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Development of Web-based Job Fair Information System

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Abstract: The development of information technology should be ordered to improve the services including job fair information system services. This work aimed to develop of web-based job fair information system. The methods used in this work consists of collecting data method, and software development method. Collecting data method using observations, interview, and literature study. Software development method using waterfall model comprising the steps of requirements, specfification and design, implementation, testing, deployment, and maintenance. The results of this work is software web-based information system provided a job information, registration, and test schedule information.

Keywords: Web-based; job fair; information system; waterfall model; software

1. INTRODUCTION

Utilization of information technology (IT) in various fields to support the easy and productivity of work at this time is very fast growing. IT utilization has also been used by various organizations or institutions to recruit prospective employees, so that the job information more quickly spread and the registration process has become more effective and efficient. This research was conducted in a Vocational School in Indonesia, namely SMKN 1 Salam Magelang. As well as to access a job fair information and registration systems, applicants should be came to school, it can be causing the applicants often miss information about job vacancies. Therefore, this work aimed to develop of web-based job fair information system.

Theory and research of recruitment show that objective characteristics, subjective considerations, and critical contact send the information of organization and opportunities to prospective applicants [1]. Specially, in selection and assessment decision making of human resources fields needed certification [2], therefore in vocational high schools in Indonesia also conducted tests competence for certification of expertise.

The work has been done before, such as applying signaling theory to the web-based recruitment domain and by testing a mediated relationship implied therein [3]; Web-based job management system simulated mechanism of user for HPC job scheduler in windows HPC sever platform [4]; Web-based framework for job-embedded technology-enhanced social language learning [5]; basic information service of job post resource based on web mining [6]; web-based job submission mechanism for scientific cloud computing [7]; and job-searcher for high school student based on deep web technology [8]. In this paper will be discussed, how about the development of web-based job fair information system using model waterfall.

The rest of this paper is organized as follows. In Section 2, described the method used in this work. In Section 3, results and discussion. The conclusion is presented in Section 4.

2. METHOD

The methods used in this work consists of: 1) collecting data method, and 2) software process development model. Collecting data method using observations, interview, and literature study. Software process development model using waterfall comprising the steps of requirements, specification and design, implementation, testing, deployment, and maintenance [9]. In this work phase waterfall model performed up to implementation and testing. Every phase comes after a phase is completed and tasks can be divided according to phases. The output of one phase becomes input of next phase but could have the option to revisit phases in the next cycle [10].

3. RESULTS AND DISCUSSION

3.1 Requirements

Information collected from data collection phase has been carried out, the requirements needed for the system that will be built must answer the following issues, such as:

1. A facility for job information. How a system may provide job information that can be accessed by the public.
2. A registration facilities. How a system may provide registration facilities for applicants.
3. A schedule test information. How a system may provide a schedule test information.

3.2 Specification and design

3.2.1 Systems Specification

Specification system and design phase were completed before the implementation phase. This phase is important to produce a system utilized as needed. The registration procedure on the website applicants asked to fill out a form including full name, school name, major, address, email, mobile phone, and verification code, in order to get a username and password used to system login. After the student login, next step is to fill out form to complete the registration, and then submit a document required. All information about latest job vacancies are design to display in the first page of website, also information about latest test schedule information will be provided in the first page. For more information applicant could be chosen by menu (Figure 1) that provided by system.

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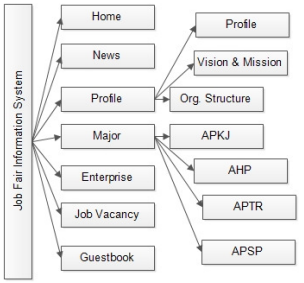

Figure 1. Job fair information system menu

The system built have three external entities including members, administrators and head of officer. Privileges access for each external entity, such as:

1. Prospective members registering as a new member by fill out the data including name, school name, major, Address, Email, mobile phone. Furthermore, prospective member will be received an activation log through email, then members could register to existing vacancies.

2. Administrators user could be manipulate (change, delete), the data of enterprise, news, job vacancies, and member.

3. Head of officer receives print out the reports of member, job vacancies, and member of job vacancies.

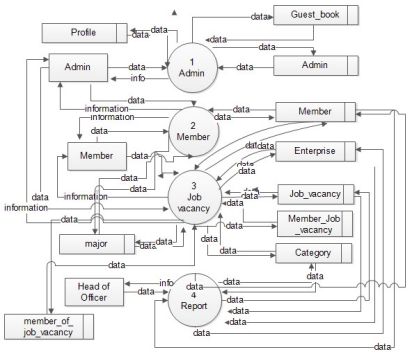

Figure 2. Data flow diagram job fair information system

Figure 2 shows that the general processes of job fair information system, i.e. Administrators process, members process, job vacancies process, and reports process. The description of each process are as follows:

1. Administrators Process. Administrators could be updating, deleting, inserting, and storing the data to all table including admin table, member table, enterprise table, job vacancy table, and category table.

2. Members Process. The prospective member could be entry the data member stored in the member table.

3. Job vacancy Process. Through this process member could be registering to the job vacancies stored in Member Job Vacancies table, and view the information. Administrators could be manipulating news and the data of job vacancies.

4. Report Process. Head of officer could be accessing the member reports, enterprise reports, and job vacancies which retrieved from the data source such as, table of member, job vacancies, member job vacancies, enterprise, and category.

3.2.2 Database design

To create a database application used for the enterprise application is a complex phase, which have the activities involving database schema design, design of the programs that access and update the data, and design of a security scheme to control access to data [11]. In this work used two model data to create a databases, such as entity relationship data model, and relational data model. A data model is a collection of conceptual tools for describing data, data relationships, data semantics, and consistency constraints [11].

3.2.2.1 Entity relationship data model

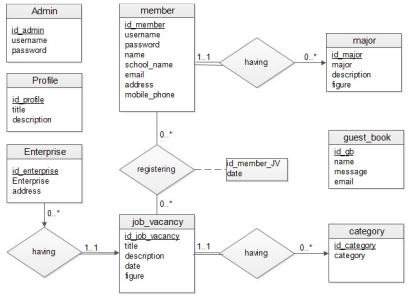

Figure 3. Entity relationship diagram

The E-R model is very useful in mapping the meanings and interactions of real-world enterprises onto a conceptual schema [11]. The ER model used three basics concepts, involving entity sets, attributes, and relationship sets [11], [12]. The entity set in this work has founded 8 entity sets (Figure 3) involving admin entity, member entity, profile, entity, enterprise entity, major entity, guest book entity, job vacancy entity, and category entity. Three entity sets no have a relationship sets, such as admin entity, profile entity, and category entity.

Entity relationship model data could not be implemented to database management system (DBMS), furthermore this

model data should be reduction to relational data model [12]. To reduction process of entity relationship model refer to Silberschatz *et. al.* [11], [13].

3.2.2.2 Relational data model

Relational data model is a model data that uses collection of tables to represent both data and the relationships among those data [11]. If the previous phase using entity relationship data model, then the relational data model created is the reduction result from the data model entity relationship created before. The reduction results showed the tables created is 9 tables (Figure 4), because relationship between member entity sets and job_vacancy sets resulting 1 new table, namely member_job_vacancy table. Other entity sets being a table (Figure 4).

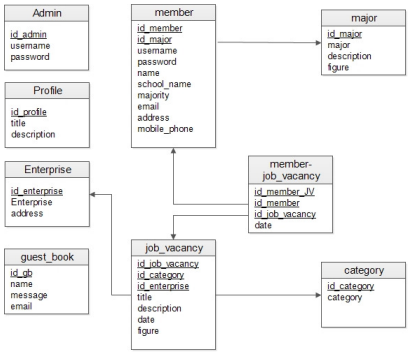

Figure 4. Schema database diagram

3.3 Implementation and testing

System implementation is how to explain the implementation of the requirements which has been set, such as software and hardware used for the system could be running and work optimally.

