4,0), (0,1),(0,2),(0,3),(0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (0,10), (0,11), (0,12), (0,13), (0,14), (0,15), (0,16), (0,17), (0,18), (0,19),(0,20), (0,21), (0,22)\}$ and the zero-divisor graph $G = \Gamma(R_3)$ is given by:

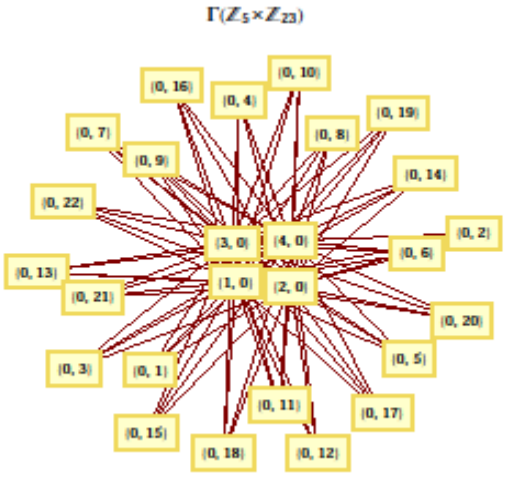

Fig: 6

The closed neighborhoods of the vertices are $N_G[(1,0)] = \{(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (0,10), (0,11), (0,12), (0,13), (0,14), (0,15), (0,16), (0,17), (0,18)\}$, $(0,19), (0,20), (0,21),(0,22),(1,0)\}$, $N_G[(2,0)] = \{(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7),(0,8),(0,9), (0,10), (0,11), (0,12), (0,13), (0,14), (0,15), (0,16), (0,17),(0,18)\}$, $(0,19), (0,20), (0,21), (0,22), (2,0)\}$, $N_G[(3,0)] = \{(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7),(0,8),(0,9), (0,10), (0,11), (0,12), (0,13), (0,14), (0,15), (0,16), (0,17), (0,18)\}$, $(0,19), (0,20), (0,21), (0,22), (3,0)\}$, $N_G[(4,0)] = \{(0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (0,10), (0,11), (0,12), (0,13), (0,14), (0,15), (0,16), (0,17), (0,18)\}$, $(0,19), (0,20), (0,21), (0,22), (4,0)\}$, $N_G[(0,1)] = \{(1,0), (2,0), (3,0), (4,0), (0,1)\}$, $N_G[(0,2)] = \{(1,0), (2,0), (3,0), (4,0), (0,2)\}$, $N_G[(0,3)] = \{(1,0), (2,0), (3,0), (4,0), (0,3)\}$, $N_G[(0,4)] = \{(1,0), (2,0), (3,0),(4,0),(0,4)\}$, $N_G[(0,5)] = \{(1,0),(2,0),(3,0), (4,0),(0,5)\}$, $N_G[(0,6)] = \{(1,0), (2,0),(3,0),(4,0),(0,6)\}$, $N_G[(0,7)] = \{(1,0), (2,0), (3,0), (4,0), (0,7)\}$, $N_G[(0,8)] =\{(1,0),(2,0),(3,0),(4,0), (0,8)\}$, $N_G[(0,9)] = \{(1,0), (2,0), (3,0),(4,0),(0,9)\}$, $N_G[(0,10)] =\{(1,0), (2,0), (3,0), (4,0),(0,10)\}$, $N_G[(0,11)] = \{(1,0), (2,0), (3,0), (4,0), (0,11)\}$, $N_G[(0,12)] = \{(1,0),(2,0), (3,0), (4,0), (0,12)\}$, $N_G[(0,13)] = \{(1,0), (2,0), (3,0),(4,0),(0,13)\}$, $N_G[(0,14)] =\{(1,0), (2,0), (3,0), (4,0),(0,14)\}$, $N_G[(0,15)] = \{(1,0), (2,0), (3,0), (4,0), (0,15)\}$, $N_G[(0,16)] = \{(1,0), (2,0), (3,0), (4,0), (0,16)\}$, $N_G[(0,17)] = \{(1,0), (2,0), (3,0), (4,0), (0,17)\}$, $N_G[(0,18)] = \{(1,0), (2,0), (3,0), (4,0), (0,18)\}$, $N_G[(0,19)] = \{(1,0), (2,0), (3,0),(4,0),(0,19)\}$, $N_G[(0,20)] = \{(1,0), (2,0), (3,0), (4,0), (0,20)\}$, $N_G[(0,21)] = \{(1,0), (2,0), (3,0), (4,0), (0,21)\}$, $N_G[(0,22)] =\{(1,0), (2,0), (3,0), (4,0), (0,22)\}$. The neighborhood of V is given by $N_G(V) = \{(1,0), (2,0), (3,0), (4,0), (0,1), (0,2), (0,3), (0,4), (0,5), (0,6), (0,7), (0,8), (0,9), (0,10), (0,11), (0,12), (0,13),(0,14), (0,15), (0,16), (0,17), (0,18), (0,19), (0,20), (0,21),(0,22)\}$. The maximum

degree is $\Delta(G) = 22$ and minimum degree is $\delta(G) = 4$. The adjacency matrix for the zero-divisor graph of $R_3 = Z_5 \times Z_{23}$ is $M_3 = \begin{bmatrix} O_{4\times4} & A_{4\times22} \\ A^T{}_{22\times4} & O_{22\times22} \end{bmatrix}_{26\times26}$ where all the entries of $A_{4\times22}$ is 1, $A^T{}_{22\times4}$ is the transpose of $A_{4\times22}$ and $O_{4\times4}, O_{22\times22}$ are the zero matrices.

Properties of adjacency matrix M_3:

(i) The determinant of the adjacency matrix M_3 corresponding to $G = \Gamma(R_3)$ is 0.
(ii) The rank of the adjacency matrix M_3 corresponding to $G = \Gamma(R_3)$ is 2.
(iii) The adjacency matrix M_3 corresponding to $G = \Gamma(R_3)$ is symmetric and singular.

Generalization for $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which p^2-2 is a prime number):

Theorem 4.1: Let R_3 be a finite commutative ring such that $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number). Let $G = \Gamma(R_3)$ be the zero-divisor graph with vertex set $Z(R_3)^*$. Then number of vertices of $G = \Gamma(R_3)$ is $p^2 + p - 4$, $\Delta(G) = p^2 - 3$ and $\delta(G) = p - 1$.

Proof: Let R_3 be a finite commutative ring such that that $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number). Let $R_3{}^* = R_3 - \{0\}$. Then $R_3{}^*$ can be partitioned into disjoint sets A, B and C such that $A = \{(u, 0): u \in Z_p{}^*\}$, $B = \{(0, v): v \in Z^*{}_{p^2-2}\}$ and $C = \{(a, b) : a \in Z_p{}^*$ and $b \in Z^*{}_{p^2-2}\}$ respectively. Clearly, all the elements of A and B are non-zero zero-divisors. But product of any two elements of C is not equal to zero. Also, product of any element of C with any element of A and B is not equal to zero because, $au \neq 0$ for $a, u \in Z_p{}^*$, $bv \neq 0$ for $b, v \in Z^*{}_{p^2-2}$ respectively. So, no element of C is a non-zero zero-divisor. Let $G = \Gamma(R_3)$ be the zero-divisor graph with vertex set $Z(R_3)^*$.Then $Z(R_3)^*$ can be partitioned into two disjoint sets A and B. Now, $|A| = |Z_p{}^*| = p - 1$ and $|B| = |Z^*{}_{p^2-2}| = p^2 - 3$. Therefore, $|Z(R_3)^*| = |A| + |B| = |Z_p{}^*| + |Z^*{}_{p^2-2}| = (p - 1) + (p^2 - 3) = p^2 + p - 4$. So, the number of vertices of $G = \Gamma(R_3)$ is $p^2 + p - 4$.

Let $x = (u, 0)$ be any vertex of A.
(i) Every vertex of A is adjacent to every vertex of B. So, x is adjacent to $p^2 - 3$ vertices of B. Therefore, $deg_G(x) = p^2 - 3$.

Let $y = (0, v)$ be any vertex of B.
(i) Every vertex of B is adjacent to every vertex of A. So, y is adjacent to $p - 1$ vertices of A. Therefore, $deg_G(y) = p - 1$.

Hence, we have $\Delta(G) = p^2 - 3$ and $\delta(G) = p - 1$.

Theorem 4 .2: Let M_3 be of the adjacency matrix for the zero-divisor graph $G = \Gamma(R_3)$ of $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number). Then (i) determinant of M_3 is zero (ii) M_3 is symmetric and singular.

Proof: Follows from **Theorem 2.3.**

Theorem 4.3: Let R_3 be a finite commutative ring such that $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number). Let $G = \Gamma(R_3)$ be the zero-divisor graph with vertex set $V = Z(R_3)^*$. Then $n_G(V) = \Delta(G) + \delta(G)$, where $n_G(V)$ is the neighborhood number, $\Delta(G)$ and $\delta(G)$ denote the maximum and minimum degree of G respectively.

Proof: Let R_3 be a finite commutative ring such that $R_3 = Z_p \times Z_{p^2-2}$ (for that odd prime p for which $p^2 - 2$ is a prime number). Let $G = \Gamma(R_3)$ be the zero-divisor graph with vertex set $V = Z(R_3)^*$. Since, $G = \Gamma(R_3)$ is connected [1], we have $n_G(V) = |N_G(V)| = |V| = |Z(R_3)^*|$. But from **Theorem 4.1**, we have $|Z(R_3)^*| = p^2+p - 4$. Therefore, $n_G(V) = p^2+p - 4$. This implies $n_G(V) = (p^2 - 3) + (p - 1)$. Also, $\Delta(G) = p^2 - 3$ and $\delta(G) = p - 1$ [from **Theorem 4.1**]. This gives $n_G(V) = \Delta(G) + \delta(G)$.

Remark: If $p = 2$, then $R_3 = Z_2 \times Z_2$. In this case $V = Z(R_3)^* = \{(0, 1),(1, 0)\}$ and $G = \Gamma(R_3)$ is a 1- regular graph. Also, $n_G(V) = 2 = 2\,\Delta(G) = 2\,\delta(G)$.

5. DEFINITIONS AND RELATIONS:

Let R be a commutative ring with unity and let $a \in R$. Then annihilator of a is denoted by $ann(a)$ and defined by $ann(a) = \{x \in R : ax = 0\}$. Let $ann^*(a) = \{x (\neq 0) \in R: ax = 0\}$.

The degree of a vertex v of a graph G denoted by $deg(v)$ is the number of lines incident with v.

Given a zero-divisor graph $\Gamma(R)$ with vertex set $Z(R)^*$, then degree of a vertex v of $\Gamma(R)$ is given by $deg(v) = |ann^*(v)|$.

Let A and B be two commutative rings with unity. Then the direct product $A \times B$ of A and B is also a commutative ring with unity.

Let G be a graph and $V(G)$ be the vertex set of G. Let $a, b \in V(G)$. We define a relation $\mathcal{R}$ on $V(G)$ as follows. For $a, b \in V(G)$, a is related to b under the relation $\mathcal{R}$ if and only if a and b are not adjacent and for any $x \in V(G)$, a and x are adjacent if and only if b and x are adjacent. We denote this relation by $a \mathcal{R} b$.

6. Results of annihilators on $\Gamma(A \times B)$:

Theorem 6.1: The relation $\mathcal{R}$ is an equivalence relation on $V(G)$, where G is any graph.

Proof: For every $a \in V(G)$, we have $a \mathcal{R} a$, as G has no self-loop. For $a, b \in V(G)$, $a \mathcal{R} b$, then clearly, $b \mathcal{R} a$. Again let

$a \mathcal{R} b$ and $b \mathcal{R} c$. If possible suppose, a and c are adjacent. Then we have b and c are also adjacent, a contradiction. So, a and c are not adjacent. Also for $x \in V(G)$, a and x are adjacent $\Leftrightarrow b$ and x are adjacent $\Leftrightarrow c$ and x are adjacent. Therefore, $a \mathcal{R} c$. Hence, the relation $\mathcal{R}$ is an equivalence relation on $V(G)$.

Theorem 6.2: For distinct $a, b \in Z(A \times B)^*$, $a \mathcal{R} b$ in $\Gamma(A \times B)$ if and only if $ann(a) - \{a\} = ann(b) - \{b\}$. Moreover, if $a \mathcal{R} b$ in $\Gamma(R_1 \times R_2)$, then $ann(a_1) - \{a_1\} = ann(b_1) - \{b_1\}$ and $ann(a_2) - \{a_2\} = ann(b_2) - \{b_2\}$, where $a = (a_1, a_2)$, $b = (b_1, b_2)$, $a_1, a_2 \in A$ and $b_1, b_2 \in B$.

Proof: First suppose, for distinct $a, b \in Z(A \times B)^*$, $a \mathcal{R} b$ in $\Gamma(A \times B)$. Let $x \in ann(a) - \{a\}$. This gives $ax = 0$, $a \neq x$. So, a and x are adjacent. Since $a \mathcal{R} b$ we have b and x are adjacent. Therefore, we have $bx = 0$, $b \neq x$. Hence, $x \in ann(b) - \{b\}$. This implies $ann(a) - \{a\} \subseteq ann(b) - \{b\}$. Similarly, $ann(b) - \{b\} \subseteq ann(a) - \{a\}$. This gives $ann(a) - \{a\} = ann(b) - \{b\}$.

Conversely suppose, $ann(a) - \{a\} = ann(b) - \{b\}$. Assume that a and b are adjacent. This gives $ab = 0 \Rightarrow b \in ann(a) - \{a\} = ann(b) - \{b\}$, a contradiction. So, a and b are not adjacent. Again for $x \in Z(A \times B)^*$, a and x are adjacent $\Leftrightarrow ax = 0 \Leftrightarrow x \in ann(b) - \{b\} \Leftrightarrow bx = 0 \Leftrightarrow b$ and x are adjacent. This gives $a \mathcal{R} b$ in $\Gamma(A \times B)$.

If $a = (a_1, a_2)$, $b = (b_1, b_2) \in Z(A \times B)^*$, let $x \in ann(a) - \{a\}$, where $x = (x_1, x_2)$. Then $ax = 0$, $a \neq x$. Therefore, a and x are adjacent. Since $a \mathcal{R} b$ in $\Gamma(A \times B)$, we have a and x are adjacent $\Leftrightarrow b$ and x are adjacent. So, $ax = 0 \Leftrightarrow bx = 0$. This gives $a_1x_1 = 0$, $a_2x_2 = 0 \Leftrightarrow b_1x_1 = 0$, $b_2x_2 = 0$. Hence we have $a_1x_1 = 0 \Leftrightarrow b_1x_1 = 0$, $(x_1 \neq a_1, b_1)$ in A and $a_2x_2 = 0 \Leftrightarrow b_2x_2 = 0$ $(x_2 \neq a_2, b_2)$ in B. Therefore, $ann(a_1) - \{a_1\} = ann(b_1) - \{b_1\}$ and $ann(a_2) - \{a_2\} = ann(b_2) - \{b_2\}$.

Example 6.3: Consider the commutative ring $Z_2 \times Z_4 = \{(0,0), (0,1), (0,2), (0,3), (1,0), (1,1), (1,2), (1,3)\}$ and zero-divisor graph $\Gamma(Z_2 \times Z_4)$**.** Here $Z(Z_2 \times Z_4)^* = \{(0,1), (0,2), (0,3), (1,0), (1,2)\}$.The possible edges are $\{(0, 1), (1,0)\}$, $\{(0,2), (1,0)\}$, $\{(0,3), (1,0)\}$ and $\{(0,2), (1,2)\}$. The pairs $\{(0, 1), (0, 2)\}$, $\{(0, 1), (0, 3)\}$, $\{(0, 2), (0, 3)\}$ and $\{(1, 0), (1, 2)\}$ establish the existence of relation $\mathcal{R}$ and **Theorem 6.1:**

7. CONCLUSIONS:

In this paper, we study the adjacency matrix and neighborhood associated with zero-divisor graph for direct product of finite commutative rings. Neighborhoods may be used to represent graphs in computer algorithms, via the adjacency list and adjacency matrix representations. Neighborhoods are also used in the clustering coefficient of a graph, which is a measure of the average density of its neighborhoods. In addition, many important classes of graphs may be defined by properties of their neighborhoods.

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Generalized Semipre Regular Closed Sets in Intuitionistic Fuzzy Topological Spaces

K. Ramesh
MPhil Scholar., Department of Mathematics,
NGM College, Pollachi-642001, Tamil Nadu, India.

M. Thirumalaiswamy
Asso. Prof., Department of Mathematics,
NGM College, Pollachi-642001, Tamil Nadu, India.

Abstract: In this paper, we introduce the notion of an intuitionistic fuzzy generalized semipre regular closed sets and intuitionistic fuzzy generalized semipre regular open sets and study some of its properties in Intuitionistic fuzzy topological spaces.

Keywords: Intuitionistic fuzzy topology, intuitionistic fuzzy generalized semipre regular closed sets, intuitionistic fuzzy generalized semipre regular open sets and intuitionistic fuzzy points.

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1. INTRODUCTION

In 1965, Zadeh [14] introduced fuzzy sets and in 1968, Chang [2] introduced fuzzy topology. After the introduction of fuzzy set and fuzzy topology, several authors were conducted on the generalization of these notions. In 1986, the notion of intuitionistic fuzzy sets was introduced by Atanassov [1] as a generalization of fuzzy sets. In 1997, Coker [3] introduced the concept of intuitionistic fuzzy topological spaces. In this paper, we introduce intuitionistic fuzzy generalized semipre regular closed sets and intuitionistic fuzzy generalized semipre regular open sets in intuitionistic fuzzy topological space. We study some of its properties in intuitionistic fuzzy topological spaces.

2. PRELIMINARIES

Throughout this paper, (X, τ) or X denotes the intuitionistic fuzzy topological spaces (briefly IFTS). For a subset A of X, the closure, the interior and the complement of A are denoted by cl(A), int(A) and A^c respectively. We recall some basic definitions that are used in the sequel.

Definition 2.1: [1] Let X be a non-empty fixed set. An intuitionistic fuzzy set (IFS in short) A in X is an object having the form

$$A = \{\langle x, \mu_A(x), \nu_A(x)\rangle / \ x \in X\}$$

where the functions $\mu_A: X \to [0,1]$ and $\nu_A: X \to [0,1]$ denote the degree of membership (namely $\mu_A(x)$) and the degree of non-membership (namely $\nu_A(x)$) of each element $x \in X$ to the set A, respectively, and $0 \le \mu_A(x) + \nu_A(x) \le 1$ for each $x \in X$. Denote by IFS(X), the set of all intuitionistic fuzzy sets in X.

Definition 2.2: [1] Let A and B be IFSs of the form $A = \{\langle x, \mu_A(x), \nu_A(x)\rangle / \ x \in X\}$ and $B = \{\langle x, \mu_B(x), \nu_B(x)\rangle / \ x \in X\}$. Then

(i) $A \subseteq B$ if and only if $\mu_A(x) \le \mu_B(x)$ and $\nu_A(x) \ge \nu_B(x)$ for all $x \in X$,
(ii) $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$,
(iii) $A^c = \{ \langle x, \nu_A(x), \mu_A(x)\rangle / \ x \in X \}$,
(iv) $A \cap B = \{ \langle x, \mu_A(x) \wedge \mu_B(x), \nu_A(x) \vee \nu_B(x)\rangle / \ x \in X \}$,
(v) $A \cup B = \{ \langle x, \mu_A(x) \vee \mu_B(x), \nu_A(x) \wedge \nu_B(x)\rangle / \ x \in X \}$.

For the sake of simplicity, we shall use the notation $A = \langle x, \mu_A, \nu_A\rangle$ instead of $A = \{\langle x, \mu_A(x), \nu_A(x)\rangle / \ x \in X\}$.

Definition 2.3: [3] An intuitionistic fuzzy topology (IFT in short) on X is a family τ of IFSs in X satisfying the following axioms:

(i) $0_\sim, 1_\sim \in \tau$,
(ii) $G_1 \cap G_2 \in \tau$, for any $G_1, G_2 \in \tau$,
(iii) $\cup G_i \in \tau$ for any family $\{G_i / i \in J\} \subseteq \tau$.

In this case the pair (X, τ) is called an intuitionistic fuzzy topological space (IFTS in short) and any IFS in τ is known as an intuitionistic fuzzy open set (IFOS in short) in X. The complement A^c of an IFOS A in an IFTS (X, τ) is called an intuitionistic fuzzy closed set (IFCS in short) in X.

Definition 2.4: [3] Let (X, τ) be an IFTS and $A = \langle x, \mu_A, \nu_A\rangle$ be an IFS in X. Then the intuitionistic fuzzy interior and an intuitionistic fuzzy closure are defined by

$int(A) = \cup\{ G / G \text{ is an IFOS in X and } G \subseteq A \}$,
$cl(A) = \cap\{ K / K \text{ is an IFCS in X and } A \subseteq K \}$.

Definition 2.5: [4] An IFS A of an IFTS (X, τ) is an

(i) *intuitionistic fuzzy regular closed set* (IFRCS in short) if $A = cl(int(A))$,
(ii) *intuitionistic fuzzy regular open set* (IFROS in short) if $A = int(cl(A))$,
(iii) *intuitionistic fuzzy semiclosed set* (IFSCS in short) if $int(cl(A)) \subseteq A$,
(iv) *intuitionistic fuzzy semiopen set* (IFSOS in short) if $A \subseteq cl(int(A))$,
(v) *intuitionistic fuzzy preclosed set* (IFPCS in short) if $cl(int(A)) \subseteq A$,
(vi) *intuitionistic fuzzy preopen set* (IFPOS in short) if $A \subseteq int(cl(A))$.

Definition 2.6: [13] An IFS A of an IFTS (X, τ) is an

(i) *intuitionistic fuzzy semipre closed set* (IFSPCS in short) if there exists an IFPCS B such that int(B) ⊆ A ⊆ B,
(ii) *intuitionistic fuzzy semipre open set* (IFSPOS in short) if there exists an IFPOS B such that B ⊆ A ⊆ cl(B).

Definition 2.7: [6] An IFS A is an IFTS (X, τ) is said to be an *intuitionistic fuzzy generalized semipre closed set* (IFGSPCS) if spcl(A) ⊆ U whenever A ⊆ U and U is an IFSOS in (X, τ). An IFS A of an IFTS (X, τ) is called an *intuitionistic fuzzy generalized semipre open set* (IFGSPOS in short) if A^c is an IFGSPCS in (X, τ).

Definition 2.8: [12] An IFS A in an IFTS (X, τ) is said to be an *intuitionistic fuzzy semipre generalized closed set* (IFSPGCS for short) if spcl(A) ⊆ U whenever A ⊆ U and U is an IFSOS in (X, τ).
Every IFCS, IFSCS, IFRCS, IFPCS, IFSPCS, is an IFSPGCS but the converses are not true in general.

Definition 2.9: [11] The complement A^c of an IFSPGCS A in an IFTS (X, τ) is called an *intuitionistic fuzzy semipre generalized open set* (IFSPGOS for short) in X.

Definition 2.10: [6] Let A be an IFS in an IFTS (X, τ). Then
(i) spint (A) = ∪{ G / G is an IFSPOS in X and G ⊆A },
(ii) spcl (A) = ∩{ K / K is an IFSPCS in X and A ⊆K }.

Note that for any IFS A in (X, τ), we have $spcl(A^c) = (spint(A))^c$ and $spint(A^c) = (spcl(A))^c$.

Definition 2.11: Let A be an IFS in an IFTS (X, τ). Then
(i) *intuitionistic fuzzy regular generalized closed set* (IFRGCS for short) if cl(A) ⊆ U whenever A⊆ U and U is an intuitionistic fuzzy regular open in X [8],
(ii) *intuitionistic fuzzy generalized pre regular closed set* (IFGPRCS for short) if pcl(A) ⊆ U whenever A⊆ U and U is an intuitionistic fuzzy regular open in X [10],
(iii) *intuitionistic fuzzy generalized pre closed set* (IFGPCS for short) if pcl(A) ⊆ U whenever A⊆ U and U is an intuitionistic fuzzy open in X [5].

An IFS A of an IFTS (X, τ) is called an *intuitionistic fuzzy regular generalized open set*, *intuitionistic fuzzy generalized pre regular open set* and *intuitionistic fuzzy generalized pre open set* (IFRGOS, IFGPROS and IFGPOS in short) if the complement A^c is an IFRGCS, IFGPRCS and IFGPCS respectively.

Definition 2.12: [9] An IFTS (X, τ) is said to be an intuitionistic fuzzy $T_{1/2}$ ($IFT_{1/2}$ for short) space if every intuitionistic fuzzy generalized closed set in X is an intuitionistic fuzzy closed set in X.

Definition 2.13: [7] Let Let α, β ∈ [0, 1] and α + β ≤ 1. An intuitionistic fuzzy point (IFP for short) $p_{(\alpha, \beta)}$ of X is an IFS of X defined by

$$p_{(\alpha, \beta)}(y) = \begin{cases} (\alpha, \beta) & \text{if} \quad y = x \\ (0, 1) & \text{if} \quad y \neq x \end{cases}$$

3. INTUITIONISTIC FUZZY GENERALIZED SEMIPRE REGULAR CLOSED SETS

In this section we have introduced intuitionistic fuzzy generalized semipre regular closed sets and have studied some of its properties.

Definition 3.1: An IFS A in an IFTS (X, τ) is said to be an intuitionistic fuzzy generalized semipre regular closed set (IFGSPRCS for short) if spcl(A) ⊆ U whenever A ⊆ U and U is an IFROS in (X, τ). The family of all IFGSPRCSs of an IFTS(X, τ) is denoted by IFGSPRC(X).
For the sake of simplicity, we shall use the notation A= ⟨x, (μ, μ), (ν, ν)⟩ instead of A= ⟨x,(a/μ_a, b/μ_b), (a/ν_a, b/ν_b)⟩ in all the examples used in this paper.

Example 3.2: Let X= {a, b} and G= ⟨x, (0.5, 0.4), (0.5, 0.6)⟩**.** Then τ = {$0_\sim$, G, $1_\sim$} is an IFT on X and the IFS A= ⟨x, (0.4, 0.2), (0.6, 0.7)⟩ is an IFGSPRCS in (X, τ).

Theorem 3.3: Every IFCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFCS. Let A ⊆ U and U be an IFROS in (X, τ). Then spcl(A) ⊆ cl(A) = A ⊆ U, by hypothesis. Hence A is an IFGSPRCS in (X, τ).

Example 3.4: In Example 3.2., the IFS A= ⟨x, (0.4, 0.2), (0.6, 0.7)⟩ is an IFGSPRCS but not an IFCS in (X, τ).

Theorem 3.5: Every IFRGCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFRGCS. Let A ⊆ U and U be an IFROS in (X, τ). Then spcl(A) ⊆ cl(A) ⊆ U, by hypothesis. Hence A is an IFGSPRCS in (X, τ).

Example 3.6: Let X= {a, b} and G= ⟨x, (0.5, 0.4), (0.5, 0.6)⟩**.** Then τ = {$0_\sim$, G, $1_\sim$} is an IFT on X and the IFS A= ⟨x, (0.4, 0.2), (0.6, 0.7)⟩ is an IFGSPRCS in (X, τ) but not an IFRGCS in (X, τ).

Theorem 3.7: Every IFGPRCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFGPRCS and A ⊆ U, U be an IFROS in (X, τ). Then spcl(A) ⊆ pcl(A), since pcl(A) ⊆ U. We have spcl(A)⊆ U. Hence A is an IFGSPRCS in (X, τ).

Example 3.8: Let X= {a, b} and G_1= ⟨x, (0.7, 0.8), (0.3, 0.2)⟩, G_2= ⟨x, (0.2, 0.1), (0.8, 0.9)⟩, G_3= ⟨x, (0.5, 0.6), (0.5, 0.4)⟩ and G_4= ⟨x, (0.6, 0.7), (0.4, 0.3)⟩**.** Then τ = {$0_\sim$, G_1, G_2, G_3, G_4, $1_\sim$} is an IFT on X and the IFS A= ⟨x, (0.7, 0.8), (0.3, 0.2)⟩ is an IFGSPRCS but not an IFGPRCS in (X, τ).

Theorem 3.9: Every IFPCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFPCS in (X, τ) and let A ⊆ U, U be an IFROS in (X, τ). Then spcl(A) ⊆ pcl(A) = A ⊆ U, by hypothesis. Hence is an IFGSPRCS in (X, τ).

Example 3.10: Let X= {a, b} and G= ⟨x, (0.3, 0.2), (0.6, 0.6)⟩. Then τ = {$0_\sim$, G, $1_\sim$} is an IFT on X and the IFS A= ⟨x, (0.3, 0.2), (0.6, 0.6)⟩ is an IFGSPRCS in (X, τ) but not an IFPCS in (X, τ).

Theorem 3.11: Every IFGPCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFGPCS in (X, τ). Let A ⊆ U and U be an IFROS in (X, τ). Since every IFROS in (X, τ) is an IFOS in (X, τ). Then spcl(A) ⊆ pcl(A) ⊆ U. Hence is an IFGSPRCS in (X, τ).

Example 3.12: Let X= {a, b} and G= ⟨x, (0.3, 0.6), (0.7, 0.4)⟩. Then τ = {$0_\sim$, G, $1_\sim$} is an IFT on X and the IFS A= ⟨x, (0.3, 0.6), (0.7, 0.4)⟩ is an IFGSPRCS in (X, τ) but not an IFGPCS in (X, τ).

Theorem 3.13: Every IFRCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFRCS in (X, τ). Since every IFRCS is an IFCS, by Theorem 3.3., A is an IFGSPRCS in (X, τ).

Example 3.14: In Example 3.2., the IFS A= ⟨x, (0.4, 0.2), (0.6, 0.7)⟩ is an IFGSPRCS but not an IFRCS in (X, τ).

Theorem 3.15: Every IFSCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFSCS in (X, τ) . Let A ⊆ U and U be an IFROS in (X, τ). Since spcl(A) ⊆ scl(A) = A ⊆ U. Hence spcl(A) ⊆ U. Therefore A is an IFGSPRCS in (X, τ).

Example 3.16: In Example 3.2., the IFS A= ⟨x, (0.4, 0.2), (0.6, 0.7)⟩ is an IFGSPRCS but not an IFSCS in (X, τ).

Theorem 3.17: Every IFSPCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFSPCS and A ⊆ U, U be an IFROS in (X, τ). Then since spcl(A)= A and A⊆ U, we have spcl(A)⊆ U. Hence A is an IFGSPRCS in (X, τ).

Example 3.18: Let X= {a, b} and G_1= ⟨x, (0.7, 0.8), (0.3, 0.2)⟩, G_2= ⟨x, (0.2, 0.1), (0.8, 0.9)⟩, G_3= ⟨x, (0.5, 0.6), (0.5, 0.4)⟩ and G_4= ⟨x, (0.6, 0.7), (0.4, 0.3)⟩. Then τ = {$0_\sim$, G_1, G_2, G_3, G_4, $1_\sim$} is an IFT on X and the IFS A= ⟨x, (0.9, 0.6), (0.1, 0.4)⟩ is an IFGSPRCS but not an IFSPCS in (X, τ).

Theorem 3.19: Every IFSPGCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

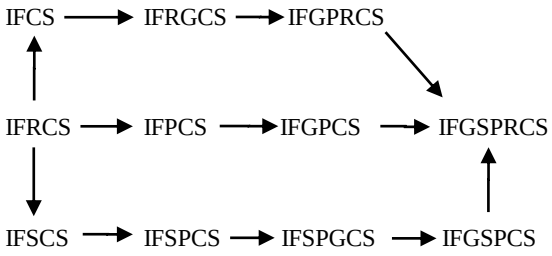
Proof: Let A be an IFSPGCS in (X, τ). Let A ⊆ U and U is an IFROS in (X, τ). Since every IFROS in (X, τ) is an IFOS in (X, τ) and every IFOS in (X, τ) is an IFSOS in (X, τ). We have spcl(A) ⊆ U, by hypothesis. Hence A is an IFGSPRCS in (X, τ).