The first one in this section described software and hardware that supporting the system. The system can run properly and optimally if the system runs on recommended software specification, involving: 1. Operating system Windows (XP, Vista, and 2. Mozilla Firefox and Google Chrome browser. To endorse the system running, it is necessary that adequate hardware like processor and RAM used. The specification of hardware is: 1) Processor Intel (minimum P4) 2) 512 MB RAM.

3.3.1 GUI for member

Figure5. Shows the screen shot of hompage of job fair information system. The menu designed in the horizontal navigation, such as menu : Home, News, Profile, Major, Enterprise, Job Vacancy, and guest books.

In part of home page (Figure 5) there is page for member login, if member already have a username and password can be login directly. But, if the member do not heve a username and password should be register first.

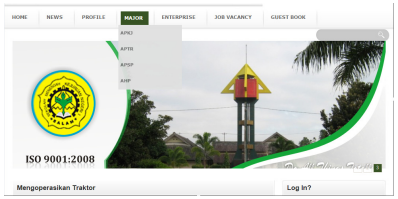

Figure 5. Screen shot of home page

To be a member should be fill out registration form (Figure 6), including username, password, full name, school name, major, address, email, and mobile phone.

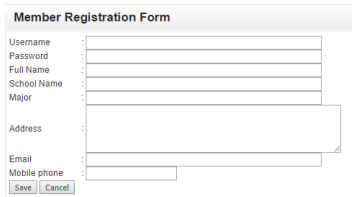

Figure 6. Registration page

The example of coding shown in Figure 7. Line 7 to 27 are syntax to show the form of register. On line 7, the command `action="simpan_anggota.php"` used for stored the data to member table.

Figure 7. Syntax of registration page

Menu pages for public user, including: Home, News, Profile, Major, Enterprise, Job vacancy, and Guest book.

3.3.2 GUI for Administrator

User administrator should be login first to access all menu to manage the job fair information system (Figure 8).

Figure 8. Login form

The Administrators could be manipulating all data and information in this system, including updating, deletion, insertion, and stored new data to the database. The menu of administrator as follows: news, job vacancy, member, profile,

major, enterprise, category, guest book, and application report (Figure 9). The syntax of administrator menu shown in Figure 10.

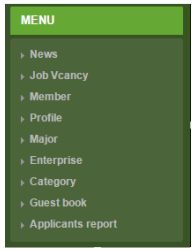

Figure 9. Menu pages of administrator

```
1 <li><a href="index.php?page=1"><b>News</b></a></li>
2 <li><a href="index.php?page=23"><b>Job Vcancy</b></a></li>
3 <li><a href="index.php?page=16"><b>Member</b></a></li>
4 <li><a href="index.php?page=7"><b>Profile</b></a></li>
5 <li><a href="index.php?page=13"><b>Major</b></a></li>
6 <li><a href="index.php?page=10"><b>Enterprise</b></a></li>
7 <li><a href="index.php?page=4"><b>Category</b></a></li>
8 <li><a href="index.php?page=17"><b>Guest book</b></a></li>
9 <li><a href="index.php?page=20"><b>Applicants report</b></a></li>
```

Figure 10. Syntax menu pages of administrator

System test results on some browsers including Google Chorme, Mozilla firefox, and Internet explorer and can be viewed properly. However, need to be improved for adaptability in which accessed or executed on mobile devices such as smart phone and tablet. Recently web-based software development for addaptibility to many devices is one of the important factors. The system should be allowed software developers to implement software such as for mobile devices [14].

4. CONCLUSION

The conclusion of this work as follows:

1. The system built could be providing the information about job vacancy, information about schedule test, member registration facilities, list of enterprise, and list of member registered to job vacancy.
2. The user of the system are public user, user member registered in system, and user administrator. Head officer received the print out of the report from the system.
3. The system need to improvement for adaptability in which accessed or executed on mobile devices such as smart phone and tablet.

5. ACKNOWLEDGMENTS

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Understanding Working Memory for Improving Learning

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Abstract: A web-based working memory (WM) test system is a management system website that allows students to test their ability and skills in remembering visual patterns. It also enables you to record and store the data for individuals. The system is developed using HTML, PHP and MySQL as a database system to manage and store the data. The system targets several users: children and adults who suffer from attention deficit or learning problems. The main objectives for developing the website are to educate the community on the benefits of performing the working memory test of the activity of the brain and improvements in social skills and improving poor academic and professional performance, especially in maths and reading comprehension. This study implements a set of tasks, testing 59 adults aged 18-24 years of age at King Abdul-Aziz University for testing and measuring WM and cognitive abilities. Results showed tests depended on the age entry by the user. The implications of the test results will help people know their WM level before ascertaining the appropriate suggestions, and to make the test suit our society.

Keywords: Web-based Working Memory, Short Term Memory, Baddeley Theory, WM Training, Long Term Memory

1. INTRODUCTION

Baddeley and Hitch [1] and Baddeley [2] replaced the concept of the short-term memory (STM) with working memory (WM). The crucial difference was that short-term memory was a simple store for information, while the more modern concept of working memory is assumed to be a cognitive component combining storage, processing and executive control of the cognitive processes at hand.

Baddeley and Hitch defined WM as "a brain system that provides temporary storage and manipulation of the information necessary for complex cognitive tasks" [1].

WM plays an essential role in complex cognition so the strength of working memory is often measured with cognitive tests, such as repeating lists of numbers in reverse order or recalling sequences of dots on a screen. People are constantly throughout life dependent on their memory. The definition of working memory is the ability to keep information on-line, typically for a few seconds .

Memory and learning are inseparable. Therefore, you cannot minimise the importance of memory in learning. Learning allows us to acquire knowledge and gain new skills. The memory is the process through which is achieved storage and retention of this knowledge and these skills: to store and activate what has been learned when we wish to use it again in the future [3].

The connection between WM and learning at least in part why WM capacity appears to predict a wide range of academic abilities, including reading and understanding, and gaining language, maths and thinking skills.

Several studies have found an association between performance on domain-specific WM measures and academic subjects.

Deficits in science and maths are the result of spatial disabilities and weaknesses in acquiring a language and learning English occur due to verbal WM disabilities. so the ability of WM can help the student to limit or contribute to the academic performance by performing some of the training.

Thus, this supports the relationship between WM, learning and academics. Therefore, you can improve the capacity to learn and maintain new information by strengthening the ability of WM. You can then use this improvement for academic achievement. This will improve reading comprehension, and you can use it as a means to improve educational competencies, accounting maths and logic skills [4].

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Proven by previous studies is that the study of improvements in Visual Attention and Working Memory through a Web-based Cognitive Training Program can improve cognitive abilities after days of training. Thus, Lumos developed Improvement of Visual Attention and Working Memory through a Web-based Cognitive Training Program that makes cognitive training tools accessible to many people and provides benefits for an individual to change and improve their abilities online from home. The program comprises a set of exercises such as Memory Match and Monster Garden to improve attention and proves you can change the capacity of the WM in healthy adults.

"Memory Match is a speeded n-back task where users must compare the current stimulus with those presented previously". In addition, the idea of Monster Garden is to navigate through several stages of the mazes while depending on spatial memory, avoiding obstacles to move to another stage. Also, the number of obstacles increases to provide for more difficult stages. The results of this study indicate that training and improving cognitive abilities such as memory, attention and how well people interact socially, and conducting tasks of daily living from problem-solving to driving, are possible with a web-based application [5][6].

Another study, CogMed Working Memory Training: CogMed WM Training, is based on the many studies designed for individuals with ADHD and/or working memory deficits and focuses in this research about effects on students. The goal of the program is to determine when the WM can be improved so the student can learn multiple skills very easily compared to before. CogMed acts as a start for improved learning, allowing the student to build the cognitive platform needed to learn and achieve success in professional and academic performance [7]. CogMed is the online program content of a group of exercises based on age, so we select/discuss one exercise for every age, for example.

- •CogMed JM - for pre-schoolers the game is Animals
- •CogMed RM - for school-age the game is visual data link
- •CogMed QM - for older adolescents and adults the game is chaos

The results of this study indicate that training can improve WM, which enables the student to solve different problems, especially at poor educational and academic levels and in the case of ADHD [8][9][10]. In addition, the study of Visual Working Memory Capacity for Emotional Facial Expressions to evaluate the ability of visual STM.This study initial stimuli display consisted of six different facial expressions, each of which occupied 3.38 º x 2.58 º of visual angle. When generating initial stimuli displays, six pictures were randomly pulled from a set of seven pictures, with the restriction that two or more identical expressions could never be present at the same display. then erased the initial stimuli and presented a blank screen for 500 ms.Then only one image of facial expression is chosen located in one place in the initial display. The results of this study indicate that the memory capacity is estimated through accurate response. It has been found that the capacity of visual memory for emotional facial expressions work equals 3.07, which is high compared with the ability to flip the identities and other visual stimuli [11].

Then there is the study on the Impact of Working Memory Training on Memory Performance in Old–Old Adults. In this study, they investigated whether training WM had a salutary effect on the performance of WM and episodic memory octogenarians. For this study, they developed three variants of WM computerised training missions that seem to be more age-appropriate. All of our WM task variants continuously adjusted to the individual's WM capacity in an adaptive way: If performing well in a particular task, the task gets harder, but if performance fell below a certain level, the task gets easier. The results of this study appear in WM task variant 1: substantial improvement was seen: . The results of this study appear in WM task variant 1: substantial improvement was seen: [12].

Finally, the study of measuring developmental changes in WM capacity. Measure the WM performing during scanning the place of circle and identifies to increase capacity of WM that measure brain activity. The test focused on filled circles which appear at the start but when the unfilled circles appear, press the button. It was made to test for visual stimulation and eye movements. The result indicates the difference between the load 3 and load 5 linked with age. WMC correlated with WM capacity and WM activity investigated the interaction between WM load and age. There are visual stimuli in task when load 3 tasks will show the difference in visual simulation [13].

The aim of this study is to develop a web-based WM system to test your ability and skills for remembering visual patterns and training to improve the memory that involves temporary storage by using Baddeley theory (2000) [14] for a working memory test. We are focusing in this study on weakness of WM and its impact on education. Also in this paper we discuss how to measure the rate of WM to keep information for a period of time and cognitive abilities for improving learning. The authors chose 59 students from King Abdul-Aziz University and randomly selected students (females) from the Faculty of Computing and Information Technology from different departments (computer science, information system, information technology) for a test to measure WM and cognitive abilities.

2. Baddeley theory

Since Alan Baddeley's WM theory co-developed with Graham Hitch was published in 1974 and based on his previous studies in psychology, he has published on many WM aspects in many journal articles. In addition, he states on the faculty webpage, "My interests are in human memory, neuropsychology and in the practical application of cognitive psychology" [2][14][15].

The term WM is first applicable to computational modelling and animal learning research after changes in cognitive psychology in the book Plans [2][14][15]. In the past, the term WM referred to short term memory (STM) and described the ability to keep information over a brief period of time (seconds) but now the concept of STM has been replaced by WM, which has increased focus on the concept of manipulation of information instead of passive maintenance [16].

The working memory test depends on Baddeley theory whose definition of working memory is the ability to keep information on-line, typically for a few seconds. It can be divided into "primary" memory, with a partial capacity, and "long term" memory. It also depends on different modules such as the Central executive (CE), Phonological loop (PL) and Visuospatial sketchpad, but now we focus in this test on measuring your ability and skills to remember the visual patterns and keep information for a few seconds. For example, some activities that are dependent on memory, such as remembering instructions or solving mathematical problems such as when you want to calculate the sum of numbers or other operations require both processing and storage in the cognitive activities. In addition, reading requires

understanding of information and retrieval in memory [17]. when individuals suffer from weakness in WM the performing daily activities become difficult, such as can not complete the learning activities and instructions. Thus, it is important to verify whether WM can be improved [18]. However, until recently, this poor WM could not be overcome, but some success in improving performance using WM training confirmed possible change [19].

3. Method

We met with a psychology expert to learn how to improve WM by providing a collection of tests to assess and develop the fundamental cognitive/mental skills and cognitive skills of a person like WM using visual processing method. We conducted the WM test on students of King Abdul-Aziz University to measure their WM performance.

3.1 Participants

The total number of participants was 59 adults aged 18-24 years old. Participants in this research were mostly taken from King Abdul-Aziz University; the experiment was done in (Female section) the Faculty of Computing and Information Technology from different departments (9 from information technology, 41 from information system and 9 from computer science department) for testing and measuring WM and cognitive abilities.

3.2 Instruments

The task of one of the types of WM test that depended on the Baddeley theory was created and run on computers in Lab 118. The test began at 12:00 pm and lasted until 2:00 pm; the number of participants was 59 students from University of king Abdul Aziz , Faculty of Computing and Information Technology in differently departments (computer science, information system , Information Technology), each group performed the test then the same way for the next group . Before the test, I began speaking about instructional information concerning the aims of the test and the time required to finish it. When they began the test that appeared to them, many pictures were displayed sequentially for 3 seconds. Each time a new picture appeared the more difficulty (increased number of options and shapes) so as to make them more focused on thing, place, shape, meaning they could answer more questions and arrive at a time of higher stage with repetition to develop memory from the STM to WM.

3.3 Procedure

The section below expounds how can be using website for procedure Working memory tests and determine and measure of WM by obtain the percentage of abilities.

When they had solved all 40 questions, the results were shown to them.

Sign-up:

On this page, the user was required to fill in the registration form and create an account before he/she started the test, as shown in Figure 1.

Figure 1: sign up page

- **Starting the test:**

The test start page is shown in Figure 2 and this page contains a sign-in form and the button that directs the user to the sign-in form, and on the left-hand side when clicked then some instructions that contain some of examples of the test appear. Also, the taker had to select the type of payment such as Visa or licence number for admin validation purposes, as shown in Figure 3.

Figure 2. Test start page

Figure 3. Test start page

Captions should be Times New Roman 9-point bold. They should be numbered (e.g., "Table 1" or "Figure 2"), please note that the word for Table and Figure are spelled out. Figure's captions should be centered beneath the image or picture, and Table captions should be centered above the table body.

Test page:

Now after the taker number is entered at the bottom, click next and click on start the test (see Figures 4, 5). The test page contains the test and displays a set of questions and every question were displayed a set of pictures sequentially for 3 seconds. Each time a new picture appeared the more difficulty (increased number of options and shapes) so as to make them more focused on thing, place, shape, meaning they could answer more questions and arrive at a time of higher stage with repetition to develop memory from the STM to WM (see Figures 5-13). After answering all 40 questions, the system then calculated the correct answers and displayed two results: the number of correct answers and the percentage depending on the age entry for the user. Also, advice was displayed about the result of the test concerning WM (see Figure 14).

Figure 4: Enter licence number page

Figure 5: Start the test page

Figure 6: The beginning of the test

Figure 7: Two images of fruit appear

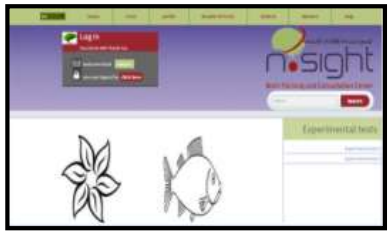

Figure 8: A flower and a fish are displayed

Figure 9: The final two images are shown

Figure 10: Answer questions

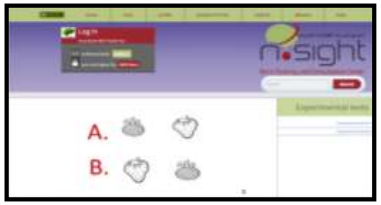

Figure 11: Click answer for picture 1

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Figure 12: Click answer for picture 2

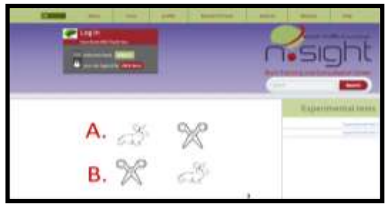

Figure 13: Click answer for picture 3

Figure 14: the results of the WM test after answering all questions

4. Results

Based on an analysis of the answers, the authors found that Twenty three participants who had the low score (the number of correct answers being less than to the mean). This excepts thirty-six participants who had the high score (the number of correct answers being greater than or equal to the mean). The mean of correct answers for all participants was = 26.3, SD= 4.8 (see Table 1). The correct answers of participants divided into three percentiles were aggregated as follows: see Table 2.