Example 3.20: In Example 3.12., the IFS A= ⟨x, (0.3, 0.6), (0.7, 0.4)⟩ is an IFGSPRCS in (X, τ) but not an IFSPGCS in (X, τ).

Theorem 3.21: Every IFGSPCS in (X, τ) is an IFGSPRCS in (X, τ) but not conversely.

Proof: Let A be an IFGSPCS in (X, τ). Let A ⊆ U and U is an IFROS in (X, τ). Since every IFROS in (X, τ) is an IFOS in (X, τ). We have spcl(A) ⊆ U, by hypothesis. Hence A is an IFGSPRCS in (X, τ).

Example 3.22: In Example 3.12., the IFS A= ⟨x, (0.3, 0.6), (0.7, 0.4)⟩ is an IFGSPRCS in (X, τ) but not an IFGSPCS in (X, τ).
In the following diagram, we have provided the relation between various types of intuitionistic fuzzy closedness.



In this diagram by "A ⟶ B" we mean A implies B but not conversely.

Theorem 3.23: Let (X, τ) be an IFTS. Then for every A ∈ IFGSPRC(X) and for every IFS B ∈ IFS(X), A ⊆ B ⊆ spcl(A) implies B ∈ IFGSPRC(X).

Proof: Let B ⊆ U and U is an IFROS in (X, τ). Then since A ⊆ B, A ⊆ U. Since A is an IFGSPRCS, it follows that spcl(A) ⊆ U. Now B ⊆ spcl(A) implies spcl(B) ⊆ spcl(spcl(A)) = spcl(A). Thus, spcl(B) ⊆ U. This proves that B ∈ IFGSPRC(X).

Theorem 3.24: If A is an IFROS and an IFGSPRCS in (X, τ), then A is an IFSPCS in (X, τ).

Proof: Since A ⊆ A and A is an IFROS in (X, τ), by hypothesis, spcl(A) ⊆ A. But since A ⊆ spcl(A). Therefore spcl(A) = A. Hence A is an IFSPCS in (X, τ).

Theorem 3.25: Let (X, τ) be an IFTS. Then for every A ∈ IFSPC(X) and for every IFS B in X, int(A) ⊆ B ⊆ A ⇒ B ∈ IFGSPRC(X).

Proof: Let A be an IFSPCS in X. Then there exists an IFPCS, say C such that int(C) ⊆ A ⊆ C. By hypothesis, B ⊆ A. Therefore B ⊆ C. Since int(C) ⊆ A, int(C) ⊆ int(A) and int(C) ⊆ B. Thus int(C) ⊆ B ⊆ C and by Definition 2.6., B ∈ IFSPC(X). Hence by Theorem 3.17, B ∈ IFGSPRC(X).

4. INTUITIONISTIC FUZZY GENERALIZED SEMIPRE REGULAR OPEN SETS

In this section we have introduced intuitionistic fuzzy generalized semipre regular open sets and have studied some of its properties.

Definition 4.1: An IFS A is said to be an intuitionistic fuzzy generalized semipre regular open set (IFGSPROS for short) in (X, τ) if the complement A^c is an IFGSPRCS in X.
The family of all IFGSPROSs of an IFTS (X, τ) is denoted by IFGSPRO(X).

Theorem 4.2: Every IFOS, IFRGOS, IFGPROS, IFPOS, IFGPOS, IFROS, IFSOS, IFSPOS, IFSPGOS, IFGSPOS is an IFGSPROS but the converses are not true in general.

Proof: Straight forward

Example 4.3: Let X= {a, b} and G= ⟨x, (0.5, 0.4), (0.5, 0.6)⟩. Then τ= {0~, G, 1~} is an IFT on X and the IFS A= ⟨x, (0.6, 0.7),(0.4, 0.2)⟩ is an IFGSPROS in (X, τ) but not an IFOS, IFSOS, IFROS, IFRGOS in (X, τ).

Example 4.4: Let X= {a, b} and G = ⟨x, (0.3, 0.6), (0.7, 0.4)⟩. Then τ = {0~, G, 1~} is an IFT on X and the IFS A = ⟨x, (0.7, 0.4),(0.3, 0.6)⟩ is an IFGSPROS in (X, τ) but not an IFGPOS, IFSPGOS, IFGSPOS in (X, τ).

Example 4.5: Let X= {a, b} and G_1 = ⟨x, (0.7, 0.8), (0.3, 0.2)⟩, G_2 = ⟨x, (0.2, 0.1), (0.8, 0.9)⟩, G_3= ⟨x, (0.5, 0.6), (0.5, 0.4)⟩ and G_4 = ⟨x, (0.6, 0.7), (0.4, 0.3)⟩. Then τ = {0~, G_1, G_2, G_3, G_4, 1~} is an IFT on X and the IFS A = ⟨x, (0.3, 0.2), (0.7, 0.8)⟩ is an IFGSPROS but not an IFGPROS in (X, τ).

Example 4.6: Let X = {a, b} and G= ⟨x, (0.3, 0.2), (0.6, 0.6)⟩. Then τ = {0~, G, 1~} is an IFT on X and the IFS A = ⟨x, (0.6, 0.6),(0.3, 0.2)⟩ is an IFGSPROS in (X, τ) but not an IFPOS in (X, τ).

Example 4.7: Let X= {a, b} and G_1 = ⟨x, (0.7, 0.8), (0.3, 0.2)⟩, G_2 = ⟨x, (0.2, 0.1), (0.8, 0.9)⟩, G_3 = ⟨x, (0.5, 0.6), (0.5, 0.4)⟩ and G_4 = ⟨x, (0.6, 0.7), (0.4, 0.3)⟩. Then τ = {0~, G_1, G_2, G_3, G_4, 1~} is an IFT on X and the IFS A = ⟨x, (0.9, 0.6), (0.1, 0.4)⟩ is an IFGSPROS but not an IFSPOS in (X, τ).

Theorem 4.8: Let (X, τ) be a IFTS. Then for every A ∈ IFGSPRO(X) and for every B ∈ IFS(X), spint(A) ⊆ B ⊆ A implies B ∈ IFGSPRO(X).

Proof: Let A be any IFGSPROS of X and B be any IFS of X. By hypothesis spint(A) ⊆ B ⊆ A. Then A^c is an IFGSPRCS in X and A^c ⊆ B^c ⊆ spcl(A^c). By Theorem 3.23., B^c is an IFGSPRCS in (X, τ). Therefore B is an IFGSPROS in (X, τ). Hence B ∈ IFGSPRO(X).

Theorem 4.9: An IFS A of an IFTS (X, τ) is an IFGSPROS in (X, τ) if and only is F ⊆ spint (A) whenever F is an IFRCS in (X, τ) and F ⊆ A.

Proof: Necessity: Suppose A is an IFGSPROS in (X, τ). Let F be an IFRCS in (X, τ) such that F ⊆ A. Then F^c is an IFROS and A^c ⊆ F^c. By hypothesis A^c is an IFGSPRCS in (X, τ), we have spcl(A^c) ⊆ F^c. Therefore F ⊆ spint (A).
Sufficiency: Let U be an IFROS in (X, τ) such that A^c ⊆ U. By hypothesis, U^c ⊆ spint (A). Therefore spcl(A^c) ⊆ U and A^c is an IFGSPRCS in (X, τ). Hence A is an IFGSPROS in (X, τ).

Theorem 4.10: Let (X, τ) be an IFTS then for every A ∈ IFSPO(X) and for every IFS B in X, A ⊆ B ⊆ cl(A) implies B ∈ IFGSPRO(X).

Proof: Let A be an IFSPOS in X. Then by Definition 2.6., there exists an IFPOS, say C such that C ⊆ A ⊆ cl(C). By hypothesis A ⊆ B. Therefore C ⊆ B. Since A ⊆ cl(C), cl(A) ⊆ cl(C) and B ⊆ cl(C). Thus C ⊆ B ⊆ cl(C).
This implies that B is an IFSPOS in X. Then By Theorem 4.2., B is an IFGSPROS. That is B ∈ IFGSPRO(X).

5. APPLICATIONS OF INTUITIONISTIC FUZZY GENERALIZED SEMIPRE REGULAR CLOSED SETS

In this section we have provided some applications of intuitionistic fuzzy generalized semipre regular closed sets in intuitionistic fuzzy topological spaces.

Definition 5.1: If every IFGSPRCS in (X, τ) is an IFSPCS in (X, τ), then the space can be called as an intuitionistic fuzzy semipre regular $T_{1/2}$ ($IFSPRT_{1/2}$ for short) space.

Theorem 5.2: An IFTS (X, τ) is an $IFSPRT_{1/2}$ space if and only if IFSPOS(X) = IFGSPRO(X).

Proof: Necessity: Let (X, τ) be an $IFSPRT_{1/2}$ space. Let A be an IFGSPROS in (X, τ). By hypothesis, A^c is an IFGSPRCS in (X, τ) and therefore A is an IFSPOS in (X, τ). Hence IFSPO(X) = IFGSPRO(X).
Sufficiency: Let IFSPO(X, τ) = IFGSPRO(X, τ). Let A be an IFGSPRCS in (X, τ). Then A^c is an IFSPOS in (X, τ). By hypothesis, A^c is an IFSPOS in (X, τ) and therefore A is an IFSPCS in (X, τ). Hence (X, τ) is an $IFSPRT_{1/2}$ space.

Remark 5.3: Not every $IFSPRT_{1/2}$ space is an $IFT_{1/2}$ space. This can be seen easily by the following example.

Example 5.4: Let X= {a, b} and let τ= {0~, G, 1~} where G= ⟨x, (0.5, 0.4), (0.5, 0.6)⟩. Then X is an $IFSPRT_{1/2}$ space but not an $IFT_{1/2}$ space.

Theorem 5.5: For any IFS A in (X, τ) where X is an $IFSPRT_{1/2}$ space, A ∈ IFGSPRO(X) if and only if for every IFP $p_{(\alpha, \beta)} \in A$, there exists an IFGSPROS B in X such that $p_{(\alpha, \beta)} \in B \subseteq A$.

Proof: Necessity: If A ∈ IFGSPRO(X), then we can take B= A so that $p_{(\alpha, \beta)} \in B \subseteq A$ for every IFP $p_{(\alpha, \beta)} \in A$.

Sufficiency: Let A be an IFS in (X, τ) and assume that there exists B ∈ IFGSPRO(X) such that $p_{(\alpha,\beta)} \in B \subseteq A$. Since X is an $IFSPRT_{1/2}$ space, B is an IFSPOS. Then $A= \bigcup_{p(\alpha,\beta) \in A} \{p(\alpha,\beta)\} \subseteq \bigcup_{p(\alpha,\beta) \in A} B \subseteq A$. Therefore $A= \bigcup_{p(\alpha,\beta) \in A} B$, which is an IFSPOS. Hence by Theorem 4.2., A is an IFGSPROS in (X, τ).

Definition 5.6: An IFTS(X, τ) is said to be an intuitionistic fuzzy semipre regular $T^*_{1/2}$ space ($IFSPRT^*_{1/2}$ space for short) if every IFGSPRCS is an IFCS in (X, τ).

Remark 5.7: Every $IFSPRT^*_{1/2}$ space is an $IFSPRT_{1/2}$ space but not conversely.

Proof: Assume be an $IFSPRT^*_{1/2}$ space. Let A be an IFGSPRCS in (X, τ). By hypothesis, A is an IFCS. Since every IFCS is an IFSPCS, A is an IFSPCS in (X, τ). Hence (X, τ) is an $IFSPRT_{1/2}$ space.

Example 5.8: Let X= {a, b} and let τ= {$0_{\sim}$, G, $1_{\sim}$} where G= ⟨x, (0.5, 0.4), (0.5, 0.6)⟩. Then (X, τ) is an $IFSPRT_{1/2}$ space but not an $IFSPRT^*_{1/2}$ space, since the IFS G is an IFGSPRCS in (X, τ) but not an IFCS in (X, τ), as cl(G)= $G^c \neq G$.

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Performance Analysis for Parallel MRA in Heterogeneous Wireless Networks

M.Boopathy
Ganadipathy Tulsi's Jain Engineering College
Vellore, Tamilnadu
India

V.Jayaprakasan
Ganadipathy Tulsi's Jain Engineering College
Vellore, Tamilnadu
India

Y.J.Nazeer Ahmed
Ganadipathy Tulsi's Jain Engineering College
Vellore, Tamilnadu,
India

Abstract: This paper analysis a different methods to find optimal path for services and power allocation to heterogeneous wireless network. Under heterogeneous wireless networks, a user can send data through a single or multi RATs (Radio Access Technology) simultaneously. The objective of this paper is to choose the optimal path for the services and power allocation to that bandwidth (BW) distributed joint allocation algorithm using Newton and modified Newton are adopted and the total system capacity compared. The analysis is done in Matlab and simulation results are compared. The numerical result shows that compare to Newton method, modified Newton method maximize the total system capacity.

Keywords: Access network selection, joint allocation, multi- radio access, optimization, radio resource management, RAT, MRA

1. INTRODUCTION

One of the challenges for communication network beyond 3G is the efficient interconnection of heterogeneous radio access networks. Networks with multiple radio access technologies would became one of the most prevalent features in the next generation mobile networks. These networks where a user equipment (multimode terminals) can transmit its data over multiple RATs simultaneously are named multi mode radio access (MRA) system which accommodates RATs such as WIMAX (World Wide inter operability for microwave Access), 3GPP, wireless LAN(WLAN) such equipment named as user equipment (UE) implementing cognitive radio (CR) over software defined radio (SDR). For such MRA system, optimal operation issues have taken lots of attention recently to increase system efficiency and improve connectivity and energy consumption. Optimal bandwidth (BW) and power allocation of the MRA system should be determined by Newton and modified Newton methods. Both the methods have some advantages and disadvantages in the way of finding the optimal path and energy consumption.

Several multi – access concepts may be found in the literature. In [1] joint resource allocation for parallel MRA was proposed and they compared with switched MRA methods. Allocating multiple services on the different sub – system is multi – access wireless system was discussed in paper [2]. Using straight forward maximization procedure, favorable near optimum sub – system service allocation in multi – access systems are formed. The principle role of Generic link layer (GLL) within the ambient network multi radio access architecture is to integrate different radio access technologies (RATs) at the link layer and to facilitate their efficient interworking [3].

The main benefits are user QOS gain in spectral efficiency and in robustness. Broadcasting technologies and business in base for 2.5 and 3G cellular systems, they offer numerous possibilities which always provide the user with a personal communication environment optimized for specific needs [4]. The embedding of multi – radio resources management (MRRM) mechanism fulfills a key role in enhancing system capacity, resources efficiency, and coverage and service quality [5].

A joint congestion control, channel allocation and scheduling algorithm for multi – channel multi – interface multi – hop wireless is discussed [6]. Dynamic allocation of spectrum prior to transmission is an important feature for next generation wireless networks was discussed in this paper [7]. The FDMA – capacity algorithm is used to devise the optimal frequency – division duplex plan for very high – speed digital subscriber lines [8]. Frequency spectrum a limited source for wireless communications may become congested. So which need to accommodate the diverse types of air interface used in next generation wireless networks [9]. Target MRA architecture has been proposed and characterized by access selection that would be based on load information. Additionally this architecture supports distribution of control so data as to follow for the co – operation among network operator [10]. To estimate the signal parameters accurately for mobile systems, it is necessary to estimate systems propagation characteristics through a medium [11].

2. SYSTEM MODEL

As shown in Fig.1.We considers MRA system model based on heterogeneous wireless networks. It consist of many subsystem (i.e. radio interfaces) available for each MMT(Multimode, multi band user terminal) by

implementing cognitive radio (CR) over software defined radio (SDR) technology [9].The presence of multi radio access techniques(RAT)is able to improve the total system performance is known as RAT diversity.

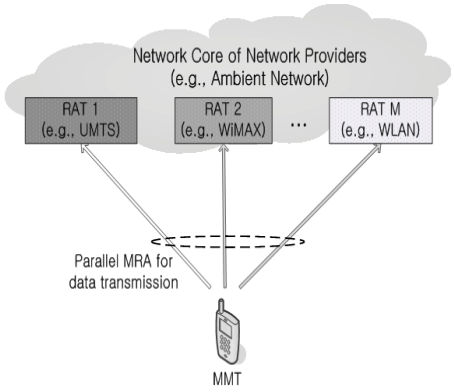

Figure.1 Parallel MRA System

Each MMT has capable of transmitting data through different RATs and operating bandwidth. Each subsystem has its own operating frequencies and its bandwidths. In MRA system data can be transmitting through switched or parallel MRA [1].

3. PROBLEM FORMULATION AND OPTIMALITY COND ITIONS

Heterogeneous wireless network is shown in figure. There are L MMT and k RATs. Based up spectrum demand, RATs q provides bandwidth units to the L MMTs. After allocating bandwidth, each MMT experiences different channel gain on each bandwidth. The channel gain to noise ratio for MMT p and RAT q can be indicated by

$$c_{pq} = \frac{|H_{pq}|^2}{N_{pq}} \quad (1)$$

Whereas H_{pq} is channel transfer function, N_{pq} is total noise power spectral density. Let bpq be the bandwidth obtained by MMT p from RAT q. each MMT q transmits his data over bandwidth bpq at rate. Therefore from Shannon capacity formula for Gaussian channel.

The achievable data rate (dp) of MMT p.

$$d_p = \sum_{q=1}^{k} \beta_q b_{pq} \log(1 + \frac{c_{pq} p_{pq}}{b_{pq}}) \quad (2)$$

Whereas k is the total number of RATs an MMT p can access b_{pq} is allocated bandwidth to the MMT p from RAT q, Ppq is the transmission power to MMT p to RAT q, β_q ($0 \leq \beta_q \leq 1$) represents the efficiency which can be guaranteed by RAT q to MMT p.

The maximization problem for MRA allocation can be formulated as

$$(P) \max R(b, p) = \max \sum_{p=1}^{l} d_p$$

$$= \max \sum_{p=1}^{L} \sum_{q=1}^{K} \beta_q b_{pq} \log(1 + \frac{c_{pq} p_{pq}}{b_{pq}}) \quad (3)$$

Subject to

$$\sum_{p=1}^{L} b_{pq} \leq B_q, \forall q \quad (4)$$

$$\sum_{q=1}^{k} p_{pq} < p_{q,} \forall p \quad (5)$$

$$b_{pq,} p_{pq} \geq 0 \quad (6)$$

Where L is the total numbers of MMTs, Bq is the total system bandwidth of RAT q and P_q is the maximum power of MMT For the optimal solution of problem (P), the Lagrangian can be formulated as

$$L(b_{pq,} p_{pq,} \lambda_q, \mu_p) = \sum_{p=1}^{L} \sum_{q=1}^{k} \beta_q b_{pq} \log(1 + \frac{c_{pq} p_{pq}}{b_{pq}})$$
$$+ \sum_{q=1}^{k} \lambda_q (B_q - \sum_{p=1}^{L} b_{pq}) + \sum_{p=1}^{L} \mu_p (P_p - \sum_{q=1}^{K} p_{pq}) \quad (7)$$

Where λ_q and μ_p are shadow prices with non negative Lagrange multipliers. Based on the karush-kuhn-Tucker (KKT) condition for the optimization problems

$$\frac{\partial L}{\partial \beta_{pq}} = \beta_q \log(1 + \frac{c_{pq} p_{pq}}{b_{pq}}) + \beta_q b_{pq} (\frac{b_{pq}}{b_{pq} + c_{pq} p_{pq}}) (\frac{b_{pq} - (b_{pq} + c_{pq} p_{pq})}{b_{pq^2}}) - \lambda_q \leq 0 \quad (8)$$

$$\beta_q \log(1 + \frac{c_{pq} p_{pq}}{b_{pq}}) + \beta_q b_{pq} (\frac{b_{pq}}{b_{pq} + c_{pq} p_{pq}}) (\frac{-c_{pq} p_{pq})}{b_{pq^2}}) - \lambda_q \leq 0$$

$$= \beta_q \log(1 + \frac{c_{pq} p_{pq}}{b_{pq}}) - \beta_q (\frac{c_{pq} b_{pq}}{b_{pq} + c_{pq} p_{pq}}) - \lambda_q \leq 0 \quad (9)$$

$$\frac{\partial L}{\partial \beta_{pq}} = \beta_q b_{pq}\left(\frac{b_{pq}}{b_{pq}+c_{pq}p_{pq}}\right)\left(\frac{c_{pq}}{b_{pq}}\right) - \mu_q \le 0$$

$$\frac{\partial L}{\partial \beta_{pq}} = \frac{\beta_p c_{pq} b_{pq}}{b_{pq}+c_{pq}b_{pq}} - \mu_q \le 0 \qquad (10)$$

Where L is the total numbers of MMTs, Bq is the total system bandwidth of RAT q and P_q is the

$$b_{pq}\left(\beta_q \log\left(1+\frac{c_{pq}p_{pq}}{b_{pq}}\right) - \frac{\beta_q c_{pq} b_{pq}}{b_{pq}+c_{pq}p_{pq}} - \lambda_q\right) = 0$$

$$p_{pq}\left(\frac{\beta_q c_{pq} b_{pq}}{b_{pq}+c_{pq}p_{pq}} - \mu_q\right) = 0 \qquad (11)$$

$$\lambda_q\left(B_q - \sum_{P=1}^{L} b_{pq}\right) = (0) \qquad (12)$$

$$\mu_p\left(P_i - \sum_{q=1}^{K} P_{pq}\right) = (0) \qquad (13)$$

Using (10) and (11) the relationship between BW and power allocation can be obtained

$$\frac{\beta_q c_{pq} b_{pq}}{b_{pq}+c_{pq}p_{pq}} - \mu_q \le 0$$

$$\frac{\beta_q c_{pq} b_{pq}}{b_{pq}+c_{pq}p_{pq}} = \mu_q$$

$$\beta_q c_{pq} b_{pq} = \mu_Q\left(b_{pq} + c_{pq}p_{pq}\right)$$

$$\mu_q b_{pq} + \mu_q c_{pq} p_{pq} = \beta_q c_{pq} b_{pq}$$

$$\mu_q c_{pq} p_{pq} = \beta_q c_{pq} b_{pq} - \mu_q b_{pq}$$

$$p_{pq} = \frac{\beta_q c_{pq} b_{pq} - \mu_q b_{pq}}{\mu_q c_{pq}}$$

$$p_{pq} = b_{pq}\left[\frac{b_q}{\mu_p} - \frac{1}{c_{pq}}\right]^{+} \qquad (14)$$

Where $[z]^+ = \max\{z, 0\}$ from this we can get optimal b_{pq} and p_{pq} value. The proposed technique Modified Newton method can be applied to b_{pq} because it is global convergence toward a local maximum than other algorithms such as steepest descent method. It's satisfy all properties such as descent property, quadratic termination property, global convergent, order of convergence i.e. p=2 [18].

Take a function

$$f(b_{p_q}^n) = \beta_q \log\left(1+\frac{c_{pa}p_{p_q}^n}{b_{p_q}^n}\right) - \beta_q\left(\frac{c_{pq}p_{pq}^n}{b_{pq}^n + c_{pq}p_{pq}^n}\right) - \lambda_q^n \qquad (15)$$

$$f'(b_{p_q}^n) = \frac{c_{pa}p_{p_q}^n}{b_{pq}^n + c_{pq}p_{pq}^n}\left(\frac{\beta_q}{b_{pq}^n + c_{pq}p_{pq}^n} - \frac{1}{b_{pq}^n}\right) \qquad (16)$$

Whereas superscript n represent the nth iteration. And the optimal bandwidth value can be obtained by Newton method and method modified Newton respectively.

$$b_{pq}^{n+1} = b_{pq}^n - \frac{f(b_{pq}^n)}{f'(b_{pq}^n)} \qquad (17)$$

$$b_{pq}^{n+1} = b_{pq}^n - \frac{f(b_{pq}^n)}{f'(b_{oo}^n)} \qquad (18)$$

After calculating optimal bandwidth, power can be calculated using equation.12, taking the derivative with respect p_{pq} give the KKT condition corresponding to the usual water filling level (n_p) of each MMT p can be represent as

$$\frac{p_{pq}^n}{b_{pq}^n} + \frac{1}{c_{pq}} = n_p, if p_{pq}^n > 0$$

$$\frac{1}{c_{pq}} \ge n_p, if p_{pq}^n = 0 \qquad (19)$$

Let the continuously differentiable dual function for updating μ_p^n and λ_q^n value for optimal solution.

$$D(\lambda_q, \mu_p) = \max_{b,p} L(b_{pq}, p_{pq}, \lambda_q, \mu_p) \qquad (20)$$

Update the μ_p^{n+1} value for power allocation is given by

$$\mu_p^{n+1} = [\mu_p^n - \xi\frac{\partial D(\lambda_q^n, \mu_p^n)}{\partial \mu_p^n}]^+ = [\mu_p^n + \xi(\sum_{q=1}^{K} p_{pq} - P_p)]^+ \qquad (21)$$

Whereas ξ is a constant step size ($\xi > 0$). For update the λ_q^{n+1} value for bandwidth allocation is given by

$$\lambda_q^{n+1} = [\lambda_q^n - \xi \frac{\partial D(\lambda_q^n, \mu_p^n)}{\partial \mu_q^n}]^+ = [\lambda_q^n + \xi(\sum_{p=1}^{L} B_{pq} - B_q)]^+ \quad (22)$$

From the iteration (14)-(22) we get the optimal solution for maximize total system capacity

4. ALGORITHM

The proposed Joint Allocation Algorithm: The two algorithms presented here is used to here to calculate the optimal path to RAT p to MMT q.

4.1.1 Newton method:

1: if K=0, then

2: Initialize $b_{pq}^{(0)}, b_q^{(0)}, P_{pq}^{(0)} and \mu_p^{(0)}$

3: else

4: Calculate b_{pq}^{k+1} using Newton's Method

$$b_{pq}^{k+1} = b_{pq}^{k} - \frac{f(b_{pq}^{k})}{f'(b_{pq}^{k})}$$

5: Determine P_{pq}^{k+1} using obtained b_{pq}^{k+1} value

$$P_{pq}^{k+1} = b_{pq}\left[\frac{\beta_q}{\mu_p^{k}} - \frac{1}{g_{pq}}\right]^+$$

6: if the Equilibrium Value of b_{pq} and P_{pq} is obtained, then

7: Transmit data unit to the RAT(s) Using b_{pq}^{k+1} and P_{pq}^{k+1}

8: else

9 : Update μ_p^{k+1} using P_{pq}^{k+1} Information

$$\mu_p^{k+1} = [\mu_p^{k} + \xi(\sum_{j=1}^{M} p_{ij}^{k+1} - p_i)]^+$$

10: Feedback the b_{pq}^{k+1} information to each RAT.

11: end if

12: end if

4.1.2 Algorithm 2 at access point of RATq

1: Compute λ_q^{k+1} using b_{pq}^{k+1} information.

$$\lambda_q^{k+1} = [\lambda_j^k + \varsigma(\sum_{i=1}^{N} x_{ij}^{k+1} - X_j)]^+$$

2: Broadcast the new λ_q^{k+1} value to all MMTs.

3: k → k+1

M represents total number of MMT p can Access

b_{pq} is allocated Bandwidth to the MMT p from RAT J

p_{pq} is the Transmission power of MMT p to Rat Q

$\beta_q (0 \le \beta_q \le 1)$ Efficiency which can be guaranteed by RAT j to an MMT.

b_q is the total system Bandwidth of RAT q

p_q is the maximum from of MMT p

N is the total number of MMIs

λ_q and μ_p are Non negative Large range multipliers.

4.2 Modified Newton method

A necessary feature we need to ensure is the existence of the iterates .one way of achieving that is to replace the Newton iteration whenever $|f_k'| \le \delta$ where $\delta > 0$ for example

$$x_{k+1} = x_k - f_k/\beta$$

Where β is sign(fk') δ if $|fk'| \le \delta$ otherwise β= fk'. This modification alone does not ensure convergence. What is needed is something that ensure the iterates are improving. One means of defining improvement is reduction in $f(x)^2$. We could have chosen |f(x)|, but f(x)2 has the advantage of being differentiable The basic idea is to define the iterate as

$$x_{k+1} = x_k - \alpha_k f_k/\beta$$

Where α_k is chosen that $f^2_{(k+1)<}f^2$. We need something slightly stronger to prove convergence, but it is enough to choose $\alpha_k = (1/2)^j$, where j is the smallest index ≥1, such that $f(x_k+(1/2)^j f_k/\beta)^2 < f_k^2$. Determing αk is a common procedure in n-dimensional problems and more elaborate and more efficient methods are know than the simple backtracking just described. However, they also require more elaborate termination conditions.

5. SIMULATION RESULTS

To evaluate the performance of joint resource allocation technique for maximize the total system capacity. We consider two RATs, bandwidth of 5MHz and 20MHz with same efficiency (i.e. $\beta_q = 1$ for q = 1, 2) and distance between the access point is 200metres. Total power consumed by each MMT is 20mW.

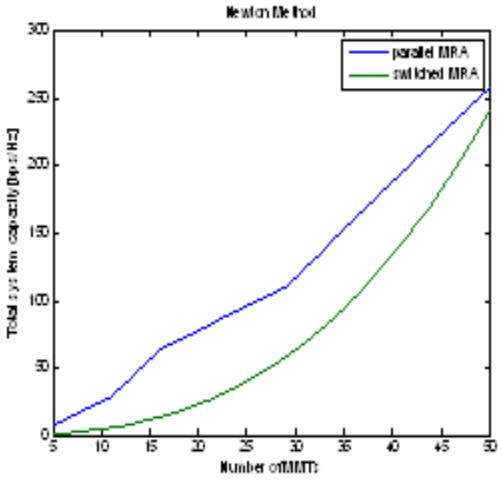

Figure.2 The comparison of parallel and switched MRA with number of MMTs using Newton method

Figure 2 shows the comparison of parallel and switched MRA with number of MMTs using Newton method. From that we concluded the total system capacity of parallel MRA is increased compared to switched MRA because parallel MRA can connect over multiple radio access technology simultaneously, whereas switched MRA can connect one radio access technology at a time. The coexistence of multi RATs enhance the total system throughput.

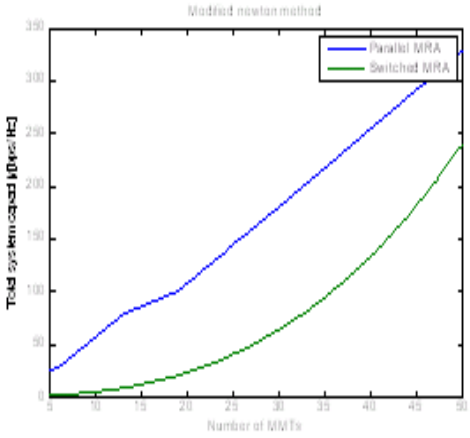

Figure.3 The comparison of parallel and switched MRA with number of MMTs using Modified Newton method

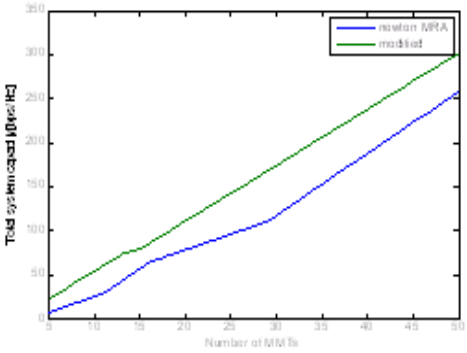

Figure.4 The comparison of parallel MRA and with number of MMTs

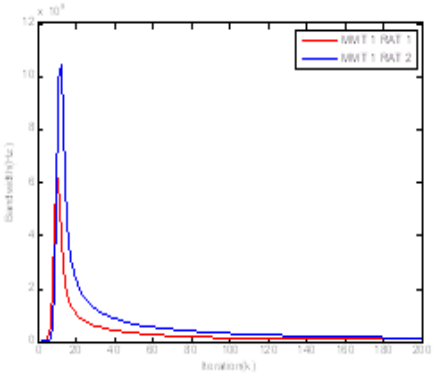

Figure .5 An illustration to how to find the optimal solution when the algorithm is applied

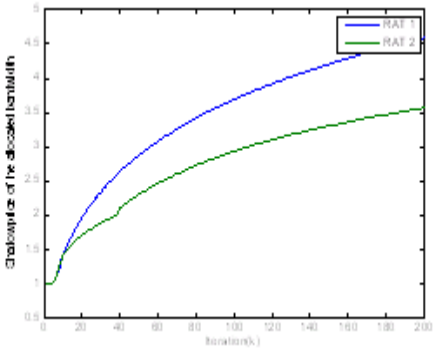

Figure.6 An illustration of the corresponding shadow price when the algorithm is applied

Figure 3. The total system capacity increases compared to the Newton method. The modified Newton converges faster towards a local maximum because Newton method is lack of global convergence property. It's satisfying all properties such as descent property, quadratic property, Global convergence and order of convergence. From Figure 4 . The total system capacity at the 25 number of MMT for Newton and modified method is 92.28 and 136.20 respectively. In modified Newton total system capacity increases up to 67% compared to the existing Newton method.