1) <= 25% (11 participants that had the correct answers within the [<= 25%] percentile interval.
2) >25%-50% (19 participants that had the correct answers within the [>25%-50%] percentile interval.
3) >50%-75% (20 participants that had the correct answers within the [>50%-75%] percentile interval.
4) >75% (9 participants that had the correct answers within the [>75%] percentile interval.

Table 1: Descriptive statistics

No_Correct

N	Valid	59
	Missing	0
Mean		26.3559
Median		26.0000
Std. Deviation		4.80934
Variance		23.130
Percentiles	25	23.0000
	50	26.0000
	75	30.0000

Table 2:Frequencies of correct answers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16.00	1	1.7	1.7	1.7
	17.00	1	1.7	1.7	3.4
	18.00	3	5.1	5.1	8.5
	19.00	1	1.7	1.7	10.2
	20.00	2	3.4	3.4	13.6
	21.00	1	1.7	1.7	15.3
	22.00	2	3.4	3.4	18.6
	23.00	5	8.5	8.5	27.1
	24.00	4	6.8	6.8	33.9
	25.00	3	5.1	5.1	39.0
	26.00	7	11.9	11.9	50.8
	27.00	3	5.1	5.1	55.9
	28.00	5	8.5	8.5	64.4
	29.00	6	10.2	10.2	74.6
	30.00	6	10.2	10.2	84.7
	31.00	4	6.8	6.8	91.5
	32.00	1	1.7	1.7	93.2
	35.00	1	1.7	1.7	94.9
	36.00	2	3.4	3.4	98.3
	38.00	1	1.7	1.7	100.0
	Total	59	100.0	100.0	

5. Discussion

In discussing the results cited the following themes were evident:

1) <= 25% (11 participants that had the correct answers within the [<= 25%] percentile interval. Advice for students: Taking action to increase brain skills is a crisis intervention to not only improve limited capabilities but make higher levels of skill an attainable option.
2) >25%-50% (19 participants that had the correct answers within the [>25%-50%] percentile interval. Advice for students: Taking action to increase brain skills is a critical need to overcome definite weakness, alter mental abilities and allow their capabilities to grow.
3) >50%-75% (20 participants that had the correct answers within the [>50%-75%] percentile interval. Advice for students: Taking action to increase brain skills is a priority based upon personal goals.
4) >75% (9 participants that had the correct answers within the [>75%] percentile. Advice for students: Taking action to increase brain skills is a critical need to overcome definite weakness, alter mental abilities and allow their capabilities to grow.

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6. Conclusion

This paper discussed that impairments of working memory are closely associated with learning deficits, as well as daily classroom activities.Without early intervention, memory deficits cannot be made up over time and will continue to compromise individual's likelihood of academic success. The results may be useful in evaluating their problems, as well as helping them to reduce memory-related failures that lie at the root of substantial learning difficulties, and thus improving the WM is strongly recommended.

7. Future work

There are many areas that can make the system more efficient by adding greater functionality. For example:

- Activation of payment procedures online by providing payment services such as PayPal, credit card and Visa, etc.
- We used this test on elementary and Bachelor's level students. We hope to apply this test to all levels of education, and to male subjects, too.
- Implementing a smart phone app.
- The system could be applied at a Saudi university for improve learning.

8. Acknowledgments

We would like to thank N.Sight Brain Training and Consultation Centre for supporting and helping in the research.

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A Survey of File Replication Techniques In Grid Systems

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Abstract: Grid is a type of parallel and distributed systems that is designed to provide reliable access to data and computational resources in wide area networks. These resources are distributed in different geographical locations. Efficient data sharing in global networks is complicated by erratic node failure, unreliable network connectivity and limited bandwidth. Replication is a technique used in grid systems to improve the applications' response time and to reduce the bandwidth consumption. In this paper, we present a survey on basic and new replication techniques that have been proposed by other researchers. After that, we have a full comparative study on these replication strategies.

Keywords: Grid environment, Data Grid, Replication, Replication Strategy, Replication Techniques.

1. Introduction

Nowadays, the management of the huge distributed and shared data resources efficiently around the wide area networks becoming an important part of shared recourses. In many fields, which are totally diverse in nature, like high energy physics, bioinformatics, earth observations, global climate changes, image processing, and data mining; the volume of data of interest is measured in terabytes and some time in petabytes Which need to be shared and analyzed[1].

Storing such amount of data in the same location is difficult, even impossible. Moreover, an application may need data produced by another geographically remote application. For this reason, a grid is a large scale resource sharing and problem solving mechanism in virtual organizations and is suitable for the above situation [2]. In addition, users can access important data that is available only in several locations, without the overheads of replicating them locally. These services are provided by an integrated grid service platform so that the user can access the resource transparently and effectively [3].Managing this data in a centralized location increases the data access time and hence much time is taken to execute the job. So to reduce the data access time, "Replication" is used [4]. When a user generates a request for a file, large amounts of bandwidth could be consumed to transfer the file from the server to the client. Furthermore the latency involved could be significant considering the size of the files involved. The main aims of using replication are to reduce access latency and bandwidth consumption. Replication can also help in load balancing and can improve reliability by creating multiple copies of the same data [5].

The replication is the process of creation and placement of the copies of entities software. The phase of creation consists in reproducing the structure and the state of the replicated entities, whereas the phase of placement consists in choosing the suitable slot of this new duplication, according to the objectives of the replication. So, replication strategy can shorten the time of fetching the files by creating many replicas stored in appropriate locations [6], [7]. By storing the data at more than one site, if a data site fails, a system can operate using replicated data, thus increasing availability and fault tolerance. At the same time, as the data is stored at multiple sites, the request can find the data close to the site where the request originated, thus

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increasing the performance of the system. But the benefits of replication, of course, do not come without overheads of creating, maintaining and updating the replicas [8].

There is a fair amount of work on data replication in grid environments. Most of the existing work focused on mechanisms for create, decision and delete replicas. The purpose of this document is to review various replication techniques and compare these techniques which have been presented by other researches in different distributed architectures and topologies.

The rest of this paper is organized as follows. In the third section, we present an overview of grid systems, types of grids and topologies that exist for grid systems. The third section describes replication scenario, challenges and parameters of evaluating replication techniques. Section four takes a closer look on basic and new existing data replication strategies in grid environment. In section five, we present a comparative study on the replication techniques that were discussed in the previous Section. Finally, section six will be reserved for the conclusion.

1. Motivation

In highly distributed environment of a grid, availability of data, response time, access cost, bandwidth consumption, reliability, scalability are some very important metrics to be considered.

The motivation of this survey is to explore the existing dynamic replication strategies so that the researchers can include all the necessary metrics in their works in this domain and the limitations of the existing ones can be overcome.

2. Grid Systems

When a user generates a request for a file, large amounts of bandwidth could be consumed to transfer the file from the server to the client. Furthermore the latency involved could be significant considering the size of the files involved. Our study investigates the usefulness of creating replicas to distribute these huge data sets among the various scientists in the grid. The main aims of using replication are to reduce access latency and bandwidth consumption. The other advantages of replication are that it helps in load balancing and improves reliability by creating multiple copies of the same data [9]. In [10] Foster introduced us to a definition of a grid as follows "coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations". There are different types and topologies of Grid developed to emphasize special functions that will be defined in the two next sections.

2.1. Types of Grid

Grid computing can be used in a variety of ways to address various kinds of application requirements and it has three primary types. Of course, there are no hard boundaries between these grid types and often grids may be a combination of two or more of these [11]. Types of grids are summarized below:

- Computational grid: Computational grid is focused on setting aside resources specifically for computing power. Such as most of the machines are high-performance servers [11].
- Scavenging grid: Scavenging grid is most commonly used with large numbers of desktop machines that are scavenged for available CPU cycles and other resources. Owners of the desktop machines are usually given control over when their resources are available to participate in the grid [11].
- Data grid: A data grid is a collection of geographically distributed computer resources. These resources may be located in different parts of a country or even in different countries. A grid connects all these locations and enables them to share data and other resources [9]. For example, you may have two universities doing life science research, each with unique data. A grid connects all these locations and enables them to share their data, manage the data, and manage security issues such as who has access to which data [12].

2.2. Grid Topologies

In this section we present an overview of major grid topologies. The performance of replication strategies is highly dependent on the underlying architecture of grid [13].Graph and tree models are used where there is a single source for data and the data has to be distributed among collaborations worldwide [13]. The Figure 1 and Figure 2, shows the Graph and tree models respectively.

A tree topology also has shortcomings. The tree structure of the grid means that there are specific paths to the messages and files can travel to get to the destination. Furthermore, data transference is not possible among sibling nodes or nodes situated on the same tier [13].

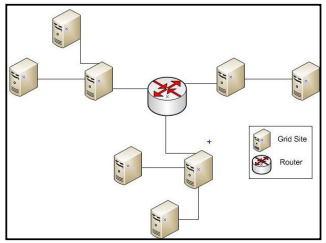

Figure 1.An example of Graph topology.

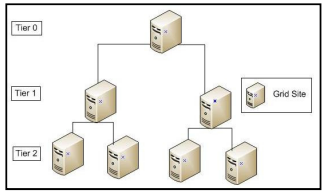

Figure 2.An example of Tree topology.

Peer to Peer (P2P) systems overcome these limitations and offer flexibility in communication among components. A P2P system is characterized by the applications that employ distributed resources to perform functions in a decentralized manner. From the viewpoint of resource sharing, a P2P system overlaps a grid system. The key characteristic that distinguishes a P2P system from other resource sharing systems is its symmetric communication model between peers, each of which acts as both a server and a client [13]. The Figure 3 shows an example of the P2P structure.

Hybrid Topology is simply a configuration that contains an architecture consisting of any combination of the previous mentioned topologies. It is used mostly in situations where researches working on projects want to share their results to further research by making it readily available for collaboration [13]. A hybrid model of a graph grid with peer linkages at the edges is shown in Figure 4.

A hybrid topology can carry features of both tree and P2P architectures and thus can be used for better performance of a replication strategy [12].

Figure 3.An example of Peer to Peer topology.

Figure 4.An example of Hybrid topology.

2.3. Classification of existing data replication techniques

The data replication algorithm has to answer critical questions such as which data must be replicated and where the replica must be placed. The dynamic behavior of grid users makes it difficult to make decisions regarding the data replications to attain the target of maximum availability.

Replication techniques can be classified into two main streams, **static replication** and **dynamic replication**. In a static replication strategy, the number of replicas and the host node is chosen statically at the start of the life cycle, no more replicas are created or migrated after that [14]. On the other hand, dynamic strategies adapt to changes in user request pattern, storage capacity and

bandwidth and can create replicas on new nodes and can delete replicas that are no longer required depending upon the global information of the data grid [9]. The dynamic strategies are better than the static ones because they can make intelligent decisions about the placement of data depending upon the information of the grid environment. Simultaneously, there are drawbacks as well; a replication decision center is required in a data grid which needs to collect the runtime information of all the nodes in a complex grid infrastructure. The overload of this central decision center further increases if the nodes in a data grid enter and quit frequently. In case of the decentralized approach, further synchronization is involved making the task difficult. Hence, the focus of this paper is only the dynamic replication strategies keeping in mind that the static replication strategies, though very simple to implement, are less useful.

2.4. Data Replication challenges

Using replication strategies in grid environment may cause some challenges. The four important challenges in replicated environments areas follow [8]:

- Time of creation of a new replica: If strict data consistency is to be maintained, performance is severely affected if a new replica is to be created. As sites will not be able to fulfill request due to consistency requirements.
- Data Consistency: Maintaining data integrity and consistency in a replicated environment is of prime importance. High precision applications may require strict consistency of the updates made by transactions.
- Lower write performance: Performance of write operations can be dramatically lowered in applications requiring high updates in replicated environment, because the transaction may need to update multiple copies.
- Overhead of maintenance: If the files are replicated at more than one site, it occupies storage space and it has to be administered. Thus, there are overheads in storing multiple files.

2.5. Data Replication evaluation

All replication strategies use subset of these parameters [15]:

- Access latency: Almost all the replications strategies try to reduce the access latency thus reducing the job response time and hence increase the performance of the grids.
- Bandwidth consumption: Similarly almost all the replication strategies try to reduce the bandwidth consumption to improve the availability of data and performance of the system. The target is to keep the data as close to the user as possible, so that data can be accessed efficiently.
- Balanced workload: Some of the replication strategies explicitly target to provide a balanced workload on all the data servers. This helps in increasing the performance of the system and provides better response time.
- Maintenance cost: With more number of replicas in a system the cost of maintaining them becomes an overhead for the system. Some of the strategies aim to make only an optimal number of replicas in the data grid. This ensures that the storage is utilized in an optimal way and the maintenance cost of replica is minimized.
- Strategic placement: Some strategies target the strategic placement of the replicas along with an optimal number of replicas. The strategic placement of replicas is a very important factor because it is integrated with few other very important factors. For example, if the replicas are placed on the optimal locations it helps to optimize the workload of different servers. It is also related with the cost of the maintenance.
- Job execution time: another very important parameter is Job execution time. Some replication strategies target to minimize the job execution time with optimal replica placement. The idea is to place the replicas closer to the users in order to minimize the response time, and thus the job execution time. This will increase the throughput of the system.
- Fault tolerance, quality assurance: Only a few replication strategies have considered replication as an option to provide fault tolerance and quality assurance.

3. Replication Techniques

The role of a replication strategy is to identify when a replica should be created, where to place replicas, when to remove replicas and how to locate the best replica. Several replication replacement strategies

have been proposed in the past and they are the basics of other replication algorithms.

3.1. Techniques for peer to peer architecture

Ranganathan et al. [16] have presented a Dynamic Model-Driven Replication strategy which proposes that data availability can be improved in large peer to peer communities. In this approach the peers can automatically produce the replicas in a decentralized fashion whenever it is required to improve the availability of data. Each peer has a set of tools by which it can find out the state of the system to take the replication decision.

The proposed replication strategy considers the following parameters: (1) Average probability of a node being up. (2) The transfer time to replicate data from one node to another node. (3) The storage cost of file F at a given node. (4) The accuracy of replica location method. The algorithm works in following steps:

1) Collect the above mentioned parameters.
2) Using those parameters it finds out a required number of replicas (r) for a file.
3) Using a replica locator service finds out existing number of replicas (M).
4) If M >r wait and check again.
5) If M <r use a resource discovery procedure to find a host for replica.
6) Send replica to the selected remote host. The target of this approach is to find an optimal number of replicas and determine the best host for a new replica.