In Figure 5. Apply the algorithm to find optimal solution it can be seen that MMT 1 chose both RAT 1 and RAT 2. And chose only one RAT after iterative calculative for maximize the system capacity. Figure 13. Shows the shadow prices for the allocated bandwidth. The shadow prices increases exponential for spectrum allocated bandwidth for each MMT. Therefore in parallel MRA each MMT accessing of different RAT depend up on bandwidth and power constraints.

Table1.Comparisons of parallel MRA

TOTAL OF MMTs	NEWTON METHOD	MODIFIED NEWTON METHOD
5	7.090	21.99
10	24.790	53.96
15	56.560	79.05
20	77.950	110.76
25	88.600	129.89
30	106.450	161.67
35	138.630	193.55
40	174.000	225.59
45	209.110	257.43
50	258.000	302

6. CONCLUSION

In this paper, we analyzed the optimal solution for parallel and switched MRA scheme and two different (namely Newton and Modified Newton) joint allocation algorithm for and efficient MRA method to maximize system capacity. The simulation results shows that parallel MRA scheme is better compare to switched MRA and Modified Newton methods gives the optimal solution for the bandwidth and power usage compare to Newton method.

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Concept of Automated Machine using Mealy

Ritika Kalihari
RCET,Bhilai
Chhattisgarh, India

Toran Verma
RCET,Bhilai
Chhattisgarh,India

Alka Jaiswal
RCET,Bhilai
Chhattisgarh, India

ABSTRACT : In recent lifestyles human require rapid processing with best quality which provides easiest lifestyle. Now-a-days, automated machines can be found everywhere in our everyday life. For example, automated machine can be found at the train stations selling train tickets. In the schools and offices automated machine provides drinks and snacks which is providing facilities to human being. And sales of goods and services via automated machine are growing strongly in India provides easiest lifestyle. Automated machine modeling is the crucial part in developing proposed model as this reduces the human resources and has been modeled using. This dissertation describes a model of an automated machine totally based on Mealy concept of FSM. The proposed model will increase the efficiency of automated machine and will also lead to cost reduction, saving time and ease of usage. The first phase involves selection of items to be purchased by consumer. In next phase, the machine generates the respective total amount required to be paid. At last the vendee enters the amount to get their products dispensed and the extra amount will be returned back by machine.

Keywords Automated machine, FSM, Mealy, Product dispensed, and Vendee.

1. INTRODUCTION

The first commercial coin operated machine was introduced in London and England used for selling post cards [11]. Sometimes automated Machines are used to dispense various products when money is inserted into it, in the absence of salesperson**.** The automated machines are more accessible and practical than the convention purchasing method. In banks as ATM machine is the best example of automated machine.

1.1 Operation of Vending Machine [10]

- When user presses the button the machine will tell the user that the product is available or not, for that it will display a message
- When users select the product and quantity of product, it will automatically calculate the net amount required to be paid/insert.
- User will have to now insert the specified amount for purchasing the product. Then machine will verify the amount provided.
- If extra amount is provided then it will check for change to return. If it available then it will return the change and will dispense the product. Otherwise it will cancel the
product and return the amount inserted.

1.2 FSM CONCEPT [9],[10]

A finite state machine (FSM) is a digital sequential circuit that consists on number of pre-defined states that are controlled by one or more inputs. The finite state machines remain stable until the inputs changes. There are two types of finite state machines: Synchronous and Asynchronous FSMs. Synchronous FSMs have a clock input and are also called Mealy machines, while asynchronous FSMs are without clock input and are called Moore machines[12]. Since, this machine is based on Mealy concept where the output is dependent on input and the present state. Only additional logic will be required simply to encode and decode the state [3] for both type of machines.

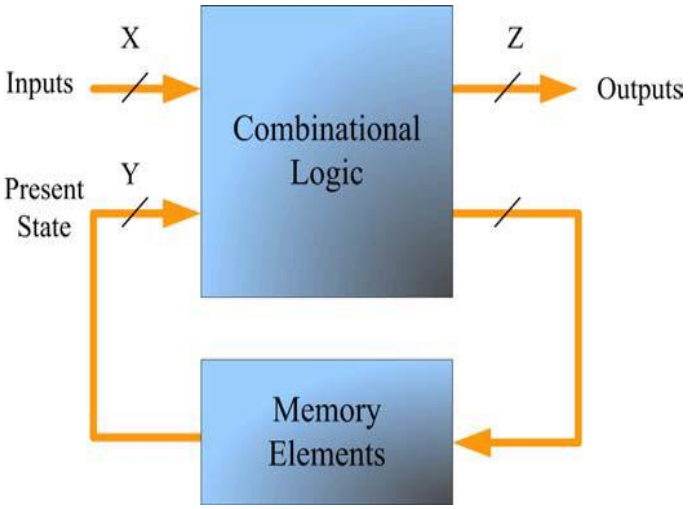


Fig. 1.1 General Diagram of Mealy machine

I. Mealy Machine

- In a Mealy machine, the outputs are a function of the present state and the value of the inputs as shown in Figure
- Accordingly, the outputs may change asynchronously in response to any change in the inputs [2].
- Mealy Machine also accepts NULL STATE.
- In Mealy Machine for **n** input there is **n+1** output**.**
- Mealy Machine is used for Transition.
- Technically Mealy Machine can be defined as

  z(t) = output[x(t) . q(t)]

  where

  x(t) is input

  q(t) is output

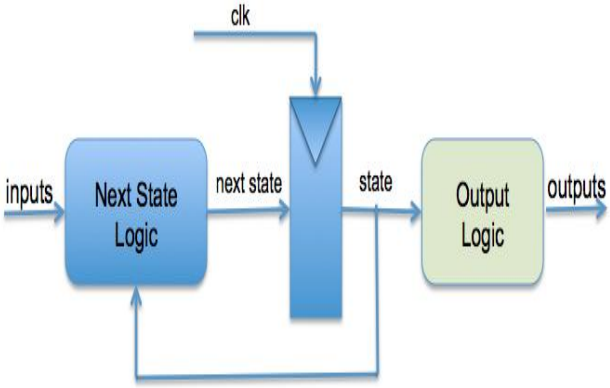


Fig. 1.2 General Diagram of Moore machine

II. II . Moore Machine

- In Moore machine the output values are determined only by its present states [4].
- Accordingly, the outputs may change synchronously in response to any change in the inputs.
- A Moore machine can be regarded as a restricted type of finite state transducer.
- For Moore machine, output is valid after state transition.
- In Moore Machine do not accept NULL STATE for **n** input there is **n** output**.**

2. LITERATURE REVIEW

A number of researches have been carried out for designing the automated machine. Some of the works previously done are:

2.1 A new approach is proposed in April 2012 to design an FSM based Vending Machine with auto-billing features in *Vending Machine with Auto-Billing Features title paper*[10].

2.2 In the year 2010 a new technique with auto billing feature for delivering the train tickets providing a new techniques for retuning greater amount implementation on Spartan-3 xc3s400 is propose and applied by Train Operating Companies (TOCs) in *Train Ticketing System Using Verilog HDL* [11].

2.3 This approach in 2011 is an efficient algorithm for implementation of vending machine on FPGA board is used. Because FPGA based vending machine give fast response and uses less power than the microcontroller based vending machine in the paper *Vending Machine using Verilog HDL* [12].

2.4 This technique shows the relationship between finite state machines and VHDL/Verilog code in *Finite State Machine and VHDL Coding Techniques in year* May 27-29, 2010 [13].

3. PROPOSED METHODOLOGY

A user friendly method is designed for any automated machine where the hardware gets reduced and also it is cost effective and time saving and convenient from the perspective of the owner and as well as the consumers. As in this the whole algorithm can be explained in one process.

In this machine model, the output depends on the present state as well as on the input as the concept is based on Mealy machine where output is dependent on present and input state.

This project is divided into 3 modules i.e.

1. Selection Module
2. Insertion Module
3. Delivery Module

3.1 Selection Module: - Vendee can select the product and specify the quantity of product. The user can select more than one product at a time. For every product the entire amount will be calculated for as per the quantity selected.

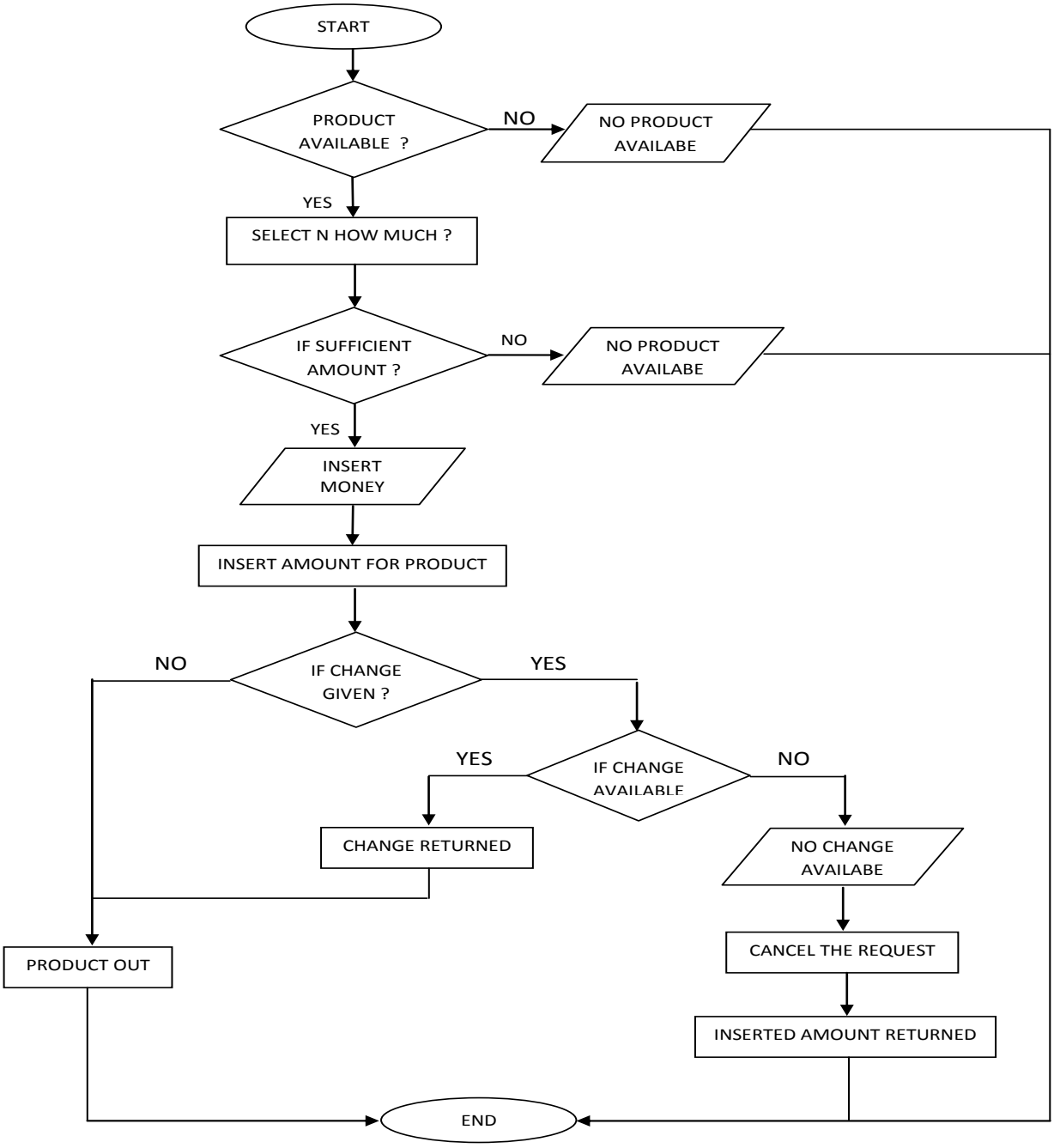
3.2 Insertion Module: - Vendee has to insert the amount for the product which he/she has selected. The amount which was inserted should not be less than the total amount i.e can be greater or equal to amount showed in the screen. So that the proper transaction can take place.

3.3 Delivery Module: - At last product will be given as output which vendee has selected according to the quantity. And rest of the amount will be returned if machine have some left amount which has to be return to the vendee.

The purpose was to improve the working rate of the automatic machine by automatically discriminating the type (structure). The designed machine can be used for many applications and we can easily enhance the number of selections. The machine is very flexible and reliable as the vendor can easily enhance the algorithm for large number of products and coins of different denominations at low cost as compared to microprocessor based vending machine. Machines accept Indian currency and give change. The machine comes with advanced features, functions and with a fully loaded payment system including Coin Change back to the user.

4. PROPOSED METHODOLOGY

On the basis of proposed technique a prototype of automated machine will be developed and later on simulation will be done using VHDL [5] to evaluate the performance and efficiency by considering factor like execution time of machine. For different choices of products and various coins combinations, the simulation waveforms are generated through Verilog HDL [6]. Since Verilog produces an output in a proper waveform and give fast response. And it is better choice for the implementation of mealy machine as compare to other simulation software such as Xilinx [6].



5. CONCLUSION

The analysis revealed several weaknesses in the existing user interface of automated machine and a number of improvements based on the proposed design heuristics were suggested. The

resulting user interface would be more robust, more tolerant to user mistakes, more intuitive and efficient to use. When designing such systems it is important to apply design processes where the possible design space is adequately explored by the design team such that one can maximize the accessibility of the product accompanied by user-centric evaluations. Algorithm is very flexible and reliable as the vendor can easily enhance the algorithm for large number of products and coins of different denominations at low cost as compared to microprocessor based automated machine.

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Deflection Routing in OBS Networks

M.Thachayani
Department of Electronics and Communication Engineering,
Pondicherry Engineering College,
Puducherry-605014, India

R.Nakkeeran,
Department of Electronics,
School of Engineering,
Pondicherry University,
Puducherry-605014, India

Abstract: Optical Burst Switching (OBS) network proposed as future optical internet is capable of carrying bursty traffic and adapting to the present technological constraints. Since the OBS network is buffer-less in nature, contention resolution using deflection technique received much attention. Deflection routing can work with limited optical buffering or even no buffering. This paper gives an overview of the research done so far in this area of deflection routing in OBS networks.

Keywords: Optical Burst Switching, contention resolution, deflection routing, alternate path selection, congestion

1. INTRODUCTION

Optical Burst Switching (OBS) network is emerging as a promising candidate for future optical internet due to its ability to carry bursty traffic, adapting to the technological constraints in All Optical Networks (AON). OBS concept has been introduced in the year 1999 [1] and till date lot of researches are going on in this area to make this network a reality.

In OBS networks, the edge nodes aggregate the incoming traffic into variable length optical bursts and core nodes asynchronously switch these bursts. Figure 1 illustrates the basic concept of the OBS network. The key characteristic of OBS is the hybrid approach in which burst control packets are signaled out of band and processed electronically while data bursts stay in the optical domain until they reach their destination node. This avoids buffering as well as synchronization problem that are present in optical packet switching. The one-pass reservation ensures elimination of significant signaling delay. However, due to this one-pass reservation strategy and statistical multiplexing, burst loss can occur in case of contention and efficient resolution strategies in OBS core nodes are essential in order to achieve a low burst blocking probability.

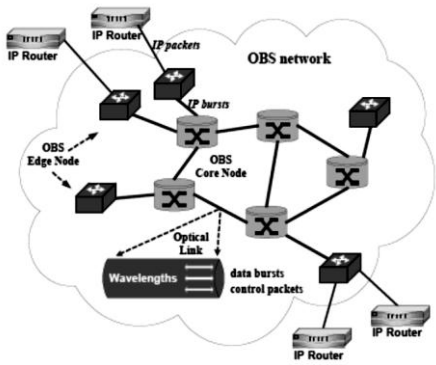


Figure 1 Schematic diagram of OBS network

Though numerous approaches like optical buffering, and wavelength conversion had been proposed to solve the wavelength contention problem in OBS, due to the technological and economical limitations most of the schemes seem to be impractical [2], [3] and [4].

Deflection routing can work with limited optical buffering or even without buffering because the contending bursts are deflected to an available output port rather than delaying them. The basic idea of the deflection routing is to utilize other unused links in the network. Since different output links are selected for the contending bursts in a deflection routed network, contention can be avoided. However it also has its limitations and problems. This paper reviews the research so far carried out in deflection routed OBS networks.

2. DEFLECTION IN OBS NETWORKS

Prior to the emergence of OBS networks, deflection routing was first used as a contention resolution method in optical networks with regular mesh topologies [5].

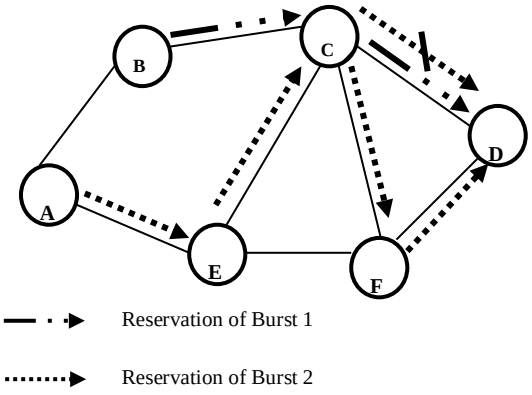
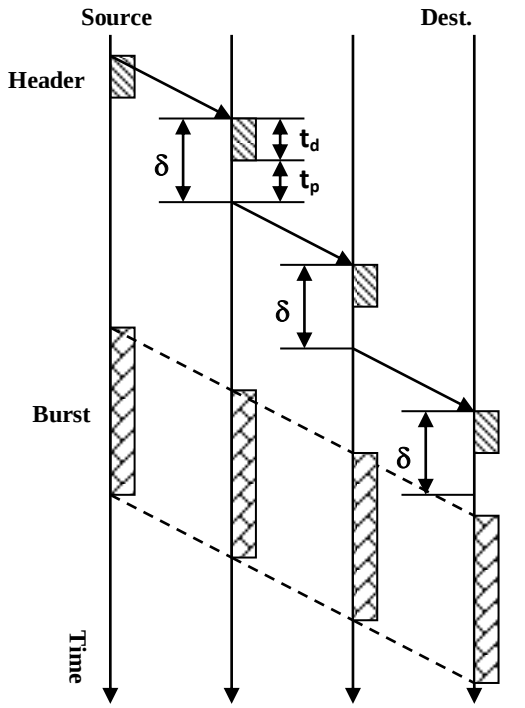
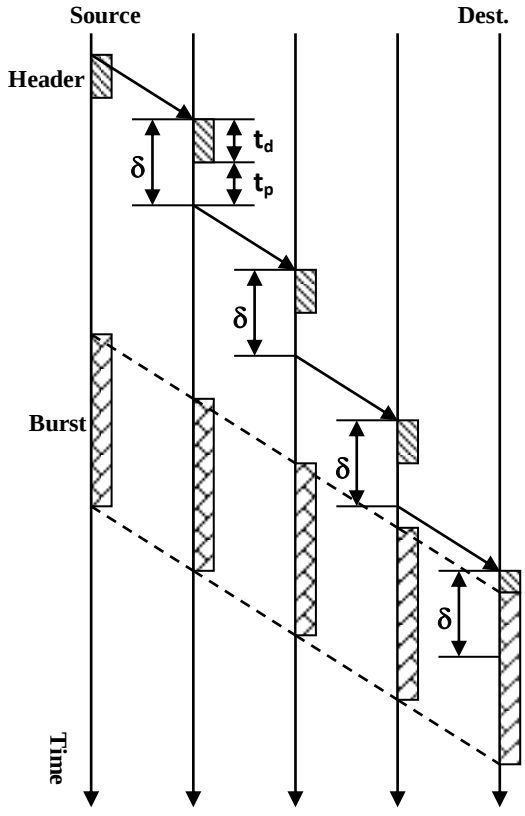


Figure 2 Conceptual view of deflection routing

It was observed that the performance of deflection routing is better than the hot-potato routing in a network with high-connectivity topology, such as Shuffle Net [6], [7]. Routing heuristics were proposed to enhance the performance of deflection routing [8].



3(a)



3(b)

Figure 3 Timeline of burst and header, 3(a) Without deflection, 3(b) With deflection

With the emergence of OBS technology, a deflection routing protocol for OBS network was proposed [9] and variants of the basic protocol were developed. The process of deflection in OBS can be explained as follows.

Consider the situation where a burst transmission request arrives at a given node and cannot be accommodated on any output fiber that could connect the burst to its designated next hop. Then the burst may be deflected from its original next hop onto a fiber connected to a different next hop node that can accommodate the burst. It then becomes the responsibility of the alternate next hop node to re-route the burst on to its destination. Sometimes it is possible that this deflected route may even pass back through the node at which the burst was originally deflected.

Figure 2 gives a clear view of this deflection routing concept. Let the bursts 1 and 2 generated by nodes B and A respectively are destined to the destination D and the routes selected are B-C-D and A-E-C-D. Assume that there is no wavelength conversion and both the bursts are using the same wavelength. At node C, the reservation request for burst 2 cannot be accepted due to contention. If deflection is used this can be rerouted via node F (i.e., A-E-C-F-D instead of A-E-C-D).

Early arrival or the insufficient offset problem is an important issue with deflection routed OBS networks. It can be explained as follows (refer Figure 3). In OBS networks the data burst follows the control packet after a time delay called "the offset time". Let the original offset time at the source (edge router) be T time units. If a control packet has to encounter H nodes along the burst's path through the network, then it will be delayed by processing at each of the H hops. The *residual offset time* at hop j is the remaining offset between the arrival of the control packet at hop j and the arrival of the burst at hop j. Referring to the timelines for the burst and control packet shown in Figure 3, we can determine the conditions required for the offset time. The control packet is transmitted at the edge router, with a transmission delay of t_d seconds. After being read at node 1 on the output of link 1, it is processed by the ECU (Electronic Control Unit) and incurs a processing delay of t_p. It is then transmitted on link 2, incurring a processing delay of another t_p seconds. The process then repeats at all intermediate nodes. At the destination, we assume that the control packet requires a final processing delay. Since both the burst and control packet are propagating with the same delay, propagation delays do not affect the residual offset times.

From figure 3(a), we can deduce that the residual offset time at the destination, must be greater than the final transmission delay and processing delay, to avoid a burst arriving at the destination ahead of its control packet. In other words, the initial offset time $T \geq (t_p + t_d)H$,

where t_d – *transmission delay per hop,*

t_p - *processing delay per node,*

H – *number of hops in the path*

If the offset time is insufficient, the burst may arrive at a node before its control packet and this is termed as an *early arrival*. In network with deflection routing, generally the deflected burst follows a longer path than the primary route and this excess delay should be accounted for to avoid the early arrival. This is illustrated in Figure 3 (b). In this case, due to deflection, the burst undergoes an additional hop and this is not accounted in initial offset time. It can be seen that the

burst arrives before the entire control packet is received by the destination and hence it will be lost.

In the basic deflection method used idle optical links are used as fiber delay lines for contention resolution. A burst may be deflected back to the sender again and this may result in short-term loops. However, a *Time To Live* (*TTL)* field is added in the header to prevent infinite loops. This scheme exhibits reduced burst loss and the average delay as compared with data retransmission from the source [9].

3. DEFLECTION AND BUFFERS

Deflection routing may be implemented with or without output buffers.

3.1 Bufferless

In bufferless deflection routing, the additional offset time required due to deflection must be added to the initial offset time at the source node. The number of times a burst gets deflected must be restricted to avoid the early arrival problem. The control packet contains the number of deflections and if this number is over the threshold value, the rerouted bursts are just dropped. An additional routing offset delay of 10% results in more than 50% reduction in contention [10].

Assigning appropriate offset delay is important since insufficient delay results in early arrival of bursts and larger delays will results in longer transmission delay. At very low loads, bursts may not be deflected and hence smaller offset delays are sufficient. Longer offset times are useful if the network is moderately loaded. Appropriate offset time may be dynamically assigned according to the load condition of the network. To implement dynamic delay, blocking probability need to be calculated at regular intervals based on the negative acknowledgements received at the source node. Based on this information, offset time may be determined using reinforcement learning. Dynamic offset time provides significant performance improvement over classical deflection routing [9]. However, the delay increases and in the worst case can be as high as 52 times [11].

When the number of times a burst gets deflected increases, the offset delay required will also increase. In bufferless networks, the initial offset delay must be large enough accounting for multiple deflections. But the entire delay may not be used often. Wavelength reservation approach is used to reduce the probability of repeated deflection [12]. In this scheme a particular number of wavelengths at every node are exclusively reserved for deflected bursts in every outgoing link. The wavelength reservation scheme marginally outperforms the limited buffers deflection scheme [13] in terms of overall blocking probability.

3.2 Buffered

Although deflection routing can be performed without buffers, the performance can be improved by including limited buffer. Two possible output buffered architectures namely share-per-port and share-per-node are considered for OBS switch [13]. With the increase of either the length or the number of FDLs (Fiber Delay Lines), the blocking probability decreases. However, the performance gain reaches a limit (upper bound), when the network capacity almost saturates.

4. HYBRID DEFLECTION SCHEMES

Deflection routing is combined with other contention resolution schemes such as wavelength conversion. The performance achieved by combining the deflection routing and wavelength conversion is better than the individual schemes. Increasing the wavelength conversion range or increasing the level of deflection significantly reduces the mean burst blocking probability, particularly for low loads. Considering the individual schemes, deflection routing marginally outperforms the limited wavelength conversion [14]. The deflection routing can also be combined with retransmission scheme in such a way that the combined scheme always results in lesser end-to-end delay and burst loss ratio compared to PDR (Pure deflection routing) and PBR (Pure blocking and retransmission) [15]. The HDR (Hybrid deflection and retransmission) scheme transmits the data bursts first using deflection routing and if the deflection routing fails, applies burst retransmission.

The HDR performs better than both PDR and PBR up to certain load. At very high loads, there is an increased probability of a burst getting repeated deflections and retransmissions in case of HDR. Hence, the performance degrades and become worse than pure deflection and pure retransmission. To avoid this degradation, a hop count based constraint is used for limiting deflection. This is termed as LHDR (Limited hybrid deflection and retransmission). This limitation is found to improve the blocking as well as delay performance at high loads.

5. LIMITED DEFLECTION METHODS

It is well known that the performance of deflection routing will degrade when the traffic load is beyond some threshold for an unslotted system [5], [9] and [16]. This is applicable to OBS networks as well and hence the deflection should be limited during heavy load condition to prevent instability of the network. Providing limited FDLs or access control of the local traffic was suggested in order to keep the network stable [5], [16].

This limitation on deflection may be introduced using different approaches. One such approach is to deflect a burst with a particular probability instead of deflecting always, when contention occurs [17]. The value of this deflection probability can be set before operation according to statistical records or adjusted dynamically based on the traffic load.

Another approach to limit deflection is to reserve a particular number of wavelengths on each link exclusively for primary bursts [18]. This wavelength reservation scheme alleviates the destabilizing effect and increases the throughput at high loads. Preemptive priority is a similar method in which a first-choice burst is given the right to preempt a reservation that has been scheduled for a deflected burst [19]. Preemptive priority has a negligible effect on blocking during stable periods and guarantees protection against destabilization during overloads.

However, it must be noted that at low loads, unprotected deflection routing may yield better performance than all the above mentioned protected deflection routing schemes.

Access or flow control approach may also be used to improve the performance of deflection routed OBS network under high loads. Leaky Bucket Deflection method, which has been used in Asynchronous Transfer Mode (ATM) can also be used in OBS (LB Deflection method) [20]. In this approach the transmission rate is restricted to a maximum value by means of generating tokens at a fixed rate. Data burst should acquire a token in order to get transmitted. This method absorbs the fluctuations of the network load and controls the burst loss

probability even at high loads. Average delay is more in this method since it is influenced not only by the transmission delay but also by the admission delay.

6. ALTERNATE PATH SELECTION BASED ON PERFORMANCE CONSTRAINTS

The basic deflection routing simply routes the traffic to any alternate path available. The alternate path may also be selected based on certain performance metric. In general, performance metric is chosen such that congestion is avoided or minimized. A path may be selected based on minimization of a performance measure that combines distance and blocking due to contention. In such schemes optimization of alternate routes is carried out based on updates received from other nodes. Traffic considered may be of adjacent nodes or of the entire network. Since load balancing is achieved and heavily congested routes are avoided, these schemes perform better in terms of blocking performance. However, the additional delay and overhead is unavoidable [21], [22], [23]. The blocking performance can be further improved by introducing a U – turn option, which allows the bursts to come back to the original node if paths to all other nodes are unavailable [22].

Another approach is to use explicit congestion notification. The principle of these schemes is, when a node detects the congested link, it sends the congestion information to preceding nodes so that the data bursts can avoid this link [24]. In order to sense the traffic condition accurately, the moving average of some past 'M' usage rates may be used [25]. Whether the burst follows the shortest path or alternate non-shortest path is decided based on the congestion status of the neighboring nodes.

7. INTEROPERABILITY WITH OTHER PROTOCOLS

The behavior of TCP connections in optical burst switching networks with deflection routing is analyzed [26]. Deflection routing is found to provide improved performance. The aggregation of more packets out of one TCP flow in a burst has positive impact on TCP performance with deflection routing.

Dynamic deflection routing in a three-node OBS test bed is demonstrated experimentally. This confirmed the usefulness and viability of deflection routing in resolving contention and the possibility of high-speed Ether frame encapsulation in OBS [27].

8. CONCLUSION

In this paper an overview of the deflection routed OBS networks is presented. Deflection routing is a simple yet powerful contention resolution technique. It is particularly useful for OBS networks since it is not possible to have unlimited number of wavelength converters or buffers in OBS networks.

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Performance Evaluation of DSDV, DSR AND ZRP Protocol in MANET

Zaiba Ishrat
Dept. of ECE
IIMT Engg college,Meerut
Meerut, India

Pankaj singh
Dept. of ECE
Sidhi vinayak Group of College,Alwar
Alwar,Rajasthan

Rehan Ahmad
Dept. of ECE
IIMT Engg college,Meerut
Meerut,India

Abstract: Mobile Ad-Hoc Networks are rapidly deployable and self-configuring networks. In MANET all the network node work as a router and must be capable to relay traffic from one to another since communicating nodes might be out of range. MANET is characterized by dynamic topology, possibly unidirectional links, constrained resources and network partitions. The main two attributes are mobility and multi-hop.[1][3] The size of MANET can be varied from small static network to highly large dynamic network. MANET use dynamic changing network topologies that are proactive, reactive and hybrid protocol.[1][2] In this paper, an attempt has been made to compare performance of Proactive, reactive and hybrid protocol for the MANET. A comparative study of DSDV (proactive) DSR (reactive) and ZRP (hybrid) has been done on the basis of their performance in MANETs using NS2 simulator. Packet delivery fraction ratio and throughput are considered as a performance parameter for evaluating the performance of DSDV,DSR and ZRP protocol.

Keywords: MANET, DSDV, DSR, ZRP, NS2

1. INTRODUCTION

A mobile ad-hoc network is a group of wireless nodes that have the capability to communicate with each other without any dependency on a fixed supportive infrastructure or a centralized administration. Therefore MANET is a "spontaneous network "that automatically "emerges" when nodes gather together [1]. Each node of a MANET can perform as a router and a host. Nodes in the MANET can communicate with other all nodes within their radio range or can use intermediates nodes to communicate with the nodes that are not present in their radio range. MANET is characterized by dynamic topology, use unidirectional links, constrained resources and network partitions. The main two attributes are mobility and multi-hop communication between the nodes. One tries to find the optimum route for the destination. The word optimum means here the route which has lower cost in comparison to other routes in the network [1] [2]. Nodes have tendency to freely move in any direction, at any time, thus frequently make or break the links with other nodes. Fig [1]

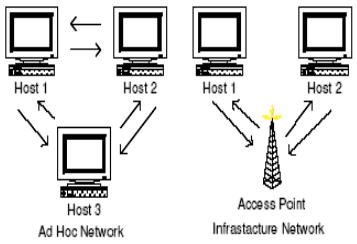

Fig 1. Ad Hoc Networks vs. Infrastructure Networks [1]

Many routing protocols have already been proposed and well-accepted in the research community and also the performance of these protocols is analyzed by different simulator tool. Many simulators can successfully simulate various routing protocols of MANET but there are only a few tools to handle the simulations with a graphical interface. In this paper NS-2 use to analyze the performance of MANET's routing protocols.

The paper is organized as follows: Section 2 gives a brief description of three major MANET routing protocols – DSDV, DSR and ZRP that have been used for performance analysis of proactive, reactive and hybrid protocol of MANET. Section 3 describes NS-2 simulator and the performance evaluations parameter to analyze the performance of routing protocol. Section 4 talks about some result and analysis and finally Section 5 discuss the conclusion of this paper.

2. MANET ROUTING PROTOCOL

2.1 DSDV (Destination Sequence Distance Vector routing)

DSDV is proactive protocol. Proactive protocol always keeps the routing Information independently of need for communication. All nodes sends update messages throughout the network periodically or whenever network topology changes , any other nodes add in the network, node move away from the network.[4] It provides low latency and suitable for real-time traffic but bandwidth might get wasted due to periodic updates of routing table.

In DSDV each node maintains a routing table which stores next hop towards each destination, cost metric for the path to each destination, destination sequence number that is created by the destination itself and sequence numbers used to avoid formation of loops. Each node periodically forwards this routing table to all its neighbors. Each node increments and appends its sequence number when sending its local routing table. This sequence number will be attached to route entries created for this node.[10][4] The sequence numbers assigned by the destination are generally even. If the broken link is detected, then the metric is assigned as infinity and the sequence number is assigned to odd. In order to maintain uniformity, each node periodically broadcasts its route and updates its routing table on the basis of received information from the neighbor routing table.[4][5]

2.2 DSR (Dynamic Source Routing)

Dynamic Source Routing (DSR) is a reactive routing protocol used for wireless mesh networks. It is similar to AODV because it also establishes a route on-demand when a transmitting mobile node requests for transmitting the data and need a path for particular destination.. However, it rely on source routing instead of using routing table of intermediate nodes. That's why it is called dynamic source routing.DSR. This protocol used two main mechanisms "Route Discovery" and "Route Maintenance", which work together to find out and maintain the optimum route for particular destination.[3][7] In this protocol, the mobile nodes maintains route cache that have the information of known route. When a source node desired to send a packet to a destination, it first consults its route cache to find out whether this node already knows any route to the destination or not. If node already have the information about the route to the destination in its route cache there is an entry for that destination than source node use this information to send its packet. If not than route request process starts for find out the route. Route request packet includes the source and a unique identification number. Each intermediate node checks its route cache to know that intermediate node knows the route for the destination if intermediate node does not have the information than it again forwards the packet until data reaches to the destination.[4][10] A node processes the route request packet only if it has not previously processed the packet and its address is not present in the route record of the packet. A route reply is generated by the destination or by any of the intermediate nodes when it knows about how to reach the destination.[4][7][9]

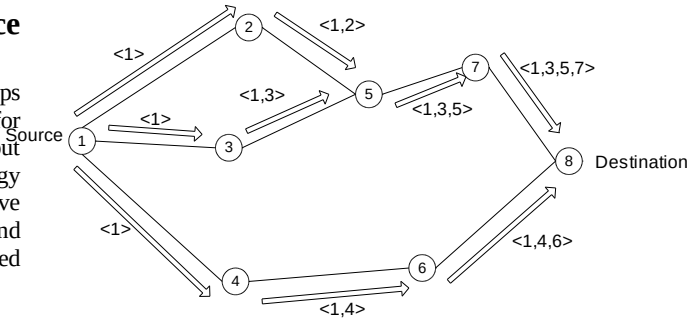

Fig 2.Building Record Route during Route Discovery [7]

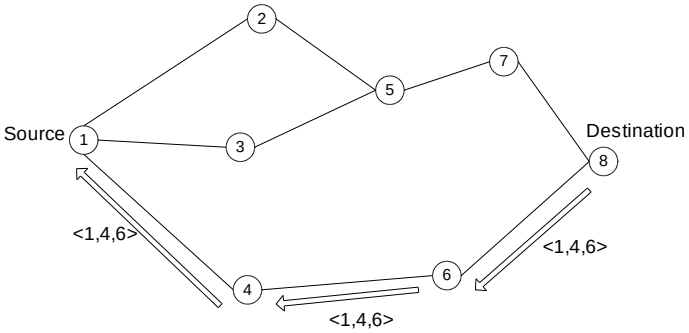

Fig 3 .Propagation of Route Reply with the Route Record [7]

2.3 ZRP (Zone Routing Protocol)

Hybrid Routing is the combination of proactive and reactive protocol. This attempts to strike balance between the two protocols. ZRP falls under the category of hybrid routing protocols with both proactive and reactive routing components. ZRP overcome the disadvantage of control overhead caused by proactive protocol and also decreases the latency in reactive protocols. It takes advantage of proactive discovery within a node close immediacy/ local neighborhood, and using a reactive approach for communication between these neighborhoods. With this ZRP reduces the proactive scope to a zone and reactive approach outside the zone. When a node has a data packet for a particular destination, a check is carried out whether a destination is within its zone or not. Packet is routed proactively if it is within the zone and if the destination is outside the zone reactive routing is used.[5][4][3]

The zone is defined as a collection of nodes whose minimum distance from the node in question is not greater than a value known as "zone radius". Each node creates its own neighborhood separately. The size of a zone is given by a radius of length r where, r is number of hops to the perimeter of the zone [5]. Each zone may have different size and each node may lie within multiple overlapping zones [6][5].

3. NS-2 NETWORK SIMULATOR

Ns-2 is a discrete event simulator using in networking research. NS-2 used for wired and wireless network to provides significant support for simulation of TCP, routing and multicast protocols. It is combination of two simulation tools. The network simulator (ns) contains all commonly used IP protocols. The network animator (nam) ,which is use to visualize the simulations. Ns-2 can fully simulates a layered network from the physical radio transmission channel to high-level applications. Ns-2 is an object-oriented simulator written in C++ and OTcl. The simulator supports a class hierarchy in C++ and a similar class hierarchy within the OTcl interpreter. There is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compile hierarchy.[6][7]

Table 1 Simulation Parameters Used

Parameter	Value
Platform	Linux CentOS 5
NS Version	Ns-2.33
Mobility Model	Random Way Point
Traffic Type	CBR
Area	500 * 500 m
Experiment Duration	150 sec
Packet Size	512 bytes
Radio Propagation	TwoRayGround
Packet Interval	0.2 second
Protocols	DSDV, DSR, ZRP
Antenna Type	OmniAntenna
Packet Size	512 bytes
Pause Time	5, 10, 20, 40, 100
Number of nodes	10, 20, 30, 40, 50

3.1 Performance Evaluation Parameter

Packet Delivery Fraction: Ratio of all received packets at the destinations to all transmitted packets from CBR source.

Throughput: It is defined as the ratio of data packets received to the destination to those generated by source means it is average rate of packets successfully transferred to their final destination per unit time.

Above two parameters are evaluated against the number of nodes and different pause time for the MANET protocols.

4. SIMULATION RESULT AND DISCUSSION

4.1 Packet Delivery Fraction

Fig shows the packet delivery fraction against the number of nodes and pause time for DSDV, DSR and ZRP protocol respectively. Fig 4.1(a),Fig 4.1(b)

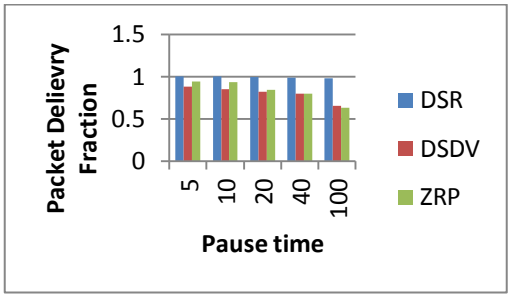

Fig 4.1(a) Packet Delivery Fraction Vs Pause Time

Fig 4.1(a) displays that number of packets received at the destination to the transmitted by the CBR source is more in DSR as compare to DSDV and DSR for different pause time and it is almost same but for DSV and ZRP when the pause time increases packet delivery fraction decreases.

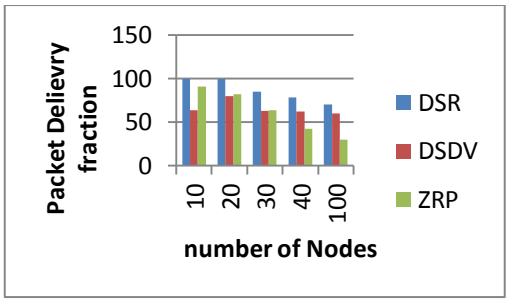

Fig 4.1(b) Packet Delivery Fraction Vs Number of Nodes

Fig 4.1(b) display as the number of nodes increases, packet delivery fraction decrease but it is still maximum in case of DSR as compare to DSDV and ZRP but ZRP have the better performance for lesser number of nodes as compare to DSDV and this performance will decrease as the number of nodes increase.

4.2 Throughput

It is shown by the graph fig 4.2(a) that throughput is increases when pause time increases for DSR,DSDV and ZRP but it is maximum for DSR. When pause time increases throughput of DSDV and ZRP is almost same.

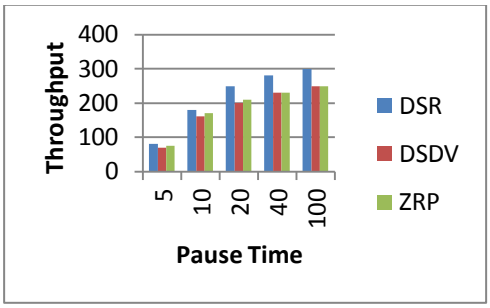

Fig 4.2(a) Throughput Vs Pause Time

Fig 4.2(b) shows that throughput of the DSR increases as the number of nodes increases but it is decreases for the ZRP when number of node increases.

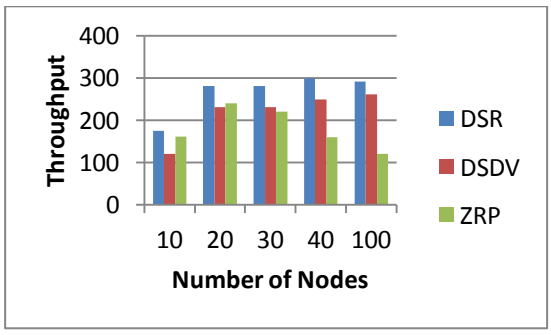

Fig 4.2(b) Throughput Vs Number of Nodes

5. CONCLUSION

In this study we have concluded that each protocol performs well in some cases while have some drawbacks in other cases. Simulation results demonstrated in terms of throughput, packet delivery fraction against number of nodes and pause time for DSR,DSDV and ZRP. This paper conclude that DSR perform better in each condition and the performance of ZRP is good for lesser number of nodes and its performance decreases when number of nodes increases. When the pause time is less throughput is low for all DSR, DSDV and ZRP protocol.Simulation results show that better performance is achieved in DSR protocol in terms of packet lost, throughput over a discontinuous network.

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Modified Visual Cryptography Scheme for Colored Secret Image Sharing

Joshi Jesalkumari A.
Thakur College Of Engineering and Technology
Mumbai, India

R.R.Sedamkar
Thakur College of Engineering & Technology
Mumbai, India

Abstract: Intent of this paper is to prove the better performance of the XOR Based visual cryptography schemes and traditional VCS on the basis of quality of reconstructed image and type of shares generated for colored images. The visual cryptography scheme (VCS) is a scheme which encodes a secret image into several shares. Here we are working with (2, 2) VCS. XOR-Based visual cryptography is capable to overcome the drawbacks of the visual cryptography scheme (VCS) the small contrast of the recovered secret image.

Keywords: Halftone, Visual Cryptography, Image decomposition, superimpose, Pixel Expansion

1. INTRODUCTION

In Visual cryptography mainly visual information is encrypted using encryption algorithm but here there is no need of decryption algorithm to reveal the visual information. Here the decryption process is done simply by human visual system. During the encryption process we simply add some noise in the original image to hide the original information and during the decryption process we reduce the noise to unhide the original information. The technique was proposed by Moni Naor and Adi Shamir in 1994.Visual Cryptography uses two transparent images. They demonstrated a visual secret sharing scheme, where an image was broken up into *n* shares so that only someone with all *n* shares could decrypt the image, while any *n-1* shares revealed no information about the original image. Each share was printed on a separate transparency, and decryption was performed by overlaying the shares. When all *n* shares were overlaid, the original image would appear. One image contains random pixels and the other image contains the secret information. It is impossible to retrieve the secret information from one of the images. [4]

The secret image is composed of black and white pixels. The original secret image can be recovered by superimposing the two share images together. The underlying operation of such a scheme is the logical operation OR. Generally, a(k, n)-VCS takes a secret image as input, and outputs share images that satisfy two conditions: First, any k out of n share images can recover the secret image; second, any less than k share images cannot get any information about the secret image. Similar models of visual cryptography with different underlying operations have been proposed, such as the XOR operation introduced in [2]–[6], and the NOT operation introduced in [7], which uses the reversing function of the copy machines.

2. PRELIMINARIES

In a VCS, there is a secret image which is encrypted into some share images. The secret image is called the *original secret image* for clarity, and the share images are the encrypted images (and are called the transparencies if they are printed out). When a qualified set of share images (transparencies) are stacked together properly, it gives a visual image which is almost the same as the original secret image; we call this the *recovered secret image*. In the case of black and white images, the original secret image is represented as a pattern of black and white pixels. Each of these pixels is divided into subpixels which themselves are encoded as black and white to produce the share images. The recovered secret image is also a pattern of black and white subpixels which should visually reveal the original secret image if a qualified set of share images is stacked. In this paper, we will focus on the black and white images, where a white pixel is denoted by the number 0 and a black pixel is denoted by the number 1. The easiest way to implement Visual Cryptography is to print the two layers onto a transparent sheet. When the random image contains truly random pixels it can be seen as a One-time Pad system and will offer unbreakable encryption.

Table 1. Basic Encoding Idea in Naor and Shamir's Scheme

p	probability	s_1	s_2	$s_1 \otimes s_2$
	1/2			
	1/2			
	1/2			
	1/2			

Naor and Shamir's[4] proposed encoding scheme to share a binary image into two shares Share1 and Share2. If pixel is white one of the above two rows of Table 1 is chosen to generate Share1 and Share2. Similarly If pixel is black one of the below two rows of Table 1 is chosen to generate Share1 and Share2. Here each share pixel p is encoded into two white and two black pixels each share alone gives no clue about the pixel p whether it is white or black. Secret image is shown only when both shares are superimposed. Various parameters are recommended by researchers to evaluate the performance of visual cryptography scheme. Naor and Shamir [4] suggested two main parameters: pixel expansion m and contrast α. Pixel expansion m refers to the number of subpixels in the generated shares that represents a pixel of the original input image. It represents the loss in resolution from the original picture to the shared one. Contrast α is the relative difference in weight between combined shares that come from a white pixel and a black pixel in the original image.

3. VISUAL CRYPTOGRAPHY SCHEME

The visual cryptography scheme (VCS), introduced by Naor and Shamir in 1994 [4] is a type of secret sharing scheme which can split secret information into *n* shares and recover them by superimposing the shares. In VCS, the secret to be hidden is a black and white image and each share is compromised of groups of *m* black and white subpixel used to recover a pixel of the secret image. It is assumed that a white

pixel in a share is transparent and a black pixel is opaque. It is impossible to get any information about the secret images from shares individually. The other advantage of VCS is that, unlike other cryptography techniques, this secret recovery does not need difficult computations. The secret information can easily be recovered with enough shares and requires human vision instead of special software or hardware devices. Naor and Shamir proposed a *k* out of *n* scheme and assumed that the image or message is a collection of binary 1 and 0 displayed as black and white pixels. According to their algorithm, the secret image is turned into *n* shares and the secret is revealed if any *k* of them are stacked together. So the image remains hidden if fewer than *k* shares are stacked together [5].

Image contrast and the number of subpixels of the shares and recovered image are two main parameters in visual cryptography schemes. The number of subpixels represents expansion of the image and should be as small as possible, while the contrast, which is a relative difference between the maximum value of Hamming weight for a black pixel and the minimum value of Hamming weight for white pixel, needs to be as large as possible [4]. Some researchers have focused on contrast degradation and introduced methods to improve the contrast of the reconstructed secret image.

3.1 The Basic Model

The basic 2 out of 2 visual cryptography model consists of a secret message encoded into two transparencies, one transparency representing the ciphertext and the other acting as a secret key. Both transparencies appear to be random dots when inspected individually and provide no information about the original clear text. However, by carefully aligning the transparencies, the original secret message is reproduced. The actual decoding is accomplished by the human visual system.
Naor and Shamir further describe the visual cryptography scheme as a visual secret sharing problem in which the secret message can be viewed as nothing more than a collection of black and white pixels. Each pixel in the original image is represented by at least one subpixel in each of the ***n*** transparencies or shares generated. Each share is comprised of collections of ***m*** black and white subpixels where each collection represents a particular original pixel. An example of the encoding of white and black pixels in a 2 out of 2 scheme can be seen in Figure 1. Here two shares out of the two generated would be needed to recover the original image. Since only two shares are generated, ***n*** = 2. Figure 1 represents a single white or black pixel in the original image and subpixel assignments that would be given to shares #1 and #2 respectively. The number of subpixels per share used to represent the original pixel is four (***m*** = 4). Finally, Figure 1(d) represents the overall visual effect when shares #1 and #2 are correctly aligned on top of one another. Notice that when the shares in this example are combined the original black pixel is viewed as black; however, the original white pixel takes on a grey scale.

The structure obtained from either white or black pixel representation in Figure 1 can be described by an ***n*** x ***m*** Boolean matrix ***Sp*** where ***p*** ε {white, black}. Any given element of the matrix ***S*** say ***s***ij, is considered to be 1 iff the *j*th subpixel in the *i*th transparency is black. When the ***n*** transparencies are properly aligned, the resulting black subpixels are the Boolean OR of the columns for each row ***i***1, ***i***2, … , ***i***n of ***S***. Shares #1 and #2 of Figure 1 would represent ***i***1 and ***i***2 respectively. Therefore, the following 2 x 4 Boolean matrices would be derived:
Swhite = { {1, 0, 0, 1}, {1, 0, 0, 1}} and
Sblack = { {1, 0, 0, 1}, {0, 1, 1, 0} }.
The matrix elements represent share assignments for share #1 and share #2 respectively Since ***m*** subpixels constitute one original pixel and the overall visual effect of a black subpixel in any one of the shares causes that particular subpixel when combined to become black, inspection of the grey level is the method of determining the original color of a pixel.

3.2 Algorithm

Encryption:
Step 1: Input the image with secret image.
Step 2: Initialize two collections of ***n*** x ***m*** Boolean matrices ***S0*** and ***S1***. ***S0*** acts as a pool of matrices from which to randomly choose matrix ***S*** to represent a white pixel while ***S1*** acts as a pool of matrices from which to randomly choose matrix ***S*** to represent a black pixel.
Step 3: Using the permutated basis matrices, each pixel from the secret image will be encoded into two subpixels on each participant's share. A black pixel on the secret image will be encoded on the *ith* participant's share as the *ith* row of matrix *S1*, where a 1 represents a black subpixel and a 0 represents a white subpixel. Similarly, a white pixel on the secret image will be encoded on the *ith* participant's share as the *ith* row of matrix *S0*.

Decryption:
Stacking all the qualified participant's share and ORing the stacked pixel to reconstructed the image.

We illustrated it with 2-out-of-2 scheme. In the 2-out-of-2scheme, every secret pixel of the image is converted into two shares and recovered by simply stacking two shares together. This is equivalent to using the OR operation between the shares. As illustrated in Table1 [4], 4 subpixels are generated from a pixel of the secret image in a way that 2 subpixels are white and2 pixels are black. The pixel selection is a random selection from each pattern. For example, when the corresponding pixel is white, one of the first six rows of Table 2 is randomly selected to encode the pixel into2 shares. It is easy to see that knowing only one share value does not reveal the other share and the secret image pixel. However superimposing all the shares reveals the corresponding binary secret image.

Experimental result

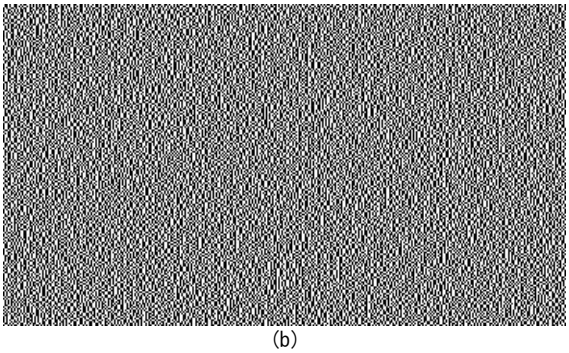
Figure 1 shows an example of Traditional Visual Cryptography scheme applying the (2, 2) with 4-subpixels layout visual secret sharing scheme, where the share images are larger than the original secret image in each dimension. That is, the share uses 4 subpixel for the original pixel. As illustrated in Figure1, (a) is the secret image, (b) and (c) are two random shares, and (d) shows the reconstructed image from superimposing the two shares.

Table 2.
(2, 2) VISUAL CRYPTOGRAPHY SCHEME

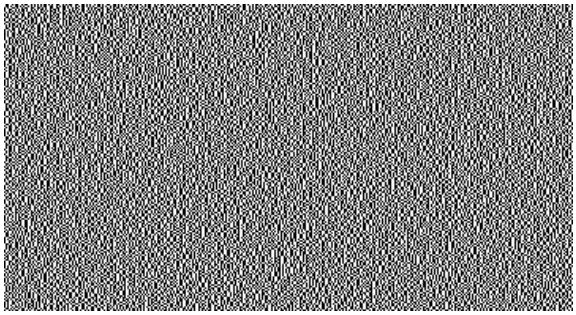
Pixel	Share 1	Share 2	After Stacking
White			

Here it is applied to binary image. However, the shortcomings of visual cryptography are as salient as its merits.

(a)



(b)



(c)

(d)

Figure 1. (a) Original Image (b) Share 1 (c) Share 2 (d) Reconstructed Image

There are three main drawbacks in visual cryptography:

- It results in a loss of resolution. The restored secret image has a resolution lower than that of the original secret image.
- Its background contrast is lost.
- Its original formulation is restricted to binary images. For color images, some additional processing such as halftoning and color-separation are required.
- The superimposition of two shares is not easy to perform unless some special alignment marks are provided. The manual alignment procedure can be tedious especially for high resolution images.

The biggest advantage of traditional method is the hard copy of the shares will give the same result as soft copy that too just by stacking the together.

4. XOR-BASED VISUAL CRYPTOGRAPHY

A (k; n) visual cryptography (VC) scheme [16] is a type of secret sharing scheme with the special property that a secret image can be recovered visually by the human eye and does not require any calculation on a computer. However, the recovered secret image has low quality. In this case, some researchers attempt to consider other different approaches to improve the quality (contrast)of the recovered image. Lee et al. [2] presented a VC scheme using an XOR process to share a binary image.

Based on the definition of Naor and Shamir [6], Verheul and van Tilborg [10] gave a more general definition. Following the notation from [16, 20], a definition of k out of n XOR-based visual cryptography scheme is given by Tuyls in Reference [7]. A (k, n) VC scheme S = (C0,C1) consists of two collections of n x m binary matrices C0 and C1.

TABLE 3.
(2, 2) XOR-BASED VISUAL CRYPTOGRAPHY SCHEME

Pixel	Share 1	Share 2	After Stacking
White			

To share a white (black) pixel, the dealer randomly chooses one of the matrices in C0(C1) and distributes its rows as shares among the n participants of the system.

Table 2 [4], shows that 4 subpixels are generated from a pixel of the secret image in a way that 2 subpixels are white and 2 pixels are black. The pixel selection is a random selection from each pattern. For example, when the corresponding pixel is white, one of the first six rows of Table 2 is randomly selected to encode the pixel into 2 shares.

4.1 Algorithm

Step 1: Input the image with secret image.
Step 2: Initialize two collections of ***n*** x ***m*** Boolean matrices ***S0*** and ***S1***. ***S0*** acts as a pool of matrices from which to randomly choose matrix ***S*** to represent a white pixel while ***S1*** acts as a pool of matrices from which to randomly choose matrix ***S*** to represent a black pixel.
Step 3: Using the permutated basis matrices, each pixel from the secret image will be encoded into two subpixels on each participant's share. A black pixel on the secret image will be encoded on the *ith* participant's share as the *ith* row of matrix *S1*, where a 1 represents a black subpixel and a 0 represents a white subpixel. Similarly, a white pixel on the secret image will be encoded on the *ith* participant's share as the *ith* row of matrix *S0*.

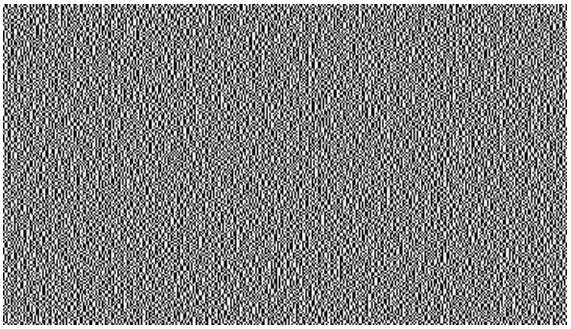
Decryption:
Stacking all the qualified participant's share and XORing the stacked pixel to reconstructed the image.

We illustrated it with 2-out-of-2 scheme. In the 2-out-of-2scheme, every secret pixel of the image is converted into two shares and recovered by simply stacking two shares together. This is not equivalent to the OR operation between the shares but we have to XOR the pixels. As illustrated in Table2 [4], 4 subpixels are generated from a pixel of the secret image in a way that 2 subpixels are white and2 pixels are black. The pixel selection is a random selection from each pattern. For example, when the corresponding pixel is white, one of the first six rows of Table 2 is randomly selected to encode the pixel into2 shares. It is easy to see that knowing only one share value does not reveal the other share and the secret image pixel. However superimposing all the shares reveals the corresponding binary secret image.

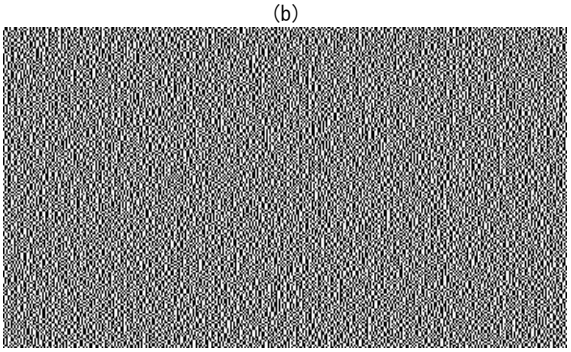
Experimental Result

Figure 2 shows an example of Traditional Visual Cryptography scheme applying the (2,2) with 4-subpixels layout visual secret sharing scheme, where the share images are larger than the original secret image in each dimension. That is, the share uses 4 subpixel for the original pixel. As illustrated in Figure 2(a) is the secret image, (b) and (c) are two random shares, and (d) shows the reconstructed image from superimposing the two shares.

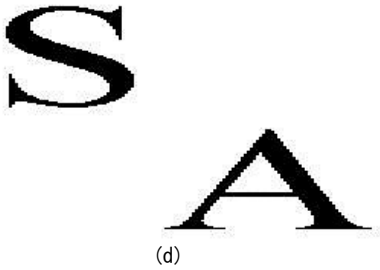
(a)



(b)



(c)



(d)

Figure 2 (a) Original Image (b) Share 1 (c) Share 2 (d) Reconstructed XORed Image

5. COMPARISON

Traditional Visual Cryptography has almost double pixels in its reconstructed image same as XOR-Based Visual Cryptography. The Reconstructed image in traditional Visual Cryptography had lost its original contrast specially in background but in XOR-Based Scheme the contrast is regained. If the decryption is done by software for stacking shares then both the method gives expected result but if the hard copy of shares are to be stacked then traditional VCS will have same output as softcopy but XOR-Based VCS will not have output as softcopy stacked.

TABLE 4.
Comparison

VCS type	Pixel Expansion	Contrast	Softcopy Decryption	Hardcopy Decryption
Traditional	More	Lost	Same as algorithm	Same as algorithm
XOR Based	More	Retained	Same as algorithm	Not Same

6. PROPOSED METHOD

In this paper, we have proposed a visual cryptography method for colored images. Following flowchart shows the Procedure:

Input a colored image which should be in rgb color model.Then split the image in CMY model.The purpose of using CMY is in printers usually CMY model is used. Because the subtractive model is more suitable for printing colors on transparencies, we will use the CMY model to represent colors in what follows. Because (R, G, B) and (C, M, Y) are complementary colors, in the true color model, (R, G, B) and (C, M, Y) possess the following relationships: C = 255−R, M = 255−G, Y = 255−B: Thus, in the (C, M, Y) representation, (0; 0; 0) represents full white and (255; 255; 255) represents full black. So here first we will split RGB spaces in original model. Then using following equation RGB is converted to CMY model. It is implemented in matlab 6.1.

c = 1-(double(r) /255);

m = 1-(double (g)/255);

y = 1-(double (b)/255);

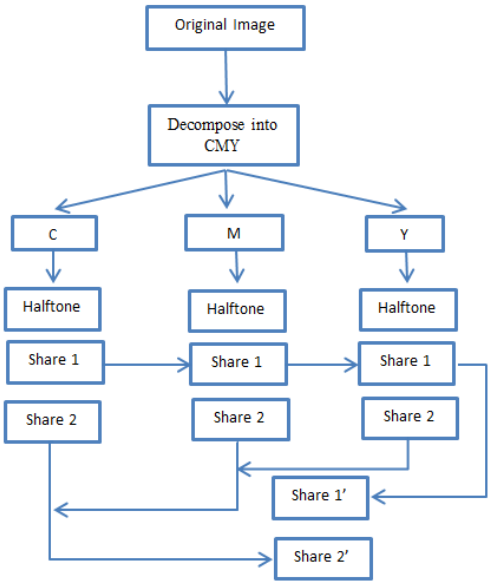


Figure 3. Generating Shares of colored images

Here, r, g, b contains red, green and blue spaces respectively and c,m,y for cyan, magenta and yellow. Color decomposition is mainly to separate C, M, and Y a color from colors within every pixel of the image. These three components form three monochromatic images. Each one looks gray-scale image on the monitor. Matlab do not support CMY color model. So decomposition of image does not show C, M and Y color on the screen.

Then we applied halftone algorithm on this three images separately. There are many halftone algorithms. Here I have used floyed's algorithm. This gives three halftoned images for each Cyan, Magenta and Yellow. Here each pixel is compared against threshold (T=127) and if intensity is greater than T make it 255 else 0.