Abdullah [17] presented a P2P model in 2008 for higher availability, reliability, and scalability. In proposed models all the peers operate independently within a peer group. All peers working in a group agrees upon a common set of services. Peers can join or leave a group at any time. When a peer joins a group it can share the data of other peers, and its own data is shared by others. A peer can be a member of more than one group at a time. Peers can share the data sets with each other without knowing from which peer they are getting the data. The process of data discovery starts when a request is forwarded to all the neighbors depending upon information stored in the routing table. Two are newly proposed in this research: ‘‘path and requestor node placement strategy’’, and ‘‘N-hop distance node placement’ ’strategy. In the ‘‘requestor node placement strategy’’ a required file when found is replicated to the requestor node only. In the ‘‘path node placement strategy’’ the file is replicated to all the nodes on the path from requestor node to provider node. The newly proposed strategy ‘‘path and requestor node placement strategy’’ is a combination of the first two strategies. In ‘‘N-hop distance node placement’’ a file is replicated to all neighbors of provider nodes within an n hop distance.

Cashing plus Cascading combines cascading and plain cashing strategies. The client caches file locally, and the server periodically identifies the popular files and propagates them down the hierarchy. Note that the clients are always located at the leaves of the tree but any node in the hierarchy can be a server. Specifically, a Client can act as a Server to its siblings. Siblings are nodes that have the same parent [12].

3.2. Techniques for multi-tier tree architecture

The multitier topology provides a very economical and efficient way to share the storage, computational and the network resources. It allows hundreds and thousands of users to share the common resources efficiently. Ranganathan et al. [9] have proposed six different replication techniques for three different access patterns in 2001. The main aims are reduced access latency and bandwidth consumption.

1) No Replication: in this case only the root node contains the replicas.
2) Best Client: a replica is created for the client who accesses the file the most.
3) Cascading: a replica is created on the path of the best client.
4) Plain Caching: a local copy is stored upon initial request.
5) Caching plus cascading: combines plain caching and cascading strategies.
6) Fast Spread: file copies are stored at each node on the path to the best client.

- NO Replication strategy will not create replica and therefore, the files are always accessed remotely. One example of the implemented strategy is the Simple Optimizer algorithm, which never performs replication; rather it reads the required replica remotely. Simple Optimizer algorithm is simple to implement and performs the best relative to other algorithms in terms of the storage space usage, but performs the worst in terms of job execution time and network usage [12].
- Best client creates replica at the client that has generated the most requests for a file, this client is called the best client. At a given time interval, each node checks to see if the number of requests for any of its file has exceeded a threshold, then the best client for that file is identified [12].
- Cascading Replication supports tree architecture the data files generated in the top level and once the number of accesses for the file exceeds the threshold, then a replica is created at the next level, but on the path to the best client, and so on for all levels, until it reaches to the best client itself [12].
- Plain Cashing: The client that requests a file stores a copy locally. If these files are large and a client has enough space to store only one file at a time, then files get replaced quickly [12].
- Fast Spread: In this method a replica of the file is stored at each node along its path to the client. When a client requests a file, a copy is stored at each tier on the way. This leads to a faster spread of data. When a node does not have enough space for a new replica it deletes the least popular file that had come in the earliest [12].
- Simple Bottom-Up (SBU) and Aggregate Bottom-Up (ABU) are two dynamic replication mechanisms that are proposed in the multi-tier architecture for data grids. The SBU algorithm replicates the data file that exceeds a pre-defined threshold for clients. The main shortcoming of SBU is the lack of consideration to the relationship with historical access records. For the sake of addressing the problem, ABU is designed to aggregate the historical records to the upper tier until it reaches the root. The results shown improvements against Fast Spread strategy. The values for interval checking and threshold were based on data access arrival rate, data access distribution and capacity of the replica servers [18].
- Proportional Share Replica (PSR) policy is an improvement in Cascading technique. The method is a heuristic one that places replicas on the optimal locations by assuming that the numbers of sites and the total replicas to be distributed are already known. Firstly an ideal load distribution is calculated and then replicas are placed on candidate sites that can service replica requests slightly greater than or equal to that ideal load [19].
- Multi-objective approach is a method exploiting operations research techniques that is proposed for replica placement. In this method, replica placement decision is made considering both the current network status and data request pattern. The problem is formulated in p-median and p-center models to find the p replica placement sites. The p-center problem targets to minimize the max response time between user site and replica server whereas the p-median model focuses on minimizing the total response time between the requesting sites and the replication sites [20].
- Latest Access Largest Weight (LALW) is a dynamic data replication mechanism. LALW selects a popular file for replication and calculates a suitable number of copies and grid sites for replication. By associating a different weight to each historical data access record, the importance of each record is differentiated. A more recent data access record has a larger weight. It indicates that the record is more pertinent to the current situation of data access [21].
- Adaptive Popularity Based Replica Placement (APBRP) is a dynamic replica placement algorithm, for hierarchical data grids which is guided by “file popularity”. The goal of this strategy is to place replicas close to clients to reduce data access time while still using network and storage resources efficiently. The effectiveness of APBRP depends on the selection of a threshold value related to file popularity. APBRP determines this threshold dynamically based on data request arrival rates [22].

- Predictive hierarchical fast spread (PHFS) is a dynamic replication method in multi-tier data grid environments which is an improve version of common fast spread. The PHFS tries to forecast future needs and pre-replicates the min hierarchal manner to increase locality in accesses and improve performance that consider spatial locality. This method is able to optimize the usage of storage resources, which not only replicates data objects hierarchically in different layers of the multi-tier data grid for obtaining more localities in accesses. It is a method intended for read intensive data grids. The PHFS method use priority mechanism and replication configuration change component to adapt the replication configuration dynamically with the obtainable condition. Besides that, it is developed on the basis of the concept that users who work on the same context will request some files with high probability [23].

- Dynamic Hierarchical Replication (DHR) is a dynamic replication algorithm for hierarchical structure that places replicas in appropriate sites. Best site has the highest number of access for that particular replica. This algorithm minimizes access latency by selecting the best replica when various sites hold replicas. The replica selection strategy of DHR algorithm, selects the best replica location for the users running jobs by considering the replica requests that waiting in the queue and data transfer time. It stores the replica in the best site where the file has been accessed most, instead of storing files in many sites [24].

- Modified Latest Access Largest Weight (MLALW) is a dynamic data replication strategy. This strategy is an enhanced version of Latest Access Largest Weight strategy. MLALW deletes files by considering three important factors:

  1. Least frequently used replicas
  2. Least recently used replicas
  3. The size of the replica

  MLALW stores each replica in an appropriate site in the region that has the highest number of access in future for that particular replica. The experiment results show that MLALW strategy gives a better performance compared to the other algorithms and prevents unnecessary creation of replica which leads to efficient storage usage [25].

- The combination of Modified DHR Algorithm (MDHRA) and Combined Scheduling Strategy. MDHRA considers three factors for replacing replicas: (1) the last time the replica was requested; (2) number of accesses and (3) size of replica. It computes the response time based on the data transfer time, storage access latency, the unprocessed replica requests and the distance between nodes. The computed response time is used to select the best replica location [26].

3.3. Techniques for general grid topology

In 2004 [27] Park et al. proposed an internet hierarchy based replication strategy called BHR to reduce the data access time by avoiding network congestions. In proposed model there can be different network regions combined with each other. If a required file is present within a region there will be less number of routers in path, but if the file has to be fetched across the region from another region, there will be more number of routes in the path. Within a region there will be broad bandwidth available. Network level locality means that if the required file is fetched from the site having broad bandwidth, it will reduce the response time significantly.
Bandwidth Hierarchy Replication (BHR) is a novel dynamic replication strategy which reduces data access time by avoiding network congestions in a data grid network. With BHR strategy, we can take benefits from "network-level locality" which represents that required file is located in the site which has broad bandwidth to the site of job execution. BHR strategy was evaluated by implementing in OptorSim simulator and the results show that BHR strategy can outperform other optimization techniques in terms of data access time when hierarchy of bandwidth appears in Internet. BHR extends current site-level replica optimization study to the network-level [27].