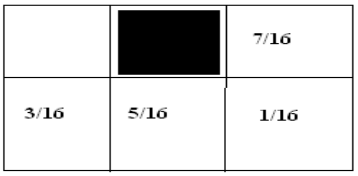


Figure 4. Coefficients' of Floyd's method

These Halftoned images are now given as an input to our Visual cryptography algorithm for (2,2). Two shares are generated for each halftoned image. Now share 1 of each image is combined which makes share1' and same for share 2.

These share 1' and share 2' are final shares that are to be given to participants.

Decoding side these shares are XORed opposite to traditional VCS. It gives better visual quality.

7. RESULTS

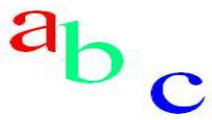
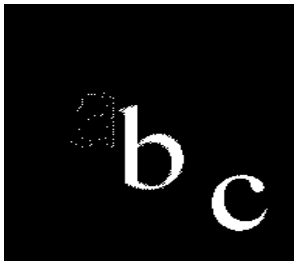
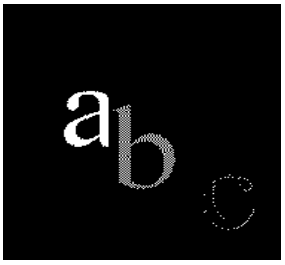


Figure 5. (a) Original Image

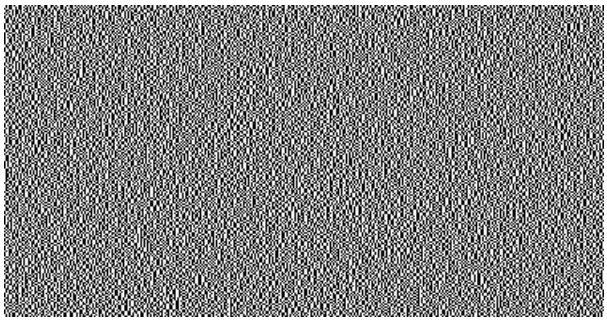


(b) Cyan

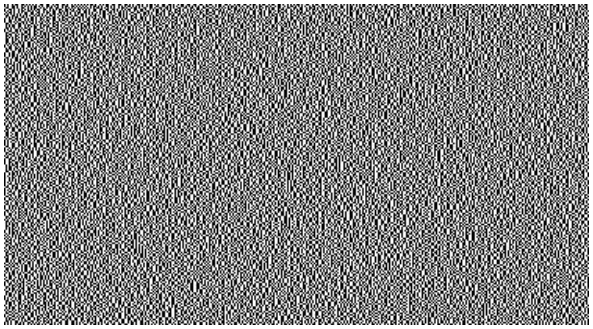
€ Magenta



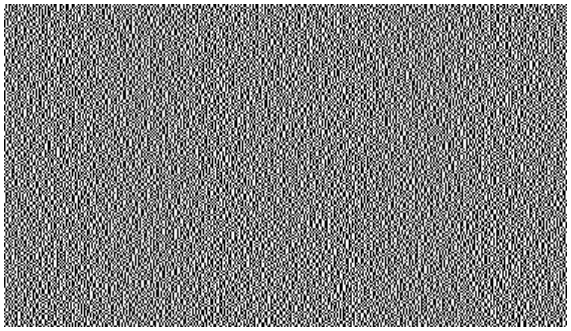
(d) Yellow



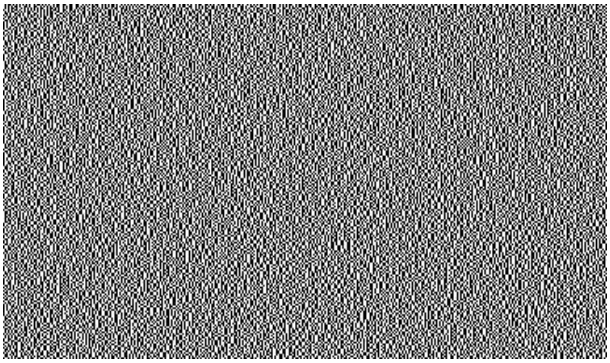
(e)Cyan Share 1



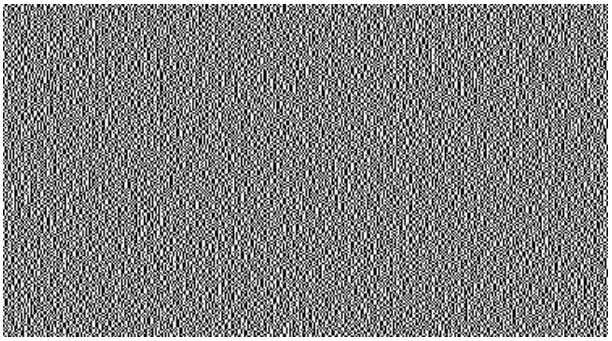
(f) Cyan Share 2



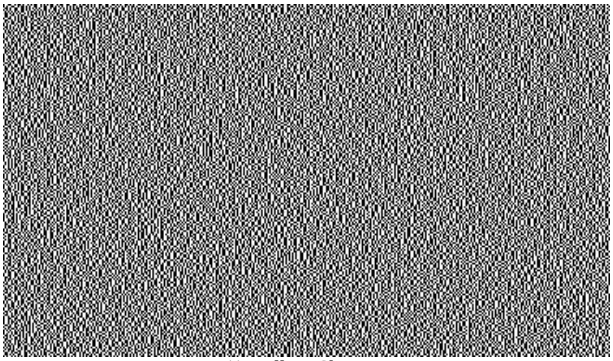
(g)Magenta Share1



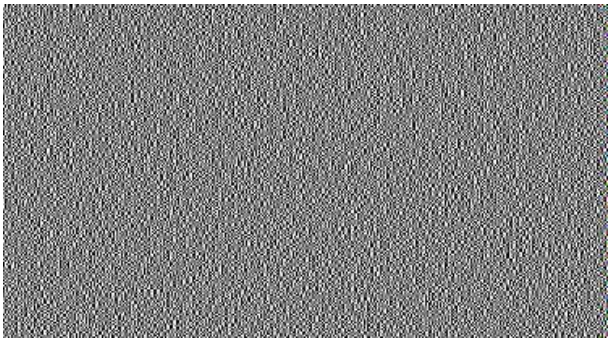
(h) Magenta Share 2



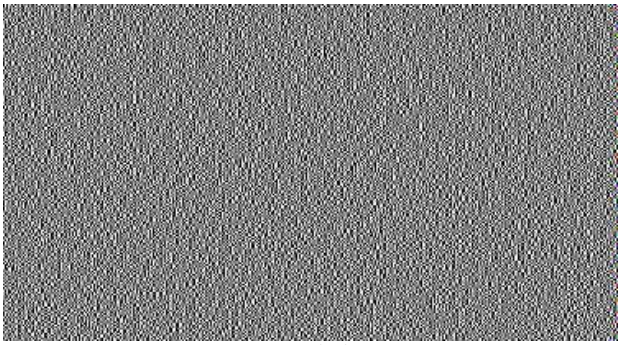
(i) Yellow Share 1



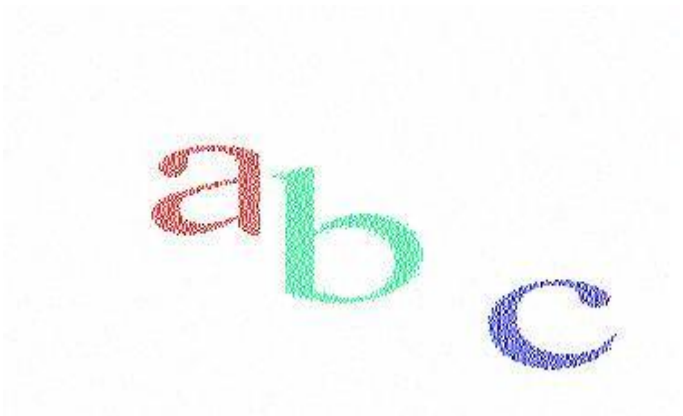
(j) Yellow Share 2



(k) Generated share 1'



(l) Generated Share 2'



(m) Traditionally Decrypted by ORing shares

(n) XORed Shares

Figure 5. Results of Proposed Method

8. CONCLUSION

Comparing traditional VCS with XOR based visual cryptography; XOR based visual Cryptography gives better visual quality. Generated shares are random dots so it doesn't reveal secret information. This proposed method can deal with both grey level and colored images. Colored image is decomposed into primary colors C,M,Y but grey level image can be directly transformed into a binary image, it can be further extended for extended visual cryptography where shares are having visual meaning.

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Survey of Various Protocols in Geographical Based Routing in Vehicular Adhoc Networks

Nupur Soni
BBD University
Lucknow, UP, INDIA

Shikha Tiwari
BBD University
Lucknow, UP, INDIA

Abstract : Vehicular Ad hoc Network (VANET), a subclass of mobile ad hoc networks (MANETs), is a promising approach for the intelligent transportation system (ITS). The design of routing protocols in VANETs is important and necessary issue for support the smart ITS. The key difference of VANET and MANET is the special mobility pattern and rapidly changeable topology. It is not effectively applied the existing routing protocols of MANETs into VANETs VANET (Vehicular Ad-hoc Network) is a new technology which has taken enormous attention in the recent years. Due to rapid topology changing and frequent disconnection makes it difficult to design an efficient routing protocol for routing data among vehicles, called V2V or vehicle to vehicle communication and vehicle to road side infrastructure, called V2I. The existing routing protocols for VANET are not efficient to meet every traffic scenarios. Thus design of an efficient routing protocol has taken significant attention. So, it is very necessary to identify the pros and cons of routing protocols which can be used for further improvement or development of any new routing protocol. The easiest way to classify the geographic routing protocolsis by type of routing (Unicast, Broadcast or Geocast). Other way to classify them is by the use that the protocol gives to the position information (Packet forwarding, Route Selection, Cluster formation, Formation of cells, Classify Forwarding Group, or RouteRequest Forwarding). For this survey we will use the type of routing classification and in each protocol we'll talk about how the protocol uses the geographic information.

Keywords :VANET,Unicast,GPSR,Greedy Routing,A-STAR

I. INTRODUCTION

Vehicular ad hoc network is a special form of MANET which is a vehicle to vehicle & vehicle roadside wireless communicationnetwork. It is autonomous & self-organizing wireless communication network, where nodes in VANET involve themselves as servers and/or clients for exchanging & sharing information. The network architecture of VANET can be classified into three categories: pure cellular/WLAN, pure ad hoc, and hybrid [1]. Due to new technology it has taken huge attention from government, academy & industry.

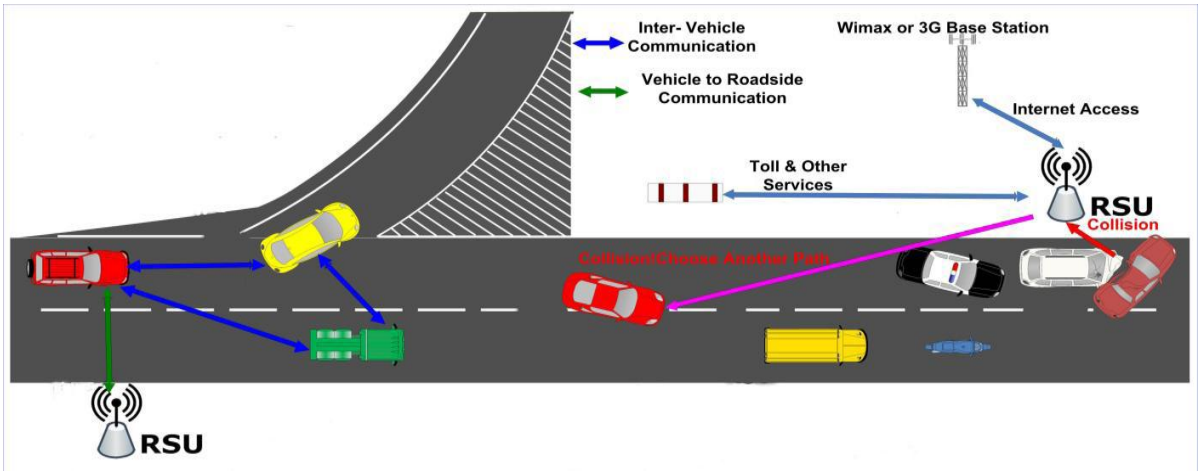

Figure-1[25]: shows a form of vehicular adhoc network.

One of the outcomes has been a novel type of wireless access called Wireless Access for Vehicular Environment (WAVE) dedicated to vehicle-to-vehicle and vehicle-to-roadside communications. While the major objective has clearly been to improve the overall safety of vehicular traffic, promising traffic management solutions and on-board entertainment applications are also expected by the different bodies (C2CCC1, VII2, CALM3) and projects (VICS4 (Yamada, 1996), CarTALK 2000 (Reichardt D, 2002), NOW5, CarNet (Morris R, 2000), FleetNet (Franz, 2001)) involved in this field. When equipped with WAVE communication devices, cars and roadside units form a highly dynamic network called a Vehicular Ad Hoc Network (VANET), a special kind of Mobile Ad-Hoc Networks (MANETs). While safety applications mostly need local broadcast connectivity, it is expected that some emerging scenarios [2] developed for intelligent transportation systems (ITS) would benefit from unicast communication over a multi-hop connectivity. Moreover, it is conceivable that applications that deliver contents and disseminate useful information can flourish with the support of multi-hop connectivity in VANETs.

Although countless numbers of routing protocols [3][4] have been developed in MANETs, many do not apply well to VANETs. VANETs represent a particularly challenging class of MANETs. They are distributed, self-organizing communication networks formed by moving vehicles, and are thus characterized by very high node mobility and limited degrees of freedom in mobility patterns.

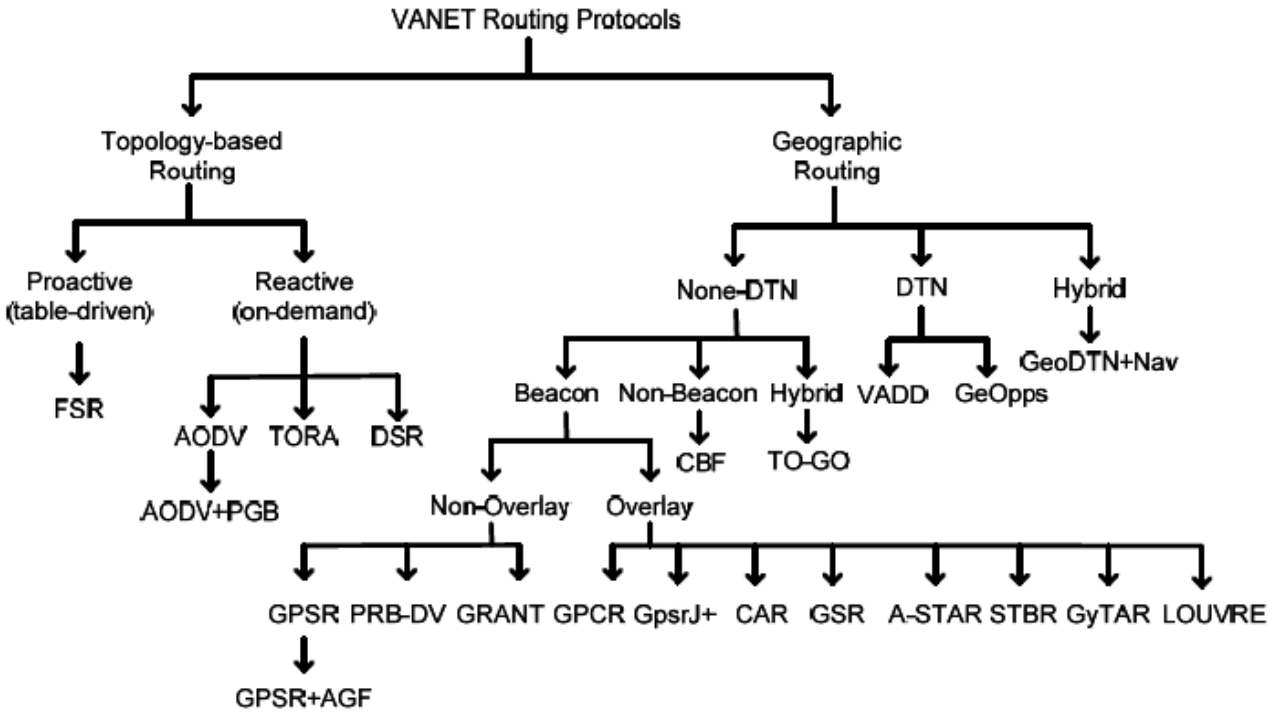

Figure 2[24]:Taxonomy of various Routing Protocols in VANET

As shown in Figure 2, there are two categories of routing protocols: topology-based and geographic routing. Topology-based routing uses the information about links that exist in the network to perform packet forwarding. Geographic routing uses neighboring location information to perform packet forwarding. Since link information changes in a regular basis, topology-based routing suffers from routing route breaks.

II. GEOGRAPHIC (POSITION-BASED) ROUTING:

In geographic (position-based) routing, the forwarding decision by a node is primarily made based on the position of a packet's destination and the position of the node's one-hop neighbors. The position of the destination is stored in the header of the packet by the source. The position of the node's one-hop neighbors is obtained by the beacons sent periodically with random jitter (to prevent collision). Nodes that are within a node's radio range will become neighbors of the node. Geographic routing assumes each node knows its location, and the sending node knows the receiving node's location by the increasing popularity of Global Position System (GPS) unit from an onboard Navigation System and the recent research on location services [5][6][7], respectively. Since geographic routing protocols do not exchange link state information and do not maintain established routes like proactive and reactive topology-based routings do, they are more robust and promising to the highly dynamicenvironments like VANETs. In other words, route is determined based on the geographic location of neighboring nodes as the packet is forwarded. There is no need of link state exchange nor route setup. Figure 1 sub-classifies Geographic routing into three categories of non-Delay Tolerant Network (non-DTN), Delay Tolerant Network (DTN), and hybrid. The non-DTN types of geographic routing protocols do not consider intermittent connectivity and are only practical in densely populated VANETs whereas DTN types of geographic routing protocols do consider disconnectivity. However, they are designed

from the perspective that networks are disconnected by default. Hybrid types of geographic routing protocols combine the non-DTN and DTN routing protocols to exploit partial network connectivity. We describe these three sub-categories in the following:

Non-DTN – Overlay The fundamental principle in the greedy approach is that a node forwards its packet to its neighbor that is closest to the destination. The forwarding strategy can fail if no neighbor is closer to the destination than the node itself. In this case, we say that the packet has reached the *local maximum* at the node since it has made the *maximum* local progress at the current node. The routing protocols in this category have their own recovery strategy to deal with such a failure.

GPSR – In Greedy Perimeter Stateless Routing (GPSR) [8], a node forwards a packet to an immediate neighbor which is geographically closer to the destination node. This mode of forwarding is termed *greedy mode*. When a packet reaches a local maximum, a recovery mode is used to forward a packet to a node that is closer to the destination than the node where the packet encountered the local maximum. The packet resumes forwarding in greedy mode when it reaches a node whose distance to the destination is closer than the node at the local maximum to the destination.

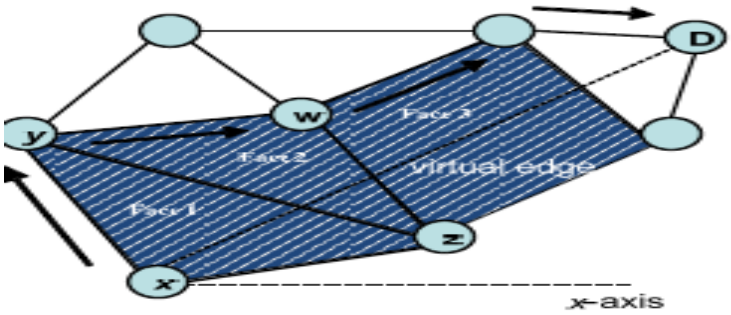

Figure 3[24]: Right-hand rule in GPSR's perimeter mode; packet performs face routing to route along Face 1, Face 2, and Face 3 toward destination D.

GPSR recovers from a local maximum using *perimeter mode* based on the right-hand rule shown in Figure 3. The rule states that when a node *x* first enters into the recovery mode, its next forwarding hop *y* is the node that is sequentially counterclockwise to the virtual edge formed by *x* and destination *D*. Afterwards, the next hop *z* is sequentially counterclockwise to the edge formed by *y* and its previous node *x* shown in Figure 3. While walking the face, however, if the edge *yz* formed by the current node and the next hop crosses the virtual edge *xD* and results in a point that is closer than the previous intersecting point *x*, perimeter mode will perform a *face change* in that the next hop *w* is chosen sequentially counterclockwise to the edge *yz* where the closer intersecting point was found. Such routing is called *face routing* because the packet traverses many faces formed by nodes in the network until it reaches a node closer to the destination than where the packet entered in the perimeter mode and where the face routing started

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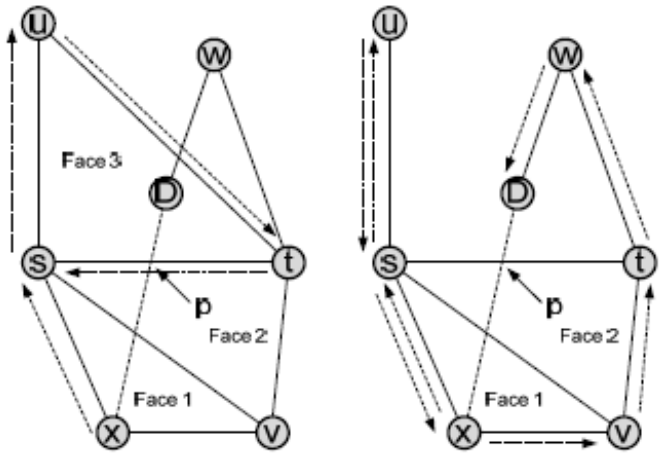


Figure 4[24]: On the left, packet will loop around face 3; on the right, packet will eventually route to D through u, s, x, v, t, and w.

Note that if the graph is not planar, that is, there are cross edges in the graph, routing loops may occur. Consider Figure 4, *x* tries to reach *D* in perimeter mode. The packet will eventually loop around face 3 with no intersecting point closer than *p*. Had the cross edge *ut* been removed, the packet would travel the exterior face *u*, *s*, *x*, *v*, *t*, and *w* to reach *D*. Given that perimeter mode must operate on planar graphs to avoid routing loops, GPSR provided two distributed algorithms that produce Relative Neighborhood Graph (RNG) [9] and [10] which are known to be planar. Both RNG and GG algorithms yield a connected planar graph so long as the connectivity between two nodes obeys the unit graph assumption: for any two vertices, they must be connected by an edge if the distance between them is less than or equal to some threshold distance *d* and must not be connected by an edge if the distance between them is greater than *d*. However, the unit graph assumption is not true in VANETs due to channel fading (obstacles and mobility). As a result, planar graphs are usually hard to achieve in VANETs.

GPSR+AGF – [11] observed two problems with GPSR in VANETs. First, due to the mobile nature of VANETs, a node's neighbor table often contains outdated information of neighbors' position. The problem can be solved by increasing beacons' frequency, yet such a solution only increases congestion and brings in potential collisions. The second problem is that the destination's location within the packet is never updated despite the destination is moving. To address these two problems, the authors proposed Advanced Greedy Forwarding (AGF) that incorporates the speed and direction of a node in the beacon packet and the total travel time, including the time to process the packet, up to the current forwarding node within the data packet. With the velocity vector, speed plus direction, each node can filter out outdated nodes in its neighbor table. With the total travel time, each forwarding node can better determine the deviation of the destination's original location and estimate its current location. Results have shown at least three times of improvement in packet delivery ratio to GPSR.

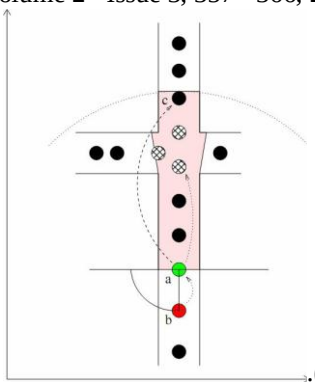
PRB-DV – Position-Based Routing with Distance Vector Recovery (PBR-DV) uses AODV-style recovery as packets fall into a local maximum. The node at the local maximum would broadcast a request packet in which is the node's position and destination's location. Upon receiving a request packet, a node would first check if it is closer to the destination than the node at the local maximum. If it is not, it records the node from which it receives the request packet (similar to backward learning) and rebroadcasts the request; otherwise, it sends a reply to the node from which it receives the request. As the reply packet travels back to the local maximum node, every intermediate node will record the previous node from which it receives the reply packet so that the local maximum node can maintain a route to a closer node than itself. The disadvantage of this scheme is that addition flooding is necessary to discover the non-greedy part of the route. There is no evaluation done comparing PRB-DV to GPSR nor AODV thus performance in packet delivery and overhead is inconclusive.

GRANT – Greedy Routing with Abstract Neighbor Table (GRANT) [12] uses the concept of *extended greedy routing* where every node knows its *x* hop neighborhood. This gives every node a far sighted vision of the best route to take to avoid local maximum. The metric in selecting the next forwarding neighbor *E* is based on the multiplication of the distance between the node *N*, *x* hop away from *E* and the destination, the shortest path from *N* to *E*, and the charge . Since the evaluation is done on static traces and the *x*-hop neighbors are assumed to be available, the beacon overhead and possible inaccuracy are not measured and well understood. In addition, although there are more paths that have smaller path length than traditional greedy routing on a normalized percentage basis, there is no absolute performance metric such as packet delivery ratio that can validate its true performance. per hop for multihop neighbors. The neighbor *E* that offers the smallest such metric will be chosen to be the next hop. Because transmitting *x*-hop neighbors in the beacon is too much overhead, GRANT separates the plane into areas and includes only one representative neighbor per area. Upon receiving a beacon, a node computes the area that the broadcasting node and its neighbors belong to, thus categorizing them into different hops from the current node. The evaluation is based on snapshots of placement of cars from a uniform distribution.

Overlay:

An overlay routing has the characteristic that the routing protocol operates on a set of representative nodes *overlaid* on top of the existing network. In the urban environment, it is not hard to observe that decisions are made at junctions as these are the places where packets make turns onto a different road segment. Therefore, the overlaid routing protocols presented below have something to do with nodes at junction.

GPCR – A new routing approach for mobile Ad-Hoc Networks,called as Greedy Perimeter Coordinator Routing (GPCR), is introduced The main idea of GPCR is to take advantage of the fact that **streets** and **junctions** form a natural planar graph, without using any global or external information such as a static street map. GPCR consists of two parts: **a restricted greedy forwarding** procedure and **a repair strategy** which is based on the topology of real-world streets and junctions and hence does not require a graph planarization algorithm. Junctions are the only places where actual routing decision are taken. Therefore packets should always be forwarded to a node on a junction rather than beeing forwarded accross a junction. Node ***u*** would forward the packet beyond the junction to node **1*a*** if regular greedy forwarding is used. By forwarding the packet to node **2*a*** an alternative path to the destination node can be found without getting stuck in a local optimum A coordinator broadcasts its role along with its position information. In a first step we assume that each node



.(Junction intersection)

Figure 5[26]: Grredy Perimeter Coordinator Routing (GPCR)

knows whether it is a coordinator (i.e., located in the area of a junction) or not Figure 5 shows an example of how the next hop is selected on a street. Node ***a*** receives a packet from node ***b***. Because ***a*** is located on a street and **not on a junction** it should forward the packet along this street. First the qualified neighbors of **a** are determined. Then it is checked whether at least one of them is a coordinator. As in this example there are **three coordinator nodes** thatqualify as a next hop one of these coordinator nodes is chosen randomly and the packet will be forwarded to this coordinator.

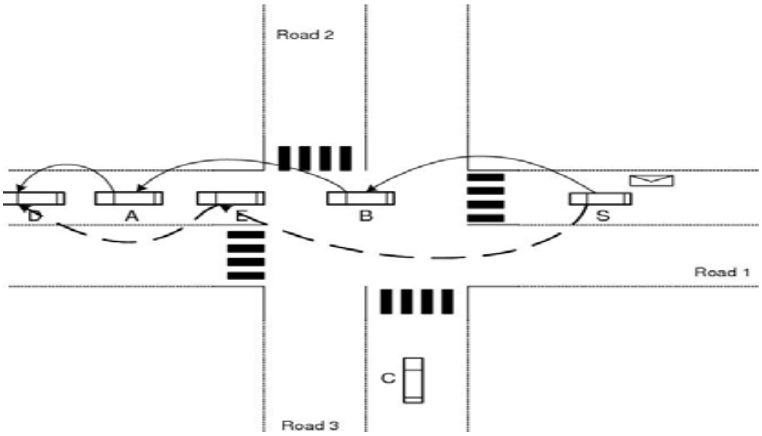


Figure 6[26]: Dashed arrows are GPSRJ+ and solid arrows are GPCR

GpsrJ+ – GpsrJ+ [13] removes the unnecessary stop at a junction while keeping the efficient planarity of topological maps. It uses two-hop neighbor beaconing to predict which road segment its neighboring junction node will take. If the prediction indicates that its neighboring junction will forward the packet onto a road with a different direction, it forwards to the junction node; otherwise, it bypasses the junction and forwards the packet to its furthest neighboring node. Figure 6 illustrates the advantage of prediction. The figure shows that GpsrJ+ can bypass the junction area and forward the packet to node *E* directly, yet GPCR forwards it to the junction node *B*, thus causing more transmissions. In the perimeter mode, GpsrJ+ uses the right-hand rule to determine the best direction (as opposed to final destination direction) and thereby the best forwarding node. That is, if the furthest node is in the same direction as the best direction, the best forwarding node is the furthest node; otherwise, the best forwarding node is a junction node. GpsrJ+ manages to increase packet delivery ratio of GPCR and reduces the number of hops in the recovery mode by 200% compared to GPSR.

CAR This work presents a novel **position-based** routing scheme called Connectivity-Aware Routing (CAR) is designed specifically for inter-vehicle communication in a city and/or highway environment.CAR integrates locating destinations with finding connected paths
between source and destination. "Guards" help to track the current position of a destination. The CAR protocol consists of four main parts:

1. Destination location and path discovery,
2. Data packet forwarding along the found path,
3. Path maintenance with the help of guards,
4. Error recovery.

Adaptive beaconing

The HELLO beacon includes location, moving direction and speed. The beaconing interval is changed according to the number of the

registered nearby neighbors. The fewer neighbors there are, the more frequent is a node's HELLO beaconing. Therefore Node 3 in Figure 7 beacons more frequently than Nodes 2 and 4 and much more frequently than Node 1.

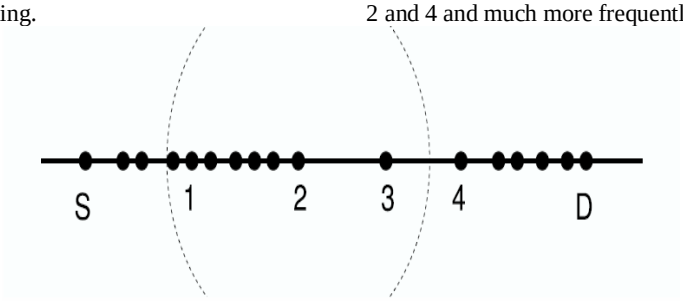


Figure. 7[26]: Influence of the neighbor table accuracy

The accuracy of node 1 neighbor table is far less important for the communication between nodes *S* and *D* than those of nodes 2, 3, and 4.

AGF is then used to forward the route reply back to the source via the recorded anchor points. When the source receives the route reply, it records the path to the destination and starts transmitting. Data packets are forwarded in a greedy manner toward the destination through the set of anchor points using AGF. In addition to handle mobility by AGF, CAR introduces "guards" to help to tack the current position of a destination. A guarding node can filter or redirect packets or adds information to a packet that will eventually deliver this information to the packet's destination.