3.4. Techniques for general graph architecture

In 2005 Rehman et al. [28] presented six dynamic replication strategies based on utility and risk for

two different kinds of access patterns. Before placing a replica at a site they considered both utility and risk index for each site according to the current network load and user requests. A site with optimized utility and risk index is than chosen for replication. They have used Graph as architecture to represent a data grid, which is closer to the real life grid scenario than a typical hierarchal architecture. Their model uses average response time a basis for comparison among various replication strategies. The best replication strategy has lower response time. The algorithms proposed based on utility select a replica site assuming that the future requests and current loads and user requests. Algorithms proposed based on risk index expose sites far from all other sites and assume a worst case whereby future requests will primarily originate from here. The replication algorithm selects one site per iteration to host a replica.

Bsoul et al. [29] in 2010 have presented an Enhanced Fast Spread replication technique for data grid. EFS consider the number and frequency of requests, size of replica and last time the replica was requested while making the replication decision. They have considered a network topology (which is a complete graph) in which there is one server node and many clients. The server node has the main storage with all the data and the clients have less storage space available as compared to the server. Whenever a file is required it is first searched locally, and is used if found. If it is not available then the client traverses the shortest path until it finds the required file. The fast spread strategy replicates the file on all nodes along the path. If storage on any node is not enough if remove some file(s) to make room for new replica using LRU or LFU.

- Agent-based replica placement algorithm is proposed to determine the candidate site for the placement of replica. For each site that holds the master copies of the shared data files will deploy an agent. The main objective of an agent is to select a candidate site for the placement of a replica that reduces the access cost, network traffic and aggregated response time for the applications. Furthermore, in creating the replica an agent prioritizes the resources in the grid based on the resource configuration, bandwidth in the network and insists for the replica at their sites and then creates a replica at suitable resource locations.

- Least Frequently Used (LFU) strategy always replicates files to local storage systems. If the local storage space is full, the replica that has been accessed the fewest times is removed and then releases the space for new replica. Thus, LFU deletes the replica which has less demand (less popularity) from the local storage even if the replica is newly stored [30].

- Least Recently Used (LRU) strategy always replicates files to local storage system. In LRU strategy, the requested site caches the required replicas, and if the local storage is full, the oldest replica in the local storage is deleted in order to free the storage. However, if the oldest replica size is less than the new replica, the second oldest file is deleted and so on [30].

- Weight-based dynamic replica replacement strategy calculates the weight of replica based on the access time in the future time window on the last access history. After that, calculate the access cost which embodies the number of replicas and the current bandwidth of the network. The replicas with high weight will be helpful to improve the efficiency of data access, so they should be retained and then the replica with low weight will not make sense to the rise of data access efficiency, and therefore, should be deleted. The access history defines based on the zipf-like distribution [31].
- Efficient Replication strategy is a replication strategy for dynamic data grids, which take into account the dynamic of sites. This strategy can increase the file availability, improved the response time and can reduce the bandwidth consumption. Moreover, it exploits the replicas placement and file requests in order to converge towards a global balancing of the grid load. This strategy will focus on read-only-access as most grids have very few dynamic updates because they tend to use a "load" rather than "update" strategy.

There are three steps provided by this algorithm, which are:

1) Selection of the best candidate files for replication; Selected based on requests number and copies number of each files.
2) Determination of the best sites for files placement which are selected in the previous step; Selected based on requests number and utility of each site regarding to the grid.
3) Selection of the best replica; Taking account the bandwidth and the utility of each site [32].

- Value-based replication strategy (VBRS) is proposed to decrease the network latency and meanwhile to improve the performance of the whole system. In VBRS, threshold was made to decide whether to copy the requested file, and then solve the replica replacement problem. VBRS has two steps; At the first steps, the threshold will be calculated to decide whether the requested file should be copied in the local storage site. Then at the second stage, the replacement algorithm will be triggered when the requested file needs to be copied at the local storage site does not have enough space. The replica replacement policy is developed by considering the replica's value which is based on the file's access frequency and access time. The experiment results show that the effectiveness of VBRS algorithm can reduce network latency [33].
- Enhance Fast Spread (EFS) is an enhanced version of Fast Spread for replication strategy in the data grid. This strategy was proposed to improve the total of response time and total bandwidth consumption. Its takes into account some criteria such as the number and frequency of requests, the size of the replica and the last time the replica was requested. EFS strategy keeps only the important replicas while the other less important replicas are replaced with more important replicas. This is achieved by using a dynamic threshold that determines if the requested replica should be stored at each node along its path to the requester [34].

4. Comparative Study

In this section, we present a full comparative study on the replication techniques that were discussed in the previous section.Benefits of data replication strategies are:

Availability: All the replication strategies aim to provide maximum availability. Rather, it would be better to say that replication is the only way to improve availability of data: generally in all distributed database environments and specifically in data grids.

Reliability: When replication increases the availability, the reliability is improved as well. The more the number of replicas more is the chance that user's request will be serviced properly, and hence systems is more reliable.

Scalability: It is another important metric that must be considered by a replication algorithm. The extent to which scalability can be provided depends upon the architecture chosen for the data grid. Different architectural models support different levels of scalability. That means, scalability is more dependent on model than replication algorithm.

Adaptability: This is a very important parameter which must be provided by a replication strategy. The nature of the grid is very dynamic. Nodes keep on entering and leaving the grid very frequently. The replication algorithm must be adaptive to provide support to all nodes present in a data grid at any given time.

Performance: As the availability of data increases the performance of the data grid environment increases.

All replication strategies use any subset of these parameters.

- Reduced access latency.
- Reduced bandwidth consumption.
- Balanced workload.
- Less maintenance cost.
- Strategic replica placement.
- Job execution time.
- Increased fault tolerance.
- Quality assurance.

These replication strategies that discussed in the previous section are compared in the Table 1, Table 2, and Table 3.

Table 1: Replication Technique for Tree topology

Replication Technique	Year	Performance Metric	Method	Additional Feature
Best client	2001	Response time , Bandwidth conservation	Replicates file to site that generates maximum number of requests	Need to compute number of request for each file
Cascading	2001	Response time , Bandwidth conservation	If number of requests exceeds threshold then replica trickles down to lower tier	Need to define a threshold for number of requests
Plain Cashing	2001	Response time , Bandwidth conservation	A requesting client receives the file and stores a replica of it locally	
Fast Spread	2001	Response time , Bandwidth conservation	If a client requests a file then a replica of file stores at each node along the path toward the client	Need to storing request history to avoid of double replicating
Simple Bottom-Up (SBU)	2005	Replication frequency, Bandwidth cost, Response time	Creates replicas as close as possible to the clients that request the data files with high rates exceeding the pre-defined threshold	Need to process records in the access history individually
Aggregate Bottom-Up (ABU)	2005	Replication frequency, Bandwidth cost, Response time	Aggregates the history records to the upper tier step by step till it reaches the root	Need to access history
Proportional Share Replica (PSR)	2004	Mean of response time	Calculates an ideal workload and distributes replicas	Need to define ideal workload
Multi-objective	2006	Average response time	Reallocates replicas to new candidate sites if a performance metric degrades significantly over best k-time periods	Need to calculate replica relocation cost
Latest Access Largest Weight (LALW)	2008	Network usage, Mean job execution time	Selects a popular file for replication and calculates a suitable number of copies and grid sites for replication	Need to find out a popular file and suitable site
Adaptive Popularity Based Replica Placement (APBRP)	2010	Storage cost, Average bandwidth cost, Job execution time	Selects a threshold value related to file popularity and places replicas close to clients to reduce data access time while still using network and storage resource efficiency	Need to determines threshold value dynamically, based on data request arrival rates
Predictive hierarchical fast spread (PHFS)	2011	Average access latency	Tries to forecast future needs and pre-replicates the min hierarchical manner. Uses the hierarchical replication to optimize the utilization of resources	Need to considering spatial locality and using predictive methods
Dynamic Hierarchical	2012	Mean job execution time	Selects best replica when various sites hold replicas.	Need to access history