The evaluation was done using a vehicular simulator and a probabilistic shadowing propagation model that uses a statistical approach to takes into account signal blockage. Results have shown CAR possesses higher packet delivery ratio (PDR) than GPSR and GPSR+AGF. The reason that CAR's PDR is higher than GPSR+AGF is that CAR guarantees to find the shortest connected path whereas GPSR+AGF may suffer from suboptimality of greedy mode in terms of finding such a path. CAR's path discovery overhead is checked by PGB. The overhead of storing guard is not in the data packets but in the beacons. According to their finding, a node on average only broadcasts 2-3 guards during the simulation. Thus, the beacon overhead is not overwhelming.

GSR – Geographic Source Routing (GSR) [14] relies on the availability of a map and computes a Dijkstra shortest path on the overlaid graph where the vertices are junction nodes and the edges are streets that connect those vertices. The sequence of junctions establishes the route to the destination. Packets are then forwarded greedily between junctions. GSR does not consider the connectivity between two junctions; therefore, the route might not be connected through. Recovery when such a case happens is greedy forwarding. The major difference between GSR and CAR is that CAR does not use a map and it uses proactive discovery of anchor points that indicate a turn at a junction.

As mentioned above, the movements of 955 vehicles are simulated by the traffic flow simulator Videlio [15], that incorporates a special lane changing model. The evaluation also considers a basic form of *obstacle modeling* as the propagation model. Simulation results have shown that GSR performs better than AODV and DSR in packet delivery ratio. In a densely populated network, most roads are connected that GSR forwards most of the packets. Scalability is not a problem to GSR as to AODV and DSR. However, GSR is not compared with other position-based routing protocols. Its performance in sparse networks is not verified.

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A-STAR-

Anchor-Based Street and Traffic Aware Routing [16] (A-STAR) is a position based routing protocol which is specially design for city scenarios for inter vehicle communication system. It ensures high connectivity in packet delivery by using vehicular traffic city bus information for an end-to-end connection However, A-STAR is traffic aware: the traffic on the road determines whether the anchor points of the road will be considered in the shortest path. A-STAR routes based on two kinds of overlaid maps: a statically rated map and a dynamically rated map. A statistically rated map is a graph that displays bus routes that typically imply stable amount of traffic. Dijkstra paths computed over the statistically rated map are in general connected because of the extra knowledge. A dynamically rated map is a map that is generated based on the real-time traffic condition on the roads. Road-side deployment units can monitor the city traffic condition and distribute this information to every vehicle. Thus, the difference between a statically rated map and a dynamically rated map is accuracy of road traffic; while a statically rated map is based on bus routes that typically have high traffic volume, a dynamically rated map is based on the traffic monitored dynamically by road-side units.The mobility model and propagation model are based on the M-Grid mobility model, a variant of the Manhattan model that considers not only the vehicular movement in a typical metropolis where streets are set out on a grid pattern but also the radio obstacles. A-STAR is compared to GSR and GPSR. Its packet delivery ratio is lower than GSR and GPSR with or without recovery as A-STAR can select paths with higher connectivity.

Street Topology-Based Routing(STBR) [17] is based on the ideaOf elucidate a given street map as a planar graph which has three valid states: master, slave, and forwarder for a node. In STBR one node is selected as a master on a junction, other nodes act as slaves & intermediate nodes between junctions act as forwarders In STBR, packets are routed based on their geographic distance to the street where the destination is on. This is different from GSR or A-STAR where routes are computed through Dijkstra shortest path.

GyTAR – Greedy Traffic Aware Routing protocol (GyTAR) [18] is an overlaid approach similar to the approaches mentioned above in that packets are forwarded greedily toward the next junction which will then determine the best junction to forward next. GyTAR assumes that the number of cars is given per each road from roadside units and determines the connectivity of roads. A score is given to each neighboring junction considering the *traffic density* and their *distance* to the destination. The weights to traffic density and their distance to the destination are configurable parameters. GyTAR tries

to mimic the shortest path routing by taking into account the road connectivity. Simulations are based on a 2500m x 2000m map of 100 to 300 nodes. The movement of cars is adapted to the mobility model from (Davis, et al., 2001). GSR is compared to GyTAR which shows better packet delivery ratio. However, since it is not compared to any other overlaid routing protocol in this category, it is hard to gauge its relative performance.

LOUVRE – [13] has summarized geographic greedy overlay routing into two camps. The first camp is geo-reactive overlay routing where the next overlaid node is determined based on their neighboring nodes' distance to the destination (STBR) or a combination of it and traffic density (GyTAR). The second camp is geo-proactive overlay routing where the sequence of overlaid nodes is determined a-priori (GSR and A-STAR). Landmark Overlays for Urban Vehicular Routing Environments (LOUVRE) belongs to the second camp. It takes note of the fact that above a given vehicular density threshold, an overlay link remains connected regardless of the vehicular spatio-temporal distribution on the link. Thus, by only considering overlay links based on such density threshold when establishing overlay routes, most routes would partially use the same overlay links. With these considerations, geo-proactive overlay routing becomes attractive as it guarantees global route optimality and reduces the delay for establishing overlay routes. The drawback of this approach is obviously its scalability.

CBF: Contention-Based Forwarding (CBF) [19] is a geographic routing protocol that does not require proactive transmission of beacon messages. Data packets are broadcast to all direct neighbors and the neighbors decide if they should forward the packet. The actual forwarder is selected by a distributed timer-based contention process which allows the most-suitable node to forward the packet and to suppress other potential forwarders. Receivers of the broadcast data would compare their distance to the destination to the last hop's distance to the destination. The bigger the difference, the larger is the progress and shorter is the timer.
CBF is compared with GPSR with the perimeter mode disabled and with beacons of different intervals using realistic movement patterns of vehicles on a highway. With beacon interval of 0.25 seconds (the lowest set in the experiment), the packet delivery ratio (PDR) of GPSR is still not as good as that of CBF. As the beacon interval increases (up to 2 seconds), its PDR drops. (Please revise) Evaluation also shows that as the communication distance and thus the number of
hops a packet has to travel increases, the load on the wireless medium increases more for GPSR than CBF due to GPSR's constant beaconing overhead.

Hybrid: TOpology-assist Geo-Opportunistic Routing (TO-GO) [20] is a geographic routing protocol that exploits topology knowledge acquired via 2-hop beaconing to select the best target forwarder and incorporates opportunistic forwarding with the best chance to reach it. It is different from CBF in three main aspects. First, rather than picking the next forwarding node that makes the best progress to the destination, it picks the next forwarding node that makes the best progress to a target node. A target node is defined to be the node that greedy algorithm or recovery algorithm would normally pick except at the junction where optimization in choosing the target node either beyond the junction or at the junction is based upon whether the routing is in greedy mode or recovery mode. The reason for choosing the target node instead of the destination as the frame of reference is to take care of the city topology where roads intersect and destination usually does not lie on the same street as the source as in the highway. Packets have to make multiple turns into different streets before arriving at the destination. The data is then broadcast to all direct neighbors. Whoever's distance is closer to the target node gets picked to be the next forwarding node.

DTN: Delay Tolerant Network (DTN) uses carry & forward strategy to overcome frequent disconnection of nodes in the network. In
carry & forward strategy when a node can't contact with other nodes it stores the packet & forwarding is done based on some
metric of nodes neighbors.). Since nodes are highly mobile, in this type of a network, they suffer from frequent disconnections. To overcome this, packet delivery is augmented by allowing nodes to store the packets when there is no contact with other nodes, to carry the packets for some distance until meeting with other nodes, and to forward based on some metric on nodes' neighbors (called carry-and-forward strategy). The notable DTN vehicular routing protocols are VADD and GeOpps described below.

VADD – Vehicle-Assisted Data Delivery (VADD) [21] is a vehicular routing strategy aimed at improving routing in disconnected vehicular networks by the idea of carry-and-forward based on the use of predictable vehicle mobility. A vehicle makes a decision at a junction and selects the next forwarding *path* with the smallest packet delivery delay. A path is simply a branched road from an intersection. The expected packet delivery delay of a path can be modeled and expressed by parameters such as road density, average vehicle velocity, and the road distance. The minimum delay can be solved by a set of linear system equations. Zhao et. al. have introduced variations of VADD that chooses the next forwarding node after the next forwarding path has been determined. Location First Probe (L-VADD) would select a node closest to the next forwarding path even though such a node is going away from the forwarding path. Direction First Probe (D-VADD) would select a node which is going toward the forwarding path even though such a node might be further from the forwarding path than other nodes on the path. Multi-Path Direction First Probe (MD-VADD) would select multiple nodes going toward the forwarding path so as not to miss forwarding to a node that offers a shorter time to the destination. Finally, Hybrid Probe (H-VADD) combines L-VADD and D-VADD so the long packet delay from D-VADD is offset by L-VADD and routing loops from L-VADD are masked by D-VADD. Results comparing with GPSR plus buffer and various versions of VADD show that H-VADD has the best performance.

GeOpps – Geographical Opportunistic Routing (GeOpps) [23] takes advantage of the suggested routes of vehicles' navigation system to select vehicles that are likely to move closer to the final destination of a packet. It calculates the shortest distance from packet's destination to the nearest point (NP) of vehicles' path, and estimates the arrival of time of a packet to destination. Figure 9 shows Node *A* in computing the NP of its neighbors *N1* and *N2*. Since N2 offers closer NP to the destination, Node *A* picks *N1* to forward its packets.
During the travel of vehicles, if there is another vehicle that has a shorter estimated arrival time, the packet will be forwarded to that vehicle. The process repeats until the packet reaches destination. The minimum delay used by VADD is indirectly obtained by selecting the next forwarding node whose path's nearest point is closest to the destination. GeOpps requires navigation information to be exposed to the network, thus, privacy such as vehicle's whereabouts might be an issue.

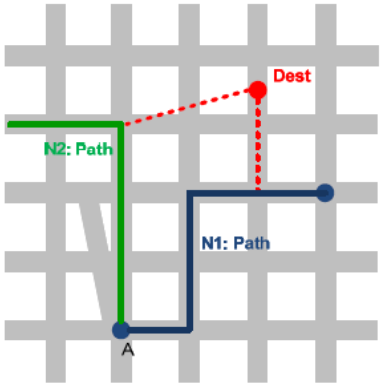

Figure 8[24]: Calculation of the Nearest Point (NP) from packet's Destination (D) for N1 and N2

Hybrid: GeoDTN+Nav [22] is a hybrid of non-DTN and DTN approach that includes the greedy mode, the perimeter mode, and the DTN mode. It switches from non-DTN mode to DTN mode by estimating the connectivity of the network based on the number of hops a packet has travelled so far, neighbor's delivery quality, and neighbor's direction with respect to the destination.. In addition to its hybrid approach, VNI offers users the option to protect their private data and at the same time provides best-effort routing decision.

Table 1. Summary of VANET TOPOLOGICAL routing protocols

Routing Protocol	**Type**	**Sub-Types**	**Overhead**	**Mobility Model**	**Propagation Model**
GPSR	Position-based	Non-DTN, Non-Overlay	Beacons	MTS	Probabilistic shadowing
GPSR+AGF	Position-based	Non-DTN, Non-Overlay	Beacons	MTS	Probabilistic shadowing
PRB-DV	Position-based	Non-DTN, Non-Overlay	Beacons and path states	Unknown	Unknown
GRANT	Position-based	Non-DTN, Non-Overlay	Two-hop beacons	Static trace from a uniform distribution	Road blocking
GPCR	Position-based	Non-DTN, Non-Overlay	Beacons	VanetMobisim	Road blocking
GpsrJ+	Position-based	Non-DTN, Overlay	Beacons	VanetMobisim	Road blocking
CAR	Position-based	Non-DTN, Overlay	Path states and beacons	MTS	Probabilistic shadowing
GSR	Position-based	Non-DTN, Overlay	Beacons	Videlio, M-Grid moblity	Road blocking
A-STAR	Position-based	Non-DTN, Overlay	Beacons	M-Grid mobility	Road blocking
STBR	Position-based	Non-DTN, Overlay	Beacons	Unknown	Unknown
GyTAR	Position-based	Non-DTN, Overlay	Beacons	Proprietory	Free space
LOUVRE	Position-based	Non-DTN, Overlay	Beacons	VanetMobisim	Road blocking
CBF	Position-based	Non-DTN, Non-Beacon	Data boradcast	Random way point	Two-Ray ground propagation model

TO-GO	Position-based	Non-DTN, Hybrid	Beacons and data broadcast	VanetMobisim	Road blocking
VADD	Position-based	DTN	Beacons	Unknown	Unknown
GeOpps	Position-based	DTN	Beacons	MTS	None
GeoDTN+Nav	Position-based	Hybrid	Beacons	VanetMobisim	Road blocking

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3.CONCLUSION

This paper discusses various routing protocols of VANET. Designing an efficient routing protocol for all VANET applications is very difficult. Hence a survey of different VANET protocols, comparing the various features is absolutely essential to come up with new proposals for VANET. The performance of VANET routing protocols depend on various parameters like mobility model, driving environment and many more. Thus this paper has come up with an exhaustive survey and comparison of different classes of VANET routing protocols. From the survey it is clear that position based, geocast and cluster based protocols are more reliable for most of the applications in VANET. In summary, the open issue in VANET routing is then whether there is any benchmark tool for evaluating these protocols. The research direction is that as VANET routings are advancing and becoming mature, many of the underlying assumptions and technologies will need to become mature as well so that much validity can be given to the benefits of these routing protocols.

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Knowledge Transfer in a Municipality Study on Baby Boomer Exodus from the Workforce

Ivy Cummings-White
Resources Consultant
North Texas Municipality
Texas, USA

Ify S. Diala
Contributing Faculty
Walden University
Minneapolis MN, USA

Abstract: A substantial number of Baby Boomers are entering retirement and will impact both public and private sector organizations. To address this upcoming challenge, organizations must establish mechanisms to identify, capture, and transfer Boomer knowledge. This qualitative phenomenological study was designed to explore the Baby Boomer phenomena through the perceptions and experiences of Boomer leaders that are eligible to retire from a North Texas Municipality. Fourteen semi-structured face-to-face interviews identified eight core themes that provide opportunities for leadership to assess organizational readiness. The eight core themes consists of obtaining perceptions from the sample size of the following: meaning of institutional knowledge, capturing institutional knowledge in current position, knowing what knowledge to capture, current methods of capturing and transferring knowledge, usefulness of written procedures, obstacles in retaining knowledge, impact of the leaving the organization, and suggestions to capture and transfer knowledge.

Keywords: knowledge transfer; knowledge management; workforce planning; Succession planning; retirement; baby boomers

1. INTRODUCTION

In the twenty-first century workplace, four generations are at work together. In the United States, the number of individuals 65 and older is expected to double from 37 million in 2010 to exceed 70 million in 2030 [1] . Born between 1946 and 1964, Boomers were the most prevalent age unit in America in 2007 [2]. A substantial number of Boomers continue to enter retirement, affecting both private and public sectors. These Boomers occupy a vast number of leadership roles, holding a significant amount of institutional knowledge. As Boomers exit an organization, tacit and explicit knowledge leave with them. This emerging phenomenon will have significant influences on organizational abilities to ensure organized transfers of skills and knowledge. .

2. PURPOSE OF THE STUDY

The objective of this qualitative phenomenological research study was to explore the phenomenon of the Baby Boomer experience related to institutional knowledge accumulation and transfer prior to retirement from the municipality. There is a lack of understanding on how municipalities are addressing the problem. The risk of knowledge loss is a particular concern for the public sector, as job tenure is more prevalent in the public sector.

3. DISCUSSION

3.1 Baby Boomers

Baby Boomers are the populating group born in the years after World War II. Baby Boomer demographics influenced society. Boomers overcrowded schools in their youth and when they entered the workforce, they set massive records for employment [3]. The Baby Boomers identify with events such as the Civil Rights movement, and Vietnam. Boomers, born between 1946 and 1955, grew up in prosperous booming times. Salaries were increasing, inflation was stable, and unemployment was low. A larger number of schools were built to accommodate growing families, and they were taught nothing was impossible for them to achieve. They were said to be susceptible to becoming workaholics, preferring bigger houses, and better cars [4]. Boomers are known for self-confidence, self-absorption, and are in the forefront based on size alone [5]. Younger Boomers, born between 1956 and 1964, had different experiences. This group arrived at an economic downturn. More than 70 million Baby Boomers have reached the retirement age [1]. Boomer labor shortages are already threatening crucial business sectors [6]. Catalysts for change, Boomers have the power to affect markets and initiate change, unlike generations prior. Baby Boomers are "a generational phenomenon unlike no other" [5] In comparison to other generations, Boomers identified themselves through their occupation and advancement. Boomer workers must generally feel like a member of the team, and possess a high work ethic. They bring a variety of knowledge because of a past of experiencing company changes such as downsizing or streamlining processes.

3.2 Theoretical Support

Several popular, theoretical concepts were applicable to this research study. Classical management theory focused on five functions of management [7]. The rational theory encompassed tasks, personnel, and resource allocation [8]. Other important integrated theories included that of *ba*, a review of adult learning styles (andragogy), and generational theories such as X and Y were thoroughly documented and explored in-depth in the literature review.

3.2.1 The classical management theory

The classical management theory created by Henri Fayol described five functions of management relative to everyday use. Management must be able to plan, organize, command, coordinate, and control functions within the organization. To obtain and transfer knowledge, management will need to devise a strategic plan that would encompass the above functions. The framework of these functions depicted a template for understanding management responsibilities [7].

3.2.2 The rational theory

The rational theory perspective concentrated on "what tasks are to be performed, what kinds of personnel are to be hired, and how resources are to be allocated among participants to guide decisions on organization" [8]. This theory was relatable to the study because to transfer knowledge, an

organization must be in tune with what the job entails as well as personnel trends, knowledge as a resource, and components linked to that organizational knowledge.

3.2.3 Management by Objective

The concept of management by objectives was introduced by Peter Drucker, who coined the term knowledge worker. Drucker [9] believed theories and assumptions revolved around people. Increased production of workers as well as how the organization can improve workers benefit both individuals and society. Drucker [10] asserted that management must be competent and have social responsibilities. He believed that people are not costs but resources. Drucker [10] stated that knowledge is the true resource of any organization and it is a social resource. The purpose of knowledge is application of specific skills. Drucker [9] believed that each organization has individuals with various skills and knowledge of different types of tasks. However, knowledge is perishable. Efforts must be made to affirm, learn, and practice constantly so knowledge does not become obsolete.

3.2.4 The Notion of Ba

The notion of ba was initiated by Kitaro Nishida, a Japanese philosopher. Nishida [11] sought to understand the nature of knowledge. He believed that knowing about knowledge is quite different from knowing about anything else. Knowing is considered a field of activity known as ba [12]. Nonaka and Konno [13] referred to ba as, "a shared space for emerging relationships". This shared space can be intellectual (shared ideas), physical (office), virtual (email) or a mixture of any of the three. Ba provided the foundation for enhancing single or group knowledge to create knowledge. The theory of existentialism suggested that ba embraced meaning. Moreover, ba is entrenched in the shared space. In this space, personal experiences are acquired as well as experiences of other individuals [13].

3.2.5 Generational Theory

Four generations of workers are creating more challenges as well as opportunities worldwide. Generational differences must be understood by management to improve workplace effectiveness. The success of an organization will depend on the organizational ability to embrace an environment with methods to develop, motivate, and retain current personnel, and attract, encourage, develop, and retain the new generation of workers [14, 15]. Certain generational differences do exist that may cause challenges based on diverse working styles and characteristics [15, 16]. The primary focuses of studies on generational differences included change management, perception of hierarchy within the organization, and work ethic. These differences can create conflict when communicating, building teams, training, and engaging in career development based on how individuals work together. Proper training is needed to address the adverse impact of older workers leaving the workplace and to implement succession planning [14, 17].

3.3 Generational Differences

To understand those to whom Boomers will transfer knowledge, it was important to review other generations. These include the GI generation, Silent Generation, Generation X, and Generation Y. The following paragraphs describe these populations. The GI generation, those born before 1932, are the parents of Boomers [14]). Also known as the Veterans, this generation lived through the Great Depression of 1929 as well as World War II and experienced labor unions [16]. Their experiences influenced savings and spending patterns. The silent generation, born between 1932 and 1945, is small in number because most men were away at war and the impact of the Great Depression resulted in fewer children. They were influenced by the Cold War and Korean War. Reared to be polite, they also stayed with one employer throughout lifetimes. This generation married early, started families, and saved money for retirement. During this time, most women did not work outside of the home [14]. Generation X, born after Boomers, between 1965 and 1976, has similarities to the Silent Generation. Born between the Boomers and Millennials, they are considered the Baby Bust generation. They watched parents work many hours for quality of life versus working hours to launch a career. Considered pragmatists, they adapt to a fast moving environment and are more ethnically diverse than their parents [4]. Generation Xers experienced single-parent homes and many were considered latchkey children. This generation is defined by the Space Shuttle Challenger explosion incident and advent of computers. Many values are shared with the Boomers such as teamwork, optimism, and personal satisfaction [16]. As conservative spenders, they save money, and have deep family roots. While self-reliant, they are also optimistic, confident, and independent. They value education and believe in parenting over work. A strong company loyalty is said to fail to exist however; there is a belief in taking skills to the best employer who fits his or her needs while seeking a work- family balance [4]. Generation Y, born between 1977 and 1994, often called the Echo Boom Generation shared similarities with the Boomer generation. Their numbers are more significant than Generation X. They have close ties with their parents. Also referred to as the boomerang kids, approximately 65% of these college graduates moved back home with parents. Diversity is taken for granted by this generation. Generation Y is computer literate and called true techies. This generation expects continuous feedback from friends, family, and employers because high speed and instant response is their norm [4]. Even with a short attention span, they appreciate career growth and development while focusing on working more efficiently. This group wants and needs challenging projects with deadlines that build ownership. In addition, they want flexible options that may include telecommuting or alternative solutions such as working part-time or the ability to go on leave to have children.

3.4 Generativity

Generativity is the "creation and maintenance of a wide range of institutional, cultural, and individual resources that are necessary to sustain the present and succeeding generations" [18]. Cox, Wilt, Olson, and McAdams [19] explained that generativity focuses on an individual's commitment and reassurance of well-being of the future generations. This concept suggested that once a human reaches the midlife period that there is a need to focus on other interests besides self and become a leader or guide to success for future generations [18]. The concept of generativity can assist organizations in preparing for the future by recognizing these differences and ensuring processes are in place to address this movement. Calo [18] suggested that organizations need to incorporate adult development programs, preretirement planning programs, and mentor roles to meet this need. Generativity is an intricate component in comprehending the midlife Boomer worker and his or her adult development. As the workforce continues to age rapidly, organizations must

use generativity to adjust thought processes to prepare for the future. Because of the aging workforce, more attention is focused on organizational leadership and the new generational worker. Zacher, Rosing, Henning, and Frese [20] presented a concept of generativity "as leaders" behaviors and actions aimed at establishing and guiding members of the younger generation, while focusing less on their own gains, careers, and accomplishments". Senior leadership is said to demonstrate more generativity than younger leadership. Leader generativity is more significant because maintaining leadership accomplishment in mature workers was said to occur at a higher rate than in younger workers. As the workforce continues to age, it will be necessary for leaders to develop more comprehension of the function of aging workers.

3.5 Organizational Knowledge

Knowledge of the organization is the practical knowledge for leadership that includes services, innovation, scientific, and social knowledge. This concept forces leadership to review the ability of knowledge workers along with systems to assist the organization. Once the organization experiences the loss of knowledge, it cannot be entirely recovered. It benefits the organization to attempt to retain crucial knowledge instead of attempting to buy or recover it [21]. Organizational knowledge is separated into dynamic process or a static substance. The organizational dynamic process knowledge encompasses human actions and activities. Static substance knowledge could be articulated, exchanged, and communicated while the dynamic process knowledge worked like an operation process [22]. Calo [21] stated that the combination of explicit with tacit knowledge is one that a mature worker possesses, and that combination is one of the most strategic, significant resources of an organization. To obtain this knowledge, workers must engage in activities to understand the organization's vision and mission. Creating new knowledge, not just reviewing and reusing existing knowledge possessed by an organization is crucial. Knowledge transfer internally among the organization is a critical component for members to embrace a learning environment that creates new knowledge and learning of current knowledge. This process was explained as a unit within an organization that affects experiences of another unit. Germinal literature indicated that additional research of Baby Boomers extending their retirement may be applicable. A characteristic of Boomers is the desire to work. Some will want opportunities to continue to contribute to the organization. Organizations may want to consider recycling Boomers into the labor force on a part-time basis to assist in mentoring the new generation of workers. Creating new positions, developing career paths, and flexibility in personnel arrangements can assist in retaining knowledge. Organizations must be more proactive in establishing avenues such as adoption of job sharing, part-time work, flexible schedules, and telecommuting to adapt to the changing demographic needs of the business to encourage the stability of older workers. Along with these changes, a review of the culture is critical to enhance the method of preparing for retirement. Because of the turbulent economic states and rising health care, the aging workforce may be motivated to stay with or return to assist the organization Employee turnover will be a challenge regardless if Boomers stay or quit working. However, leadership must be able to manage the multi-generational workforce to create strategies to retain knowledgeable employees.

3.6 Knowledge Management

Most organizations have retirement geared toward the age of 65. Because of this notion, companies must prepare knowledge management techniques to secure their knowledge. Incorporating knowledge management into an organization's processes along with changing the culture can promote a knowledge sharing environment. While successfully assessing and obtaining knowledge may be a challenge, the changing labor demographics are forcing industries to take action. The Baby Boomers are a sizeable group in the workplace and employers are struggling to transfer their knowledge [21]. No matter how knowledge is acquired, there must be a way for it to be captured, shared, and deployed. The potential of KM can exist in capturing, retaining, and leveraging knowledge of personnel. Facilitation of knowledge transfer from older workers will enable the younger generation of workers to leverage one another's knowledge that will increase organizational efficiency and productivity.

3.7 Human Capital

An organization's most significant source is intellectual capital and knowledge. Intellectual capital also known as human capital is considered the value of skills, thinking, knowledge, creativity, and experiences of the workforce. As the workforce ages, workers acquire knowledge and experience customized to the operations and culture of the organization. This makes it a challenge to replace their knowledge as they exit the organization. Organizations may benefit by putting measures in place to capture and have access to human capital of the more mature workforce even if retired. Instead of concentrating on optimizing profit, the focus should be to treat information and knowledge from workers as human capital. An example is incentive pay meant to be a reward; however, it encourages the same performance but does not enhance an entrepreneurial workforce. In other words, it keeps performance at minimums and does not permit exceptional performance. The role of leadership is to be intrinsic and search for the inner motivation of employees to leverage energy and imagination. Organizations must devise strategies to assist in retaining intellectual capital of older workers. As Baby Boomers prepare for retirement, organizations need to ensure that both experience and knowledge does not retire with them. The knowledge of an organization's human capital must be captured and transferred to take advantage of the knowledge to comprehend, manipulate, and link it to an objective or purpose. The most effective way for organizations to increase competitiveness and capabilities is to retain human capital.

3.8 Mentoring

Mentoring can be seen as the pairing of individuals, one of whom needs to acquire the expertise or experience possessed by the other. Relationships within the organization persuade results by motivating personnel to learn from one another. Mentoring and coaching are good sources to transfer explicit and tacit knowledge because of the personal relationship and supportive culture. Most organizations take on the form of mentoring to assist in developing personnel. Mentoring can assist an organization in tapping into experience of Boomers. Senior employees may approach the mentor-mentee relationship as an opportunity to leave a legacy, or pay forward the support received from others in their own past. Organizations must recognize the important of mentors in

transferring knowledge to the younger generation of workers as soon as possible. Establishing mentor relationships can improve communication between the generations. The relationship among the mentor and mentee creates an avenue to articulate both explicit and tacit knowledge. Additional training to promote knowledge transfer can come in the form of classroom trainer led by Boomers creating a learning environment that encourages sharing experience and leveraging various learning styles such as videos or interviewing [3]. Bozeman and Feeney [23] explained that most public sector entities promote a mentoring relationship. One of the key factors is the demographics that the public sector faces as new barriers arise as the workforce becomes older; however, there is still a need for more skills coaching and education. This demand is creating a challenge for the public sector to retain and attract workers but can be combated by successful mentoring relationships.

3.9 Workforce Planning

The exodus of Baby Boomers will be a challenge that the public sector is encountering and will continue to experience. Because of the high ratios of older workers, there will be a need for new knowledge workers. Those that have the necessary talent and skills may become more difficult to recruit and retain. Jacobson [24] defined workforce planning as "a process designed to ensure that an organization prepares for its present and future needs by having the right people in the right places at the right times". Workforce planning can assist the public sector with strategically preparing to face these workforce demands. This type of planning will assist organizations with their mission and values, recruiting, retention, and training. Because of demographic changes, it is essential for the government to establish a workforce planning model. The following components in the workforce planning model are: reviewing the organization's objectives, analyzing present and future workforce needs to identify necessities, developing and implementing human resources plans, and evaluating, monitoring, and adjusting the plan as necessary. Implementing and following these steps will require long-term commitment and must have the support of executive management to prepare the organization for change for decades to come [24]. Recent trends indicate that the time to plan is now. Heffes [25] explained four components contributing to the shortage in the workplace. Downsizing, aging boomers, changes in the expectations of both the employer and employee agreement, and less younger workers affected the workplace. The results of his survey indicated that 45% of organizations were not actively capturing crucial knowledge and expertise from retiring workers within the framework of any workforce planning model [25]. Organizations must recognize the issue, strategically plan, and measure progress. If organizations do not prepare a workforce plan, the organization will be impacted by a shortage of talent, skills, and human capital. Workforce planning strategies must be established to capture processes with a culture that values employees and their needs.

3.10 Succession Planning

To take adequate advantage of the benefits of succession planning, organizations must identify talent early to replace senior leadership positions. Shaheen [26] introduced the HIPO (highly talented individuals with promise) Paradox, a method for recognizing individuals who possess those skills, experience, and qualities needed to become a member of leadership in the organization. A method of recognizing these types of individuals was to identify key roles and identify key personnel within the organization. Greer and Virick [27] introduced several factors that should be included in an effective succession plan. Strategic integration is important within which strategies align and establish programs to identify those individuals with high potentials. Once established, these strategies must be communicated through leadership. Values must be established along with the commitment of executives to communicate those values. Accountability and authority must be established to obtain success goals. Succession planning will assist in identifying future behavioral competencies, conducting searches for talents, establishing credible mentors, and using assessments to validate objectives and learning. Competencies must be developed to ensure proper training and development to create a pool of diverse talent with use of establishing procedures and opportunities for mentor/mentee relationships. The final component is the program's management practices to monitor and identify efficient mentors to leverage skills along with incorporating performance evaluations and reward systems. Performance evaluations and reward systems could monitor success and evaluate items such as retention, development, and advancement of talent pool [27]. Succession planning is a controversial topic in both business and government leadership. Shaheen [26] argued that, "no organization has a monopoly on the best talent". Organizations spend considerable amounts on human capital to promote succession planning however; usually it is at the executive level. The success of these types of programs will depend on the leadership within the organization. Often little time is spent on creating the basics of securing the future workforce and transferring to it the knowledge of predecessors. Whereas there is succession management among the executive levels, often talent management and knowledge management are not included in the equation. Shaheen [26] emphasized that succession management should focus on implementing succession planning as well as workforce planning programs. Ndubisi [28] stated that succession planning was deemed to be very rewarding in several aspects. Benefits often incorporate personal development, increased management involvement, and compiling best practices. As Baby Boomers become retirement age, younger personnel are needed to replace vital leadership positions. Succession management was proven to be a critical component in times of retirement, resignation, or death of current leadership to assist in providing suitable leaders to ensure long business goals and survival. Shaheen [26] stated succession management can result in a competitive advantage. While the significance of succession planning is expressed, several organizations ignored the concept or did not take it seriously [28].

4. Methodology

The purpose of this phenomenological qualitative study was to explore knowledge transfer of 14 Baby Boomers and the methods currently used and perceived to be necessary to capture and sustain institutional knowledge in a North Texas municipality. The study addressed the emerging necessity of capturing the crucial knowledge needed to be transferred and the methods necessary to sustain institutional knowledge in a North Texas Municipality. The design of the research dictated the structure of the processes used to conduct data collection and analysis [29]. Based on the literature review, the research indicated that organizations will experience a mass exodus of Baby Boomers in the next few decades and organizations generally are ill-prepared [30]. The loss of institutional knowledge will create challenges for organizational leaders to meet work demands. This study

included tools to explore this phenomenon in detail and results may assist organizational leaders in building leaders for the future. . A phenomenological method was used to discover data on central themes for this study. Semi-structured, face-to-face interviews were used to gather data regarding the phenomena from Baby Boomer management employees. Data analysis was used to explore meanings that reveal varying perspectives of experiences and integrate those meanings into a distinctive experience. The population under investigation consisted of Baby Boomer management employees, born between 1946 and 1964 with eligibility or nearing the retirement age in a North Texas Municipality. The general population consisted of approximately 2,300 full time employees, of which nearly 800 were Baby Boomers. An estimation of 121 Baby Boomers in 14 departments of the municipality, met the criteria of being leaders born between 1946 and 1964, with the ability to retire in 10 years following the study. In this municipality, retirement was determined by age plus tenure. Typically the tenure of these individuals was greater than five years. Participants were leaders selected from a variety of work related positions in the following departments: airport, city attorney's office (CAO), community development and planning (CDP), convention center (CC) economic development (ED), financial and management resources (FMR), fire, Handitran (Transportation for seniors and the disabled), library, parks and recreation, police, public works and transportation (PW), and water utilities. Some departments were excluded because they did not have a leader who met the participant criteria. Leaders of those individual departments were under the supervision of, answered to, and were directed by a deputy city manager, who approved the study participation of department leaders and employees. Participants provided consent to be digitally voice-recorded or were eliminated from the study.

5. Analysis and Results

NVivo9® helped to conduct analyses. NVivo9® accommodated several types of data such as audio files and text documents. This software assisted in the process of coding to discover emerging themes. For the purpose of this research study, word documents (transcripts) were imported into the system [31]. NVivo9® allowed for each interview to be created and stored for future use. Analysis of the data occurred with the use of NVivo9® qualitative software. As the study participants answered the interview questions, the results revealed eight themes which consisted of:

5.1 Review of Themes

5.1.1 Theme One

Theme one: To gather data for the perception of defining institutional knowledge, each participant was asked to define institutional knowledge. Seventy one percent of participants defined institutional knowledge as knowledge and experience whereas 29% of the participants identified institutional knowledge as history and knowledge.

5.1.2 Theme two

To gather data on the perception of what institutional knowledge to capture in the participant's current position, each participant commented on what institutional knowledge needs to be captured. Forty-three percent of the participants believed that institutional knowledge should be captured through planning, policies, and procedures whereas 22% believed that interpersonal experiences and relationships were relevant in capturing in his or her current position. Fourteen percent stated that it is essential to capture technical knowledge for the organization. Fourteen percent stated that experience must be captured whereas less than 7% stated "everything" is necessary to capture.

5.1.3 Theme Three

Knowing what knowledge to capture; Forty-three percent of the participants perceived knowledgeable about plans, agreements, and establishment of processes as essential. Twenty-two percent perceived expertise as essential to capture. Each following invariable constituent received 14%: history not common knowledge, big picture, and purpose. Seven percent identified purpose as essential to capture.

5.1.4 Theme Four

Forty-six percent of the participants captured and transferred knowledge through the means of policies, procedures, and manuals. Thirty-one percent used mentoring, cross-training, training academies, shadowing, and in-house training mechanisms for capturing and transferring knowledge. Twenty-three percent used documentation and filing as methods to capture and transfer knowledge. Seven percent used business retention visits as a means to capture and transfer knowledge from the community to the organization.

5.1.5 Theme Five

Sixty-four percent of participants' perceived written documentation as a helpful in capturing knowledge. Twenty-two percent identified written documentation as capturing the "how" but not the "why" whereas 14% believed other methods of capturing of knowledge is necessary.

5.1.6 Theme Six

Twenty percent perceived lean staffing as an obstacle. Another 13% perceived turnover and retention as obstacles whereas another 13% recognized lack of looking for knowledge and not knowing what information employees know as obstacles. The following invariable constituents were 7% for each: amount of value one has on the importance of capturing and transferring knowledge, communication, and retrieval of knowledge and system.

5.1.7 Theme Seven

Impact of leaving the organization; Fifty percent of the participants believed that the organization will be impacted upon his or her departure. Forty-three percent perceived there to be no impact to the organization whereas less than 7% are unsure of the impact.

5.1.8 Theme Eight

Suggestions to capture and transfer knowledge; Thirty-four percent of the participants perceived mentoring, cross-training, shadowing, and formal training as appropriate means to capture and retain knowledge. Twenty-five percent of participants believed that documentation and professional pages were essential to capture knowledge whereas 17% identified succession planning as a tool to capture and transfer knowledge. Eight percent identified the following as suggestions to capture and retain knowledge: prioritizing to determine what knowledge to capture, capturing knowledge from those who do the job and analyze the data, employee retention, and use of knowledge transfer software.

5.1.9 Findings

The findings from the data collection and analysis disclosed that knowledge is critical to organizational success. Results indicated that while there are some measures in place to capture knowledge such as mentoring, succession planning, and policies and procedures, as an organization there is a lack of consistency with these programs. Whereas there is awareness, more methods should be implemented to prepare for the Boomer exodus. However, the study did indicate that leaders want to share their knowledge prior to exiting the organization. Reported obstacles in transferring knowledge consisted of: (a) perception of value, communication, (b) retrieving knowledge and documents, (c) lean staffing, (d) workload/busy/distractions, (e) staff turnover/retention, (f) procedure changes, (g) lack of looking for knowledge or knowing what employees do not know. As indicated by the literature review and participants of the study, organizations must identify key knowledge areas, create objectives for knowledge transfer, and identify those that possess crucial knowledge to transfer [32]. Organizations may suffer risks and challenges with capturing and transferring Boomer knowledge [33]. Leadership recognizes that knowledge transfer methods need to be in place. This research study suggested that leadership recognizes the possibility of the loss of Boomer knowledge and must develop knowledge transfer methods to continue organizational effectiveness [34, 35].

6. Conclusion

The workforce is more diverse and evolving. The workplace consists of four generations in the workplace together which can create challenges in any organization. To improve organizational effectiveness, generational differences must be recognized and understood by leadership. An organization's success will be determined by an ability to adopt methods that will motivate and retain personnel and attract, develop, and sustain future workers and leaders [14, 15]. The results of this research study indicated a leadership need in establishing methods to capture, transfer, and retain institutional knowledge. The aforementioned themes can assist leadership in assessing and preparing for knowledge transfer possibilities. Leaders may gain additional insight in maintaining organizational effectiveness and operational efficiency regardless of the Boomer exodus. This study added additional research to other studies that explored experiences of Baby Boomers' perceptions of organizational readiness as they retire. Leaders are tasked with finding ways to identify, capture, transfer, and retain knowledge. Based on the results of the research study, the following suggestions will be presented to the municipality. It is suggested that the organization should establish the following for each department to capture and transfer knowledge: (a) succession planning, (b) mentoring, cross training, shadowing, formal training, (c) documentation and professional employee pages, (d) prioritizing to determine what knowledge to capture, (e) capturing knowledge from those who do the job and analyze data, (f) knowledge sharing plans and systems, and (g) employee retention plans. Each department should consult with senior staff and human resources to assess institutional knowledge and to determine the best way to capture and transfer knowledge. Devising a knowledge transfer plan will address ongoing organizational needs that will be inserted into policies and procedures. Design of the plan and system should flow around the day-to-day responsibilities to obtain work-related knowledge [32]. Kapp [32] emphasized "teachable moments" that can provide training and guidance to workers such as debriefings, hallway conversations, mentoring, and emails. When these moments occur, it is essential that they are recorded for future reference. Once a knowledge transfer plan is implemented, it is crucial to monitor the process to ensure that objectives are progressing. It is essential that organizations discover new means to capture critical information to instruct the new generational worker [32].

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Comparative Analysis of File Transfer Algorithms to Reduce Average Download Time in Peer to Peer Networks

Anjali Malekar
CSE Department
RCET Bhilai

Neelabh Sao
CSE Department
RCET Bhilai

Abstract: File sharing using the peer-to-peer techniques are very effective and popular among Internet users. The peer-to-peer (P2P) network is used for downloading large-volume contents such as movies and software. To address the problem of flexibility and scalability, we propose a distributed peer-to-peer architecture and algorithms for data clustering. In general the file download can take more time depending on the level of network congestion or the service capacity fluctuations. In this paper we proposed distributed random chunk based periodic switching algorithm for file distribution. This algorithm remove the limitation of the existing systems i.e. Parallel downloading, Chunk based switching, periodic switching, dynamically distributed parallel periodic switching algorithm thus reduce the average download time. In this method corresponding file is divided into many small chunks, peers select their targets for downloading in a random fashion, thus increase the average download time in P2P networks and then analyze a simple, distributed algorithm to effectively remove these negative factors, thus minimizing the average download time.

Keywords: Peer-to-Peer Networks, Distributed Content Sharing, average download time.

1. INTRODUCTION

Peer to peer (P2P) network is widely used for content sharing application. Peer to peer networks are Decentralized networks, it improves the capability of resources sharing, and maximizes the utilization of resources. In this paper we analyze various algorithms [1] for average download time in a P2P network with multiple competing downloading peers. We investigate the relationship between the average download time, in peer to peer networks. More recent research in the direction of evaluating P2P systems has focused on performance. Peer selection schemes were evaluated in [2], where measurements are used to optimize the selection of good peers and improve the overall system performance. The work in [3] is also evaluate system performance in peer to peer network, and define Variable Chunk based switching scheme in which the file to be downloaded is divided into many chunks, but in this scheme a user downloads the chunks sequentially one at a time. Early work [5], [6] are study on clustering technique for average download time in peer to peer networks. The approach of using the average service capacity to analyze the average download time has been a common practice in the literature [7],[8],[9],[10].

1.1 Peer to peer network:

A peer to peer (P2P) computer network is type of network in which each workstation has equivalent capabilities and responsibilities. Each computer in this network can act as a client or server. Client means placing a request (i.e.) client is a running application programs on a local site that requests service from a running application program on a remote site. Server means a program that can provide services to others program. Peer to peer network can be set up within the home, a business, or over the Internet. Peer to peer network can be used for sharing content such as audio, video, data, or anything in digital format. P2P is a distributed application architecture that partitions tasks or workloads among peers. Peers are equally privileged when a P2P network is established over the Internet a distributed network can be established where the sharing of files is split between all the users in the network that are storing a given file.

P2P network is different from client-server network. Client-server network involves multiple clients connecting a single, central server. Content distribution is a centralized one, where the content is distributed from the centralized server to all clients requesting the document. Clients send request to the centralized server for downloading the file. Server accepts the request and sends the file as response to the request. In most client-server setups, the server is a dedicated computer whose entire purpose is to distribute files. There are many drawbacks of client-server network such as scalability problem arises when multi requests arises at a single time, servers need heavy processing power, downloading takes hours when clients increases, requires heavy storage in case of multimedia content.

Content providers that use peer to peer network can benefit from a cost-effective distribution of content to thousands of simultaneous users, both Internet-wide and in private networks.P2P content distribution is only viable by satisfying the requirements of both the content providers and the end-users. The advantage of peer-to-peer networking is the easier control concept not requiring any additional coordination entity and not delaying transfers by routing via server entities. In this network, software applications can be installed on the single computer and shared by every computer in the network.

This network allows reducing the traffic at a central server by delegating a fraction of it to the server's clients. Peer-to-peer architectures can be very effective in reducing the server traffic, to an extent that a large user population can be supported while requiring only limited resources at the server side. Unlike traditional distributed computing, P2P networks aggregate large number of computers and possibly mobile or handheld devices, which join and leave the network frequently. Nodes in a P2P network, called peers, play a variety of roles in their interaction with other peers. When accessing information, they are clients. When serving information, they are server.

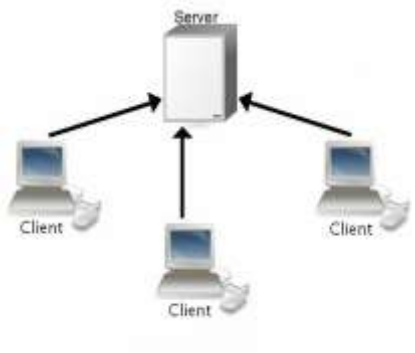

Fig 1 Client Server architecture

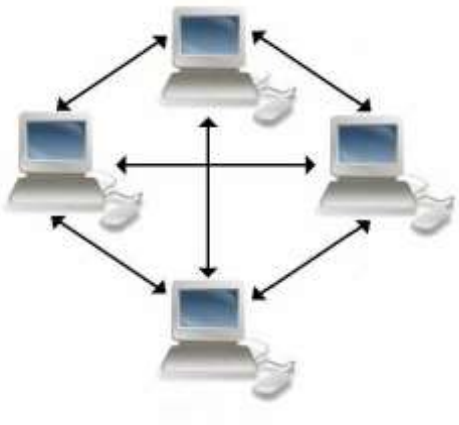

Fig 2 Peer to peer architecture

2. CLUSTERING AND MEDIA STREAMING

In this paper we proposed clustering technique for file splitting in order to reduce transfer delay. In clustered P2P model divides the sharing file into many chunks and Transmits the Chunks to each peer in the cluster. In this paper many algorithms are used for file splitting such as random chunk based switching algorithm, variable chunk based switching algorithm and etc.In chunk based switching algorithm downloaded file is divided in to many chunks either sequentially or randomly.

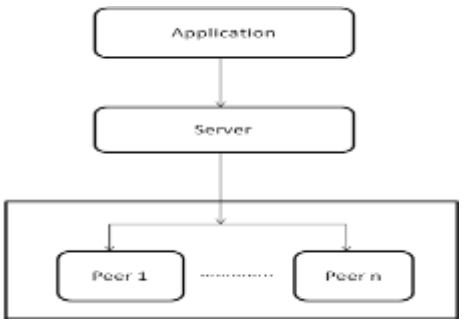

Fig 3- Architecture of server clustering

Streaming is a process of generating and delivering a steady, isochronous flow of data packets over networking medium, e.g., the Internet, from a source to a destination. Streaming media usually denotes digital audio and video data; however an alternative that alleviates the bandwidth cost problem by offering a service to deliver continuous media streams directly between peer nodes. Examples of streaming systems that may be used to distribute stored content are Narada, HMTP, and Pastry. Media streams are generated by live sources (e.g., cameras and microphones) and the data is forwarded to other nodes in real-time. A streaming process can be separated into three stages that overlap in time (Figure 1): data acquisition, data delivery and data presentation. Data acquisition is the stage that determines how the streaming content is acquired, packetized and distributed for streaming. The data presentation stage represents the methods on how to buffer, assemble and render the received data. Data delivery is the process of how the stream data is transported from the source to the destination. The source, the destination and all the intermediate nodes in a streaming system participate in a topology that is constructed based on the specific system's protocol. In a P2P streaming system, this network architecture exhibits peer-to-peer characteristics.

3. TECHNIQUES FOR FILE DOWNLOADING IN PEER TO PEER NETWORKS

In this paper we present various Techniques for content distribution .The goal of these techniques is reduce file downloading time in peer to peer network. Suppose that a downloading peer wants to download a file of size F from N possible source peers. Let ci be the average end-to-end available capacity between the downloading peer and the source peer (i = 1, 2, . . . ,N). The actual value of ci is unknown before the downloading peer actually connects to the source peer i.The average service capacity of the network, A(ĉ). The actual value of ci is unknown before the downloading peer actually connects to the source peer i

3.1 Parallel downloading

Parallel downloading is one of the ways to reduce the download time. In parallel download, a file is divided into k chunks of equal size and single file is allowed to download in parallel with simultaneous connections. Parallel downloading is better than single downloading. In the network with single one user, parallel downloading may not reduce the download time up to the mark. The parallel downloading may perform well if the capacity of each possible source peer is known so as to allocate larger chunks to faster connections and smaller chunks to slower connections.

Downloading a file of size F from the network, average service capacity, the download time T is given by

$$T = F / A(\hat{c})$$

$$= \frac{FN}{\sum_{i=0}^{N} c_i}$$

Where $$\hat{c} = \frac{1}{N} \sum_{i=0}^{N} c_i$$

3.2 Random chunk Based Switching

In the random chunk-based switching scheme, the file to be downloaded is divided into many small chunks. In this

method the user randomly selects a new source peer and connects to it to retrieve a new chunk. The download time for one chunk is independent of that of the previous chunk. The switching of source peers based on chunk can reduce the correlation in service capacity between chunks. A file of size F is divided into m chunks of equal size, and let be the download time for chunk. Then, the total downloads time

$$T_{chunk} = \sum_{j=0}^{m} \frac{1}{N} \sum_{i=0}^{N} \frac{F/m}{c_i}$$

3.3 Random Periodic Switching

In this method the downloader randomly chooses a source peer at each time slot, independently of everything else. It is observed that both the spatial heterogeneity and the temporal correlation in the service capacity can significantly increase the average download time of the users in the network. Random periodic switching strategy will always reduce the average download time and that the average download time under the random periodic switching is given by F/(ĉ).Random periodic switching removes the negative impact of both the heterogeneity and the correlations. Our algorithm is extremely simple and does not require any information about the system.

4. Limitation of the Existing methods

In Parallel Downloading, if the downloader stuck with any one of the bad source peer over k peers, then it waits for long time until getting the chunk. The download time of this method is the maximum time taken by any of the k peers that take the longest time to complete. The main disadvantage of the Chunk-Based Switching is that if we get stuck in a bad source peer with very low service capacity, downloading a fixed amount of bytes from that source peer may still take a In Random Periodic Switching, the downloader randomly chooses a source peer at each time slot and it may get stuck with bad source peer. So this method cause too much overhead associated with switching to many source peers and integrating those many chunks into a single file

4.1 Dynamically Distributed Parallel Periodic Switching

Dynamically Distributed Parallel Periodic Switching algorithm that effectively removes correlations in the capacity fluctuation and the heterogeneity in space, thus greatly reducing the average download time. Dynamically Distributed Parallel Periodic Switching algorithm has two methods (i) parallel connection (ii) parallel random chunk based switching. In first method the source selection function does not change in fixed time slot t, but instead of choosing a single source peer, here the downloader chooses multiple fixed source peers over possible source peers and it makes permanent connection for the fixed time slot t.In second method the source selection function changes for each randomly selected time slot but instead of choosing a single source peer, here the downloader randomly chooses multiple fixed source peers over possible source peers and it makes parallel connection with that k source peers for each randomly selected time slot.

4.2 Distributed variable chunk based parallel switching

In this method chunk size changes with time and provides no. Of parallel connections which changes with hardware utilization which overcomes of Chunk Based Switching algorithm. This method also removes correlations in the capacity fluctuation and the heterogeneity in space. If bandwidth available is increased then downloading can complete before specified time. If bandwidth available is decreased then downloader will search another peer with good bandwidth and get it replaced. After downloading all chunks from the all sources, the system will check whether the entire file got downloaded or not. But this method is not cost effective.

Another limitation of existing algorithm

1) We find that the existing algorithm has follows limitation-

2) Source selection function randomly selects source peer but that source may be with low bandwidth.

3) A source has more bandwidth but downloader cannot utilize this bandwidth.

4) Random chunk based switching is sequential approach.

5) The main disadvantage of random chunk based switching is that, if we get stuck in a source peer with very low service capacity, downloading a fix amount of bytes from that source peer may take a long time..

5. PREPOSED ALGORITHM

In this paper we propose distributed random periodic switching algorithm. In this method, the source selection function changes for each randomly selected time slot as in simple Random Chunk Based Switching of existing Periodic Switching. But instead of choosing a single source peer, here the downloader randomly chooses multiple peers. In this algorithm, the file to be downloaded is divided into many small chunks. Whenever a user completes a chunk from its current source peer, the user randomly selects a new source peer and connects to it to retrieve a new chunk .The switching of source peers based on chunk can reduce the correlation in service capacity between chunks.

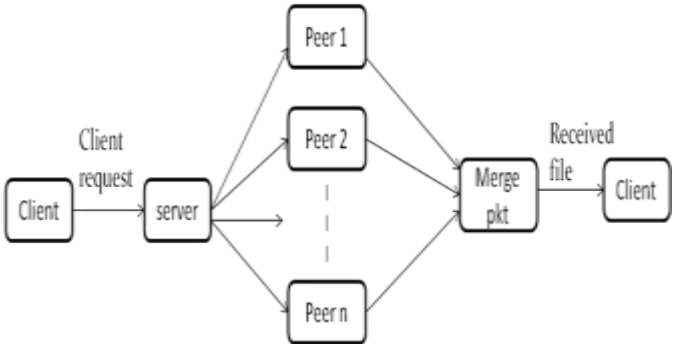

Fig. 4 clustered peer to peer (P2P) architecture

Algorithm

- Input: Node-servers network capacity at node i=[0,1……n]
- Output: X, The total time to complete download of entire k mb file.
- X ← 0
- // file that has been broken into m kb chunks
- For j = 0 to m-1
- int rand =random(0,n)
- int ChunkDownLoadTime = (k MB * 1024KB)/bandwidth
- X = X + ChunkDownLoadTime
- End for
- X = X / 60 \\convert seconds into minutes
- return X
- Exit

Different strategies have different impact on the average download time of each peer, which may result in different system dynamics as well, e.g., how fast a downloader can start to contribute (become a source peer) or how fast a peer leaves the system after finishing download. The switching of source peers based on chunk can reduce the correlation in service capacity between chunks. The benefit of chunk-based switching conversion from downloading peers to uploading Peers and thus indirectly affect the average download time

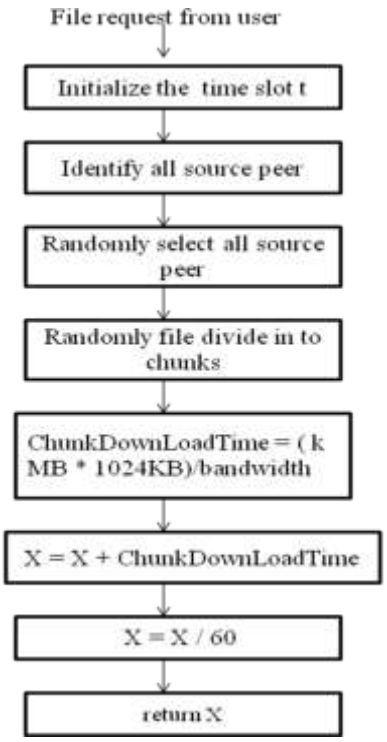

Fig 5- Process of File Splitting

6. CONCLUSION

In this paper, we discussed peer-to-peer systems that have been deployed in file sharing and media streaming. Services to content providers and consumers but also need we investigated existing P2P based file sharing and media streaming applications, and discussed the limitations of their implementations. We studied various techniques that might help improveP2P performance. We have compared several schemes widely used in practice, including chunk-based file transfer, parallel downloading and have shown that all those schemes are not so effective for reducing average download time In this paper we have designed a clustering technique that effectively reduces the average download time. We observed that our new proposed distributed random periodic switching algorithm is performing better than previous technique. From both experimental and analytical viewpoints, we have concluded that proposed model improved the system performance and reduced the network traffic.

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A survey of Anomaly Detection using Frequent Item Sets

Gaurav Shelke
RITS, Bhopal
Bhopal, India

Anurag Jain
RITS, Bhopal
Bhopal, India

Shubha Dubey
RITS, Bhopal
Bhopal, India

Abstract: Knowledge extraction is a process of filtering some informative knowledge from the database so that it can be used wide variety of applications and analysis. Due to this highly efficient algorithm is required for data mining and for accessing data from large datasets. In frequent item sets are produced from very big or huge data sets by applying some rules or association rule mining algorithms like Apriori technique, Partition method, Pincer-Search, Incremental, Border algorithm and many more, which take larger computing time to calculate all the frequent itemsets. As the network traffic increases we need an efficient system to monitor packet analysis of network flow data. Due to this frequent itemsets mining is basic problem in field of data mining and knowledge discovery. Here in this paper a brief survey of all the techniques related to frequent item sets generation has been given.

1. INTRODUCTION

Data mining can be achieved by Association, Classification, Clustering, Predictions, Sequential Patterns, and Similar Time Sequences. In Association, the relationship of a particular item in a data transaction on other items in the same transaction is used to predict patterns. In Classification, the methods are intended for learning different functions that map each item of the selected data into one of a predefined set of classes. Given the set of predefined classes, a number of attributes, and a ―learning (or training) set,‖ the classification methods can automatically predict the class of other unclassified data of the learning set. Cluster analysis takes ungrouped data and uses automatic techniques to put this data into groups. Clustering is unsupervised, and does not require a learning set. It shares a common methodological ground with Classification [1]. Prediction analysis is related to regression techniques. The key idea of prediction analysis is to discover the relationship between the dependent and independent variables, the relationship between the independent variables. Sequential Pattern analysis seeks to find similar patterns in data transaction over a business period. Existing algorithms for mining association rules are mainly worked on a binary database, termed as market basket database. On preparing the market basket database, every record of the original database is represented as a binary record where the fields are defined by a unique value of each attribute in the original database. The fields of this binary database are often termed as an item. For a database having a huge number of attributes and each attribute containing a lot of distinct values, the total number of items will be huge. Storing of this binary database, to be used by the rule mining algorithms, is one of the limitations of the existing algorithms. Another aspect of these algorithms is that they work in two phases. The first phase is for frequent item-set generation. Frequent item-sets are detected from all-possible item-sets by using a measure called support count (SUP) and a user defined parameter called minimum support. Support count of an item set is defined by the number of records in the database that contains all the items of that set. If the value of minimum support is too high, number of frequent item sets generated will be less, and thereby resulting in generation of few rules. Again, if the value is too small, then almost all possible item sets will become frequent and thus a huge number of rules may be generated. Selecting better rules from them may be another problem. After detecting the frequent item-sets in the first phase, the second phase generates the rules using another user defined parameter called minimum confidence [2] and [3-5].

2. RELATED WORK

Association Rules

Association rules are if and then statements that help uncover relationships between seemingly unrelated data in a relational database or other information repository. An association rule has two parts, an antecedent (if) and a consequent (then). Association rule is expressed as X=>Y, where X is the antecedent and Y is the consequent. Each association rule has two quality measurements, support and confidence. Support implies frequency of occurring patterns, and confidence means the strength of implication [1-3] and [9]. Associations: itemsets and sets of rule the result of mining transaction data in rules are associations. Conceptually, associations are sets of objects describing the relationship between some items (e.g., as an itemset or a rule) which have assigned values for different measures of quality. Such measures can be measures of significance (e.g., support), or measures of interestingness (e.g., confidence, lift), or other measures (e.g., revenue covered by the association). All types of association have a common functionality in rules comprising the following methods:

• Summary to give a short overview of the set and inspect to display individual associations,

• Length () for getting the number of elements in the set,

• Items for getting for each association a set of items involved in the association (e.g., the union of the items in the LHS and the RHS for each rule),

• sorting the set using the values of different quality measures (sort),

• Subset extraction,

• Set operations (union, intersect and set equal), and

• Matching elements from two sets (match),

• Write for writing associations to disk in human readable form. To save and load associations in compact form, use save and load from the base package.

The associations currently implemented in package a rules are sets of itemsets (e.g., used for frequent itemsets of their closed or maximal subset) and sets of rules (e.g., association rules). Both classes, itemsets and rules, directly extend the virtual class associations and provide the functionality described. Class itemsets contains one item Matrix object to store the items as a binary matrix where each row in the matrix represents an itemset. In addition, it may contain transaction ID lists as an object of class tidLists. Note that when representing transactions, tidLists store for each item a transaction list, but here store for each itemset a list of transaction IDs in which the itemsets appears. Such lists are currently only returned by éclat [4-6]. Class rules consists of two itemMatrix objects representing the left-hand-side (LHS) and the right-hand- side (RHS) of the rules, respectively. The items in the associations and the quality measures can be accessed and manipulated in a safe way using access or replace methods for items, lhs, rhs, and quality. In addition the association classes have built-in validity checking which ensures that all elements have compatible dimensions. It is simple to add new quality measures to existing associations. Since the quality slot holds a data frame, additional columns with new quality measures can be added. These new measures can then be used to sort or select associations using sort () or subset (). Adding a new type of associations to a rules is straightforward as well [6-8].

Rules interestingness measures

The aim of the association rules is to reveal interesting relations between data. For that reason certain are used which evaluate the level of importance of each rule. These are:

Confidence: The confidence of an association rule is the proportion of the isolates that are covered by the LHS of the rule that are also covered by the RHS. Values of confidence near value 1 are expected for an important association rule.

Support: The support of an association rule is the proportion of the isolates covered by LHS and RHS among the total number of isolates. Support can be considered as an indication of how often a rule occurs in a data set and as a consequence how significant a rule is.

Coverage: The coverage of an association rule is the proportion of isolates in the data that have the attribute values or items specified on the LHS of the rule. Values of coverage near value 1 are expected for an important association rule.

Leverage: The leverage of an association rule is the proportion of additional isolates covered by both the LHS and RHS above those expected if the LHS and RHS were independent of each other. Leverage takes values inside [-1, 1]. Values equal or under value 0, indicate a strong independence between LHS and RHS. On the other hand values near 1 are expected for an important association rule.

Lift: The lift of an association rule is the confidence divided by the proportion of all isolates that are covered by the RHS. This is a measure of the importance of the association that is independent of coverage [7] and [9-10].

Ignasi Paredes-Oliva, proposed an efficient technique of classifying frequent patterns on the basis of traffic patterns [16], here in this paper based on elegant combination of frequent item-set mining with decision tree learning.

Farah Hanna AL-Zawaidah and Yosef Hasan Jbara and Marwan AL-Abed Abu-Zanona et. al. presented a novel association rule mining approach that can efficiently discover the association rules in large databases. The proposed approach is derived from the conventional Apriori approach with features added to improve data mining performance. They had performed extensive experiments and compared the performance of the algorithm with existing algorithms found in the literature. They developed a visualization module to provide users the useful information regarding the database to be mined and to help the user manage and understand the association rules. Future work includes:

1) Applying the proposed algorithm to more extensive empirical evaluation; 2) Applying the developed approach to real data like retail sales transaction and medical transactions to confirm the experimental results in the real life domain; 3) Mining multidimensional association rules from relational databases and data warehouses (these rules involve more than one dimension or predicate, e.g. rules relating what a customer shopper buy as well as shopper's occupation); 4) Mining multilevel association rules from transaction databases [1].

Anandhavalli M, Suraj Kumar Sudhanshu, Ayush Kumar and Ghose M.K et. al. is to find all the possible optimized rules from given data set using genetic algorithm. The rule generated by association rule mining algorithms like priori, partition, pincer search, incremental, border algorithm etc, does not consider negation occurrence of the attribute in them and also these rules have only one attribute in the consequent part. By using Genetic Algorithm (GAs) the system can

predict the rules which contain negative attributes in the generated rules along with more than one attribute in consequent part. The major advantage of using GAs in the discovery of prediction rules is that they perform global search and its complexity is less compared to other algorithms as the genetic algorithm is based on the greedy approach. They have dealt with a challenging association rule mining problem of finding optimized association rules. The frequent itemsets are generated using the Apriori association rule mining algorithm. The genetic algorithm has been applied on the generated frequent itemsets to generate the rules containing positive attributes, the negation of the attributes with the consequent part consists of single attribute and more than one attribute. The results reported in this paper are very promising since the discovered rules are of optimized rules [3].

Peter P. Wakabi Waiswa and Dr. Venansius Baryamureeba et. al. present a Pareto based multi objective evolutionary algorithm rule mining method based on genetic algorithms. They used confidence, comprehensibility, interestingness, and surprise as objectives of the association rule mining problem. Specific mechanisms for mutations and crossover operators together with elitism have been designed to extract interesting rules from a transaction database. Empirical results of experiments carried out indicate high predictive accuracy of the rules generated.

In this paper deal with the ARM problem as a multi objective problem rather than as a single one and try to solve it using multi-objective evolutionary algorithms with emphasis on genetic algorithms (GA). The main motivation for using GAs is that they perform a global search and cope better with attribute interaction than the greedy rule induction algorithms often used in data mining tasks. Multi-objective optimization with evolutionary algorithms is well discussed. The proposed algorithm was tested on a dataset drawn from the UCI repository of machine learning databases. For brevity, the data used is of a categorical nature. In this paper they had dealt with a challenging NP-Hard association rule mining problem of finding interesting association rules [5].

Xin Li et al [11] proposed Frequent Itemsets Mining in Network Traffic Data. They think about the problem of frequent itemset mining problem in network traffic data, and propose an algorithm for mining frequent itemsets. They try to minimize the size of results and only maximal frequent itemsets are considered. To protect the privacy, intermediate mining results are encrypted using hashing method by different servers. The proposed algorithm is evaluated from the perspectives of accuracy and efficiency.

Mining of frequent itemsets using Genetic algorithm was proposed in [12]. This work carried out with logic of GA to improve the scenario of frequents itemsets data mining using association rule mining. The main benefit of using GA in frequent itemsets mining is to perform global search with less time complexity. This scheme gives better results in huge or larger data set. It is also simple and efficient.

Another frequent itemsets mining approach based on genetic algorithm for non binary dataset was proposed by G. Vijay Bhasker et al [13]. They present an efficient algorithm for generating significant association rules among database items. GA is used to improve the scenario and system can predict about negative attributes in generated rules. As per results obtained this scheme is simple and efficient one. The Time complexity of the algorithm is also less and suitable for non binary data sets.

In continuation with this R. Vijaya Prakash et al [14] proposed similar method mining frequent itemsets for large data set using Genetic Algorithm. They implement frequent itemsets mining for numeric attributes also. Association rule mining is used to find relationship among attributes of database. This process was much time consuming and applied on discrete attributes. GA gives the facility of global search and minimum complexity. This algorithm avoids the necessity of discretizing apriori in attribute domain. They used an evolving algorithm to find the most appropriate amplitude of the intervals that be conventional a k-itemset, so that they have an elevated support value without being the intervals too extensive.

Sanat Jain and Swati Kabra [15] proposed Mining & Optimization of Association Rules Using Effective Algorithm. In this they work on association rules organization and frequent itemsets generation using positive and negative association rule mining. They proposed an apriori based algorithm to find valid positive and negative association rule in confidence framework or structure. As per result this algorithm is efficiently works for mining of positive and negative association rules in database and also optimize positive and negative association rule using genetic algorithm. This approach also reduces the search space and improved usability of mining rules that uses correlated coefficient to judge which association rule is used to mine.

3. CONCLUSION

Here in this paper a brief introduction and survey of different algorithm that is used for the knowledge discovery. An association rule based mining approach is also given and different item sets mining approach for the knowledge extraction.

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FRAMEWORK FOR MONITORING FIREWALL FUNCTIONALITY USING INTRUSION DETECTION SYSTEMS

Peter Kiprono Kemei
Department of Computer Science, Egerton University
Njoro, Kenya.

William P.K. Korir
Department of Computer Science, Egerton University
Njoro, Kenya

Joseph Mbugua Chahira
Department of IT
Nkabune Technical Training
Meru, Kenya

Abstract: In the last few years, the intranet and Internet has experienced explosive growth due to number of benefits. Internet is insecure which makes security of private networks system an imported limitation. Firewall is installed as the first step of securing private networks. Firewalls are implemented at the block point of private network to protect them from external attacks through restricted defined rules and policies reaching network interface. Regular complaints have been raised due to invasion, intrusions and attacks of private networks even with the presence of firewalls. For purpose of confirmation, real time framework needs to be implemented to observe, examine effectiveness and functionality of firewalls by installing Network Intrusion Detection Systems (NIDS) security software within network perimeter to examine firewall operation. NIDS detects, offensive, inaccurate, or irregular action on a network and they are proper for any types of institute for defending the networks and systems. By setting up framework according to defined rules and policies deviation are reported automatically where administrator can check the events examined or audit to check if the firewall complies according to configured rules or policies where some are complex and high-level to implement all rules setup. The reported events enable the administrator to enforce and implement the appropriate rule which make the network safer to use.

Keywords: Firewall, Networks, Intrusions, Detection, Systems, Framework.

1. INTRODUCTION

Intrusions and attacks are the main threats against networks and information security. With rapidly growing illicit activities in networks, intrusion detection systems as a component of defense- in-depth are very necessary because traditional firewall techniques cannot provide complete protection against intrusion [12]. NIDS have become an essential component of computer security to detect these attacks before they inflict widespread damage [13]. They are used to monitor the usage of such systems and to detect the apparition of insecure states. They detect attempts and active misuse by valid users of the information systems or external parties to abuse their privileges or exploit security vulnerabilities [8]. NIDS make a robust application for identify, recognized and response from security violations, it needs the framework that cooperates with connected and related several components for accurate, intelligent adaptive and extensible with composite to an integrated system [6]. The main aim for integrating NIDS with a firewall includes filtering, management of update data set, the sensor can take dissimilar actions based on how they are configured and event reaction process. Security policies are decisive step to secure exacting system since it identifies the security properties. There are strong confirmation that the installation of up to date NIDS system that are position at the perimeter can defer significant protection for networks [5] which supplement major shortcomings of firewall.

2. RELATED WORK

Firewalls utilize static, manually configured, security policies to differentiate genuine traffic from non-genuine traffic. They prevent illegal external users from accessing computing resources on the internal network, avoid the negative untrusted relations impact of a break in, provide a reliable connection to the internet where users do not implement their own insecure private connections and control internal user access to the outside network to prevent the export information. Firewalls cannot provide complete protection against some attacks and intrusion [12]. They have shortcoming such as inability to prevent networks from interior attacks [11]. They may not be properly configured to stop all apprehensive packets based on rules or policies due to complex and expertise of unknown traffic or emerging threats. Utilize manually configured set of rules to differentiate genuine traffic from permitted traffic. Firewalls cannot protect against attacks that bypass the rules and policies implemented. Interior system may have dial-out ability to join to an internet service providers. An internal local area network may support a modem band that provides dial-in capability for mobile employees and teleworks which pose network security threats [2], [7], [17], [20] and cannot protect against the transfer of malicious programs or files. Firewalls are essential part of network security, but they do not provide airtight perimeter protection, due to highlighted shortcomings. In order to be sure of firewall functionality installation of updated NIDSs inserted within network environs to supplement shortcomings and examine firewall functionality could be viable. Network administrators can perform a more secure network system by using NIDSs as an extra layer of protection beside the firewall. Protecting information system today must be done in a layered process, which includes technology and user intervention. NIDSs have software potential of identifying illegal use, misuse and exploitation of computer by attackers and intruders [15].NIDS are intended to identity suspicious and wicked activities that tend to compromise the

confidentiality, integrity and guarantee of network computer systems [10]. Unlike firewalls that filter "bad traffics", NIDS analyzes packets to detect apprehensive traffic packets attempts. From the survey report CSI 2012, NIDS was ranked seventh with 62.4% [14] as per usage by network administrator to improved network security. The number and severity of these attacks has been increasing continuously [9]. NIDSs automate examine and evaluate the attacks [16] and used to classify asses and report permits network activities so that correct actions can be implemented to prevent supplementary damage [1]. NIDSs detection techniques join tools or a method that collect and audits the information from any number of sources, after collection it evaluate the information and determines problems existing in packets at some stage in transmission. It identifies and reports unauthorized or malicious network action. The main goals of NIDSs are to detect intrusions that have occurred or that are in the process of occurring in attempting to understand or moderate suspicious activities [4]. NIDS are submissive device that simply detects problems and cause alarms or alerts the security administrators**.** Detects the patterns of known attacks by corresponding pattern with the rule base. It can recognize the signatures of malware programs and the types of attacks. Encryption can be severe setback for network-based NIDS because it cannot handle encrypted network traffic [3],[18]. The encrypted traffic should be ignored by NIDS for high performance and to reduce false positives. NIDS decodes SSL and TLS traffic and stops inspection of the encrypted data. Only the SSL handshakes of each connection are inspected to determine that the last client-side handshake packet was not crafted to evade the NIDS. Once the data determined to be encrypted, further inspections of the data on the connection are stopped [19]. Detects variation from regular actions of network systems by implementing protocol and traffic anomaly detection. It detects abnormal behavior, such as extraordinary increase in traffic from a port, protocol, timestamp and several uninterrupted ineffective attempts at logging into the computer and network.

3. OBJECTIVES, APPROACH AND CHARACTERISTICS

NIDS are proactive technique used to prevent attacks from entering the network by examining various data record and detection deportment of pattern gratitude sensor when an attack are identified, intrusion prevention block and log the aberrant data. The main objective of proposed framework is to provide early caveat from intrusion security violation with knowledge based, dynamic, smart in classifying and distinguish of packet data, if curious or mischievous are detected, alert triggers and event response execute. The mechanism trigger allow process packet data associated with the event. NIDS objective is to examine stream network traffic detecting distinguishes and recognized any packets that could trace any security breaches. The proposed methodical approach differs from previous since the concepts examining firewall operation using NIDS approach in detecting normal usages and malicious activities using diverse data which leads to improvement and enhances mechanism with combine anomaly misuse based and event parameters data input. The methodological approach improvement mechanism which uses data from sources. The parameters data input includes different structure, label, variable of data detected, collection from public DNS registry, public IP Block list, universal resource locator blacklist, NIDS snort rules, vulnerability from common vulnerability and exposures, data pattern from bastion host and DMZ, signature, dynamic update patch, Log events server, web applications, firewall and network environment, spam, IP Block list, virus definition, policies definition, event from NIDS and regular reported IP address or hosts. The basic idea of exploratory firewall operation using NIDS makes a strong system for identify, recognized and reaction from security breaches, the framework connects and related several component for perfect, intelligent, adaptive and extensible components composite to an integrated system. The characteristics of the proposed framework consist of:-

- Filtering. It involves data collection from initiating dataset formerly, after effectively pass from filtering and screening. In the process, filtering, screening and proxy with firewall function, such as IP Address, port number used, protocol used and timestamp. The propose IP tables under NIDS transmission and sorting packet with accordance to security policy set. Firewalls provide diverse rule logic with dissimilar parameters based on rule set.

- Administration inform to control dataset consist of signature recognition, rules, policy, pattern, process attack, URL blacklist, renew patch, log system, listing variant of virus and normal expression, all these collected and labelled to classify attack patterns .This technique depends on the input in sequence collected in a database. The sequence in the database come from a diversity of information collected and stored periodically. In some cases, emerging attacks based on preceding patterns, particularly the attacks from malicious threat, on acquaintance process, execute composite and coalesce the data residing on the database to be sorted, queries and reused as input. The learning process occurs to unite and choose quickly by evaluating robust of the data in the database for analysis in preventing unknown attacks of intrusion.

- Sensor detects the packet events found on how they are configured. If threat evaluation passes, the system triggers event reply with status alarm or risk rating status. If an alert triggers, then the alert fused with other existing alert to decrease the number of alert with the same cause. Risk level is the quantitative measure of a network's suspicious threat level before event response alleviation. When new events are detected and sensor detect an attack, an analyst can check to see if the event's regular activity components, store in archive event database if not in list. Database component gets rate mark and lists it within risk rating can deeper examination with signature corresponding and behaviour scrutiny.

- The event reply are group into reactive response are trigger and implement after intrusion have been detected and proactive reply, aimed to anticipate actions to prevent an anticipated attack, By using this approach every unknown activity or doubtful threat has labelling according to NIDS rule based on priority classification which used in validating the framework based on information traced in order to make sound decisions.

4. FRAMEWORK CONCEPTUAL MODEL

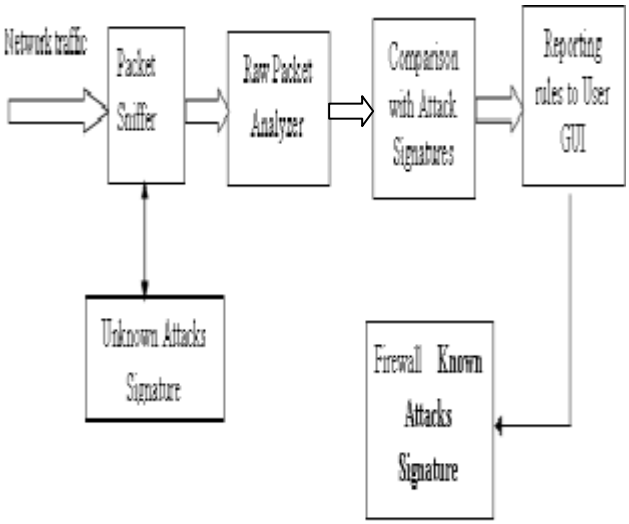

Figure 1: Framework Conceptual Model

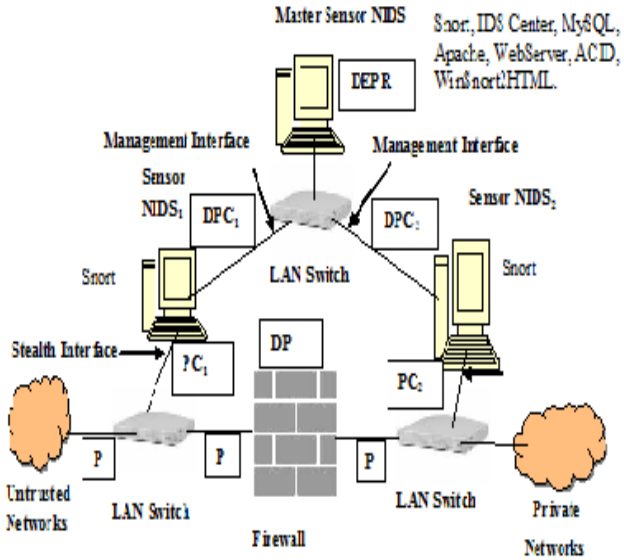

Figure 2: Framework Main Components and Network Traffic Flow Lifecycle

From the figure 1 packet sniffer module captures all incoming and outgoing network traffic. The packet sniffer installed at the edges of the network traces all suspicious packets since it operates in promiscuous mode. In raw packet analyzer module identifies attack packet signature based on packet header of particular attack identification packets details such as follows by source and destination IP address, ports, protocols, header size, Time to Live, flag bits used. Attacks identification involves extraction of essential information traces packets details and compare with raw packet analyzer to determine module actual attack launched. Reporting attack details module involves reporting the attack to the participate for decisions making such as rules, actions events, state of network, reports and alerts. It involves the conceptual model framework for examining firewall operation using NIDS main aims at identifying unknown suspicious packets both private and untrusted network to trace the firewall rule targeted or affected informs the administrator in making sound decisions. Specification of attack details such as source victim IP addresses, time stamp of attack and type of firewall rule target.

From figure 2 packets can either originate from private or untrusted network. If the packet [P] originates from an untrusted network it first encounters LAN switch. The packet [P] flows to the firewall where its main is to filter traffic depending on the rule-set configured. If the packets are drop then the packet lifecycle ends. If the Packet has some suspicious packets the sensor $NIDS_1$ have the ability to detect and a packet copy [PC_1] is created by LAN switch capabilities. The packets are delivered through stealth interface sent detected packet copy [DPC_1] for examination and analysis according to rules and policies set in Master Sensor NIDS as detected examined packet result [DEPR]. If the firewall allows, the detected packet [DP] encounters a second LAN switch where again a packet copy PC_2 created if any suspicion detected packet copy [DPC_2] should be sent to Master sensor NIDS for examination and analysis according to rules and policies defined in Master sensor NIDS to confirm if firewall truly enforce the configured rules and policies. It's normal packet then it passes to the private networks, the packet reaches the destination and packet ends the life cycle. If the packet originates from the private networks then similar procedure takes place as packet originating from untrusted networks.

5. FRAMEWORK IMPLEMENTATION MAIN COMPONENTS

5.1 Framework Implementation Monitoring Proposed Algorithm

		IF		THEN
		SENSOR $NIDS_1$	SENSOR $NIDS_2$	CHECK POINT FIREWALL
Incoming traffic	Drop	Alert	No Alert	Normal Operation
		Alert	Alert	PROBLEM
	Accept	Alert	Alert	Normal Operation
		Alert	No Alert	PROBLEM
Outgoing traffic	Drop	No Alert	Alert	Normal operation
		Alert	Alert	PROBLEM
	Accept	Alert	Alert	Normal Operation
		No Alert	Alert	PROBLEM

Table 1: Framework Monitoring Algorithm

The framework implementation examining algorithm main goal is to detect whenever there is network suspicious traffic then framework ability is to reveal the problem inclusive with captured traffic details as shown in table1.The goal of installing the sensor $NIDS_1$ in untrusted networks before the check point firewall and sensor $NIDS_2$ after the check point firewall in private networks to examine the traffic before filtration and after passing the check point firewall. The goals achieved are:-

1. Examine if check point firewall enforces configured rules /policies of incoming and outgoing traffic;
2. Examining of attacks or intrusion originating from private networks and confirmation if check point firewall enforces configured rules/policies;
3. Examining of successful packets filtered by check point firewall from private/untrusted network;
4. Gives administrators room to analyse types of attacks, intrusions and adjust the security rules / policies accordingly.
5. Adoptable as one of the source of computer, network and data communication forensic investigation.

5.2 Framework Implementation Model

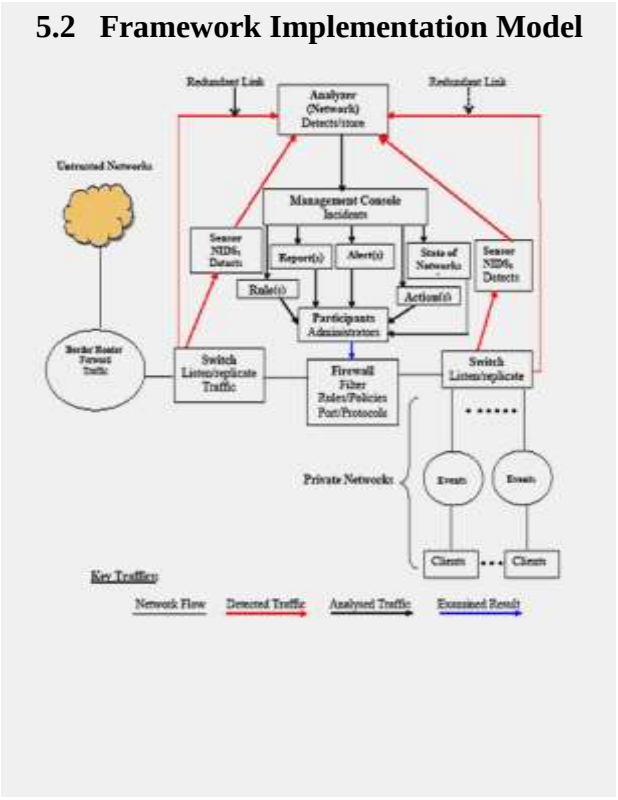

Figure 3: Framework Implementation Model

From figure 3 framework implementation model have advantages over the existing model since most of implemented models trace the packet flow only once during transit in terms of examining firewall operation between private network and firewall, untrusted network, firewall and network in general. Framework implementation model checks network traffic flows by determined by the module attributes. Framework implementation model checks network traffic flows by determined by the module attributes capabilities. It involves identification of the packets definition breaking, malfunction rules/policies affected in normal operation of firewall or network in general. The module attributes play their roles based on the functionalities. The network packet first encounters the LAN switch which have listen and replicates packets on transit and pass to the firewall to filter according to rule and policies configured. The Sensor NIDSs installed at network perimeter uses in-built abilities to detect suspicious packets flows according to signatures, pattern and bahaviour of the packet then packet captured pass to analyzer network determine breach rules or policies. The analyzed traffic passes to management console for identification of specific type of incidents. The participant implement the decisions according to the examined results which enables networks administrators to define**,** configured appropriate rules/policies to encounters firewall and network problems in general. The two redundant links supplement the link between LAN switch, Sensor NIDS and network analyzer in case link failure the link connects automatically making the examination and detection of network traffic continuously without any interruption.

6. FRAMEWORK IMPLEMENTATION MODEL RESULTS AND DISCUSSION

Most firewalls are administered by network administrator which sometimes may be complex to examine it operation depend on the nature of network. The framework proves to examine firewall operation based on configured rules-set and detects network problems or attacks from the tests and experiment analyzed.

6.1 Absence of Internal Filtering

operations	Date	Time	From	Name	To	Name	Protocol	Detection	Details
[cr][st]	08-09-2012	16:29:03	198.168.0.191:7567	Complab	198.168.0.128:27231	1125-56	tcp	[Snort: backdoor subseven 22]	Details
[cr][st]	08-09-2012	15:45:39	198.168.0.191:7567	Complab	198.168.0.128:27231	1125-56	tcp	[Snort: backdoor subseven 22]	Details
[cr][st]	08-09-2012	15:05:11	198.168.0.191:7567	Complab	198.168.0.128:27231	1125-56	tcp	[Snort: backdoor subseven 22]	Details
[cr][st]	08-09-2012	14:27:26	198.168.0.191:7960	Complab	198.168.0.128:20034	1125-56	tcp	[Snort: backdoor netbus pro 2.0 connection request]	Details
[cr][st]	08-09-2012	14:01:46	198.168.0.191:8509	Complab	198.168.0.128:20034	1125-56	tcp	[Snort: backdoor netbus pro 2.0 connection request]	Details
[cr][st]	08-09-2012	14:00:09	198.168.0.191:7960	Complab	198.168.0.128:20034	1125-56	tcp	[Snort: backdoor netbus pro 2.0 connection request]	Details
[cr][st]	08-09-2012	12:03:12	198.168.0.5	Complab	198.168.0.128:27231	1125-56	icmp	[Snort: ping of death]	Details
[cr][st]	08-09-2012	12:02:34	198.168.0.5:4567	Complab	198.168.0.128:12376	1125-56	tcp	[Snort: backdoor netbus getinfo]	Details
[cr][st]	08-09-2012	12:02:28	198.168.0.5:4567	Complab	198.168.0.128:12376	1125-56	tcp	[Snort: backdoor netbus getinfo]	Details

Figure 4: Framework Detection of Absence of Internal Filtering

From figure 4 the framework revealed that firewall was able to act according to configured rule-sets based on known traffic but cannot filter unknown traffics and its details internally. Once a host connected to internal LAN it can send packets to any host across network without internal filtering by the firewall. Experiments were conducted to test the framework by sending traffic both physical LAN and untrusted networks such wireless. All traffic got to framework indicating that no firewall filtering for unknown traffic across network boundaries which pose networks threats and intrusion. The framework was able to detect the traffics and full packets descriptions in details which can enable network administrator to implement the necessary steps on the configuration of firewall based on framework detected reports.

6.2 Heavy Traffic on Specific Ports and Protocols

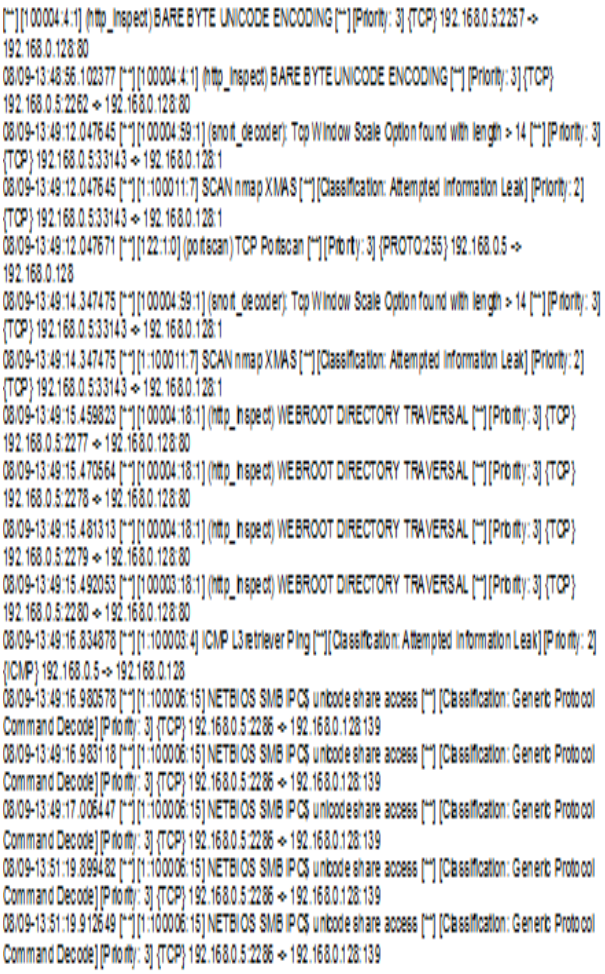

Figure 5: Heavy Traffic on Specific Ports and Protocols

From figure 5 the reported events with high number of regular traffic on ports 135, 137, 138, 139, 80, 23, 8080, 8180 and 445 as per the tests and experiment captured by the framework. Port 135 normally used to remotely managed service including DHPC server, DNS server detected by framework as among reported events using TCP protocol. Ports 137 used for NetBIOS-ns (name service), 138 used for NetBIOS-dgm (datagram service) and 139 used for NetBIOS-ssn (session service) are all network services used by NetBIOS LAN hosts for communication among themselves detected by the framework as the among most examined reported traffic using TCP protocols. Ports 80 which were initial block and open for specific services specific ACK and SYN flags but the framework also detected heavy traffic on the same port. On further analysis it revealed that the port reported used flag FIN, URG and PUSH which initial was not block on firewall rule-set chain policy utilizing TCP protocol. Framework detected heavy traffic detected on port23 used for remote access using TCP specifically ICMP telnet protocol for unencrypted text communications, initial UDP protocol was block using port 23 in firewall chain policy. Ports 8080 and 8081 uses TCP protocols especially HTTP alternate (HTTP_alt). Port 8080 commonly used by Web proxy and caching, APACHE servers was also detected by framework as among heavy traffic examined events among port not initially configured on the firewall chain rule policy. This

implies that the framework was able to detect and report the port and classifies the type of protocol used and other packet details. Port 445 using TCP protocols which used Server Massage Block (SMB) and Inter Process Communication ($IPC) for files sharing on Microsoft active directory. This was detected by framework as among the port with heavy traffic examined events reported. All these ports and protocols provide essential information about the status of the hosts within the network. This information could be used to map network services and launch network attacks or intrusion if firewall rule sets and policies are not fully implemented and operational as expected.

6.3 Suspicious Packets and Internal IP Addresses

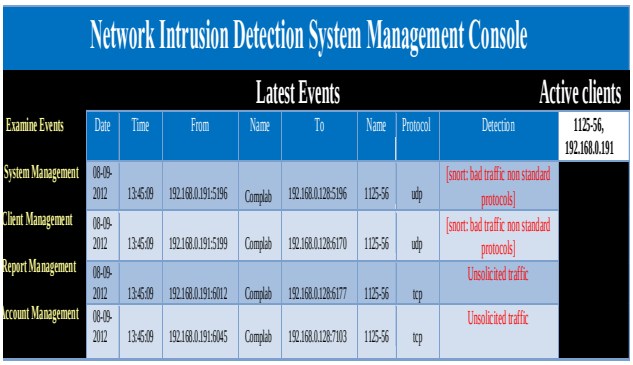

Figure 6: Suspicious Packets and Internal IP Addresses

From figure 6 the tested results from the framework traced numerous suspicious packets and internal IP address which firewall could not filter especially for network which are not centrally managed, where IP addresses are not assigned dynamically specific ports and protocols could be filtered. The framework detected bad traffic non- standard IP protocols, unsolicited connection mostly using TCP using port 445 and UDP using port 111 respectively were the most reported suspicious packets with specific hosts IP addresses source names and their destinations. Other detected packets and logged events revealed evidence by the framework was mis-configured software and hosts on the network. These two ports detected as bad traffic non standard IP protocol which portmapper to access network services both internally and externally due undetected traffic by firewall. After resetting the firewall rule set then the firewall filtered the traffic.

6.4 Suspicious Foreign Packets and IP Addresses

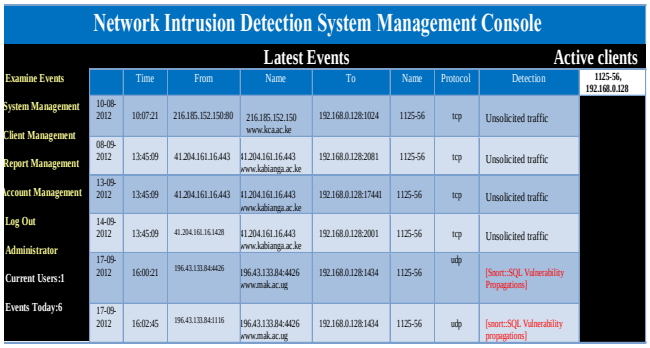

Figure 7: Suspicious Foreign Packets and IP Addresses

From figure 7 the framework detected suspicious foreign packets and IP addresses even with the installation of firewall expected to provide high degree of protection. After testing the framework using internal network foreign IP address, the IP address was delivery to the destination and the framework could detect these suspicious foreign and IP address. This indicates that the firewall was mis-configured since the number and frequency of packets on the network from foreign IP addresses and the times at which they were highly reported by the framework. Although some of the packets were drop but the fact that some packets were detected by the framework which indeed reveals a significant firewall security flaws. The framework detected TCP or UDP packets originating from untrusted network and submitted to port 1434 which were propagated by the vulnerabilities in Microsoft SQL server database management system which could launch a denial of service attacks against internet hosts and show slow down network speed by engaging the bandwidth. Many suspicious source address report by framework associated with attempting to connect to port 1024, a port that if often used by backdoor application which includes Netspy, port 10000 which host Webmin and port 161 which is associated with SNMP services**.**

7 CONCLUSIONS AND FURTHER WORK

With new emerging network threats and mostly firewall are normally configured manually they cannot be examined to critically review normally operation which leads to the option of developing a framework to examine firewall operation and network in general. Since there exist programs which have capability to detected and examine every packet flow within network setup they can utilized and implemented to examine firewall operation. This detected software includes NIDS specifically snort software which is open source having mechanism to inspect packet signature patterns and behaviours patterns. It can be utilized within network perimeters purposely to examine firewall operation and network in generally.

Firewall as network component vital in connecting two homogeneous networks. The operation of firewall has not been clearly examined to check its operation. These lead to conceptual of developing a framework which purposed installed within network environment to examined firewall operation. The framework can be adaptable since it functions on real time, which implies that it is active, persistent and careful consideration of any detected network anomalies based on framework information which forms foundation of knowledge in the light of detection grounds that support firewall and network weaknesses before making conclusion. The aim of the framework is to examine firewall and explores an issue of concern, a triggered detected packet which breaches network security policies configured in the firewall and engage to explore an order which lead to new understanding and appreciation information before implementing corrective measure. Firewall and other networks protection systems do not see packets patterns nor do they report on events that do break their rules where attacks and intruders may that advantage to exploit the network services without being noticed. The proposed framework can provide extended information on possible incidents management where administrator and users can use in providing defense in depth analysis of firewall operation and current network security status. Firewall do not see what happen within themselves where approve request are not saved or traced. Pattern attacks are detected by the framework

instantly and problems of firewall as well. Generated events and reports provides a solid base for any network incident, valuable information directly from the source, long run or incidental problems as well which enable network administrator to analysis and make sound decision based on reported events. By setting up framework according to rules and policies deviation are reported automatically where administrator can check the events examined or audit to check if the firewall is compliant according to configured rules or policies where some are complex and high-level. The reported events enable the administrator to enforce and implement the appropriate rule which make the network safer to use. The framework application as integrated part of the network information technology landscapes any new application or internet both from internal or untrusted networks is check from day one instantly. Further research should be carried for cases of IP spoofing events, watch list IP assigning methods, detected attacks which generates false positives alerts from NIDSs and over reported detected network traffic which should improve the framework performance.

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