Replication (DHR)			Places replicas in appropriate sites that has the highest number of access for that particular replica	
`Modified Latest Access Largest Weight (MLALW)	2012	Effective network usage, Mean job execution time	Stores each replica in an appropriate site. Deletes files by considering least frequently used replicas, least recently used replicas and the size of the replica factors	Need to LRU lists of replicas, LFU lists of replicas and access history
Modified Dynamic Hierarchical Replication Algorithm (MDHRA)	2013	minimizes the bandwidth consumption thus reducing the network traffic	replaces replicas based on the last time the replica was requested, number of access, and file size of replica	Need to the last time the replica was requested, number of accesses and size of replica

Table 2: Replication Technique for peer to peer & general grid topology

Replication Technique	Year	Performance Metric	Method	Additional Feature
Cashing plus cascading	2001	Response time , Bandwidth conservation	Joining two replication techniques: Cashing and cascading techniques	Need to define a threshold for number of requests
Bandwidth Hierarchy Replication (BHR)	2004	Total job execution time	Replicates files which are likely to be used frequently within the region in near future	Need to define network-level locality and regions

5. Conclusion

Replication enables faster access to files, decreases bandwidth consumption, and distributes server load. In contrast to static replication, dynamic replication automatically creates and deletes replicas according to changing access patterns, and thus ensures that the benefits of replication continue even if user behavior changes.

In this paper, a review and a comparative study has been done on basic and new replication techniques that have been implemented in grids. After a brief introduction, an overview of grid systems, types of grids and grid topologies were presented in Section 3. In Section 3, replication scenario, challenges and ways of evaluating replication techniques were described. In Section 4, we have presented a classification of dynamic replication strategies for grid environment. In Section 5, a full comparative study was presented on the replication techniques that were discussed in Section 4. And finally, in this section, Table 4 is presented that shows the results of discussed replication techniques.

From this survey it can be seen that there is still a lot of work to be done in the field of data replication in grid environment.

Table 3: Replication Technique for Graph topology

Replication Technique	Year	Performance Metric	Method	Additional Feature
Agent-based replica	2009	Execution time test, Data availability test	By an agent for each site that holding the master copies, select a candidate site for the placement of replica that exceeds the conditions	Need to define agents
Least Frequently Used(LFU)	2003	Job execution time	Always replicates files to local storage , if no space : delete least accessed files	Need to files access history
Least Recently Used (LRU)	2003	Job execution time	Always replicates files to local storage , if no space : delete oldest file in the storage	Need to files access history
Weight-based dynamic replica	2008	Effective network usage, Mean job execution time	Calculates the weight of replica based on the access time in the future time window, based on the last access history	Need to access history that define based on zip-like distribution
Efficient Replication	2010	Response time, Effective Network Usage	Takes into account the dynamic of sites. Exploits the replicas placement and file request in order to converge towards a global balancing of grid load	Need to considering dynamicity of sites
Value-based replication strategy (VBRS)	2010	Mean job time, Effective Network Usage	Calculates the ideal threshold to decide whether the file should be copied or not. Chooses the replica that should be replaced based on the values of the local replicas	Need to define threshold
Enhance Fast Spread (EFS)	2011	Total response time, Total bandwidth consumption	Uses a dynamic threshold that determines if the requested replica should be stored at each node along its path to the requester. Keeps only the important replicas while other less important replicas are replaced with more important replicas	Need to frequency of requests, the size of the replica and the last time that the replica was requested

Table 4 : SUMMARIZES THE MAJOR RESULTS OF REPLICATION TECHNIQUES IN GRIDS

Replication Technique	Result	proper strategies
Cascading[12]	Has an small degree of locality	Tree
Cashing[12]	High response time	Tree
Cascading plus Cashing[12]	Better performance than cascading Better performance than cashing	Peer to Peer
Fast Spread[12]	High I/O and CPU load High storage request	Tree
Proportional Share Replication (PSR)[19]	Better results over cascading technique	Tree
Bandwidth Hierarchy Replication (BHR)[27]	Better total job times than LRU and LFU	Peer to Peer
Simple Bottom-Up (SBU)[18] Aggregate Bottom-Up (ABU)[18]	Better results over Fast Spread technique	Tree
Multi-objective approach[20]	Good performance in dynamic environments	Tree
Weight-based replication[31]	Better performance than LRU and LFU	Graph
Least Access Largest Weight (LALW)[21]	Better job execution time and effective network usage than LRU, LFU and BHR	Tree
Adaptive Popularity Based Replica Placement (APBRP)[22]	Better performance than Best client, Cascading, Fast Spread, ABU and LRU	Tree
Efficient replication strategy[32]	Improves the response time Increases data availability Reduces bandwidth consumption	Graph
Value Based Replication Strategy (VBRS)[33]	Decreases network latency Improves performance of the hole system	Graph
Enhanced Fast Spread (EFS)[34]	Improves total of response time Improves total bandwidth consumption Enhanced version of Fast Spread for replication strategy in data grid	Graph
Predictive Hierarchical Fast Spread (PHFS)[23]	Optimizes the utilization of resources Decreases access latency in multi-tier data grids Improved version of common Fast Spread Lower latency and better performance compared with common Fast Spread	Tree
Dynamic Hierarchical Replication (DHR)[24]	Prevents unnecessary creation of replica Efficient storage usage Minimizes access latency	Tree
Modified Least Access Largest Weight (MLALW)[25]	Modified version of LALW strategy Better performance than LRU, LFU, BHR, LALW and DHR	Tree
Modified Dynamic Hierarchical Replication Algorithm (MDHRA)[26]	Modified DHR Algorithm is compared with LFU, LRU, BHR, Modified BHR, 3LHA and DHR and was proved the best	Tree

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Using a Mobile Based Web Service to Search for Missing People – A Case Study Of Kenya

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Abstract: Being out of touch with a loved one is concerning and not hearing from someone you care about is terrifying. Several cases of missing people have been reported for many years, where most of the searches turn out unsuccessful. In order to quickly reunite families and friends with their missing loved ones, a solution for effectively searching for the missing people is presented. In evaluation of this solution, an F1 score test was simulated using 20 scenarios, out of which an impressive score of 0.72 was attained. The study concludes that we need to leverage on mobile based technology to device a more efficient method of finding missing persons more easily and quickly.

Keywords: Mobile Application; Emergency communication system; National Disaster Operation Centre(NDOC); Emergency communication system(ECS); United Nations(UN); Missing Persons Community of Interest(MPCI); International Committee of the Red Cross(ICRC)

1. INTRODUCTION

Reports of missing persons worldwide have increased significantly in the past recent years, from roughly 450,000 in 1990 to about 10,000,000 this year [1]. The increase was driven in part by the ever growing population. The numbers indicate that more people are becoming victims each day. An astounding 2,300 Americans are reported missing every day, including both adults and children. Kenya on the other hand has at least 20,000 missing people on record every year. Out of the reported number,40% are located after a long period of search while 30% are left untraced. Only 30% of the reported victims are found within a reasonably short period of up to 3 months.

More recently, the abductions of children and adults have reawakened public concern about missing people. In most parts of the world, the police and non-governmental organizations working with missing people have recently reviewed their policies and are planning to improve coordination of their work [2]. People end up missing in different scenarios [3]. The circumstances that may lead adults or children to become missing people are often complex and multi-layered. The missing phenomenon is best understood as a continuum in which a break in contact may be either intentional or unintentional. Some people make a conscious decision to leave, albeit often not in circumstances of their own choosing, while others may drift apart from family members over time. Some may never have intended to be missing, and indeed may not conceptualise their experience in these terms, while others may be forced apart through the actions of others. Some of the causes entailed herein are natural disasters, psychological complications, abduction and domestic conflicts [4].

2. PREVIOUS EFFORTS DONE IN THE SEARCH FOR MISSING PEOPLE

Research concerning missing persons has been done in the past. A few of the research efforts have been successfully implemented while others did not see the light of the day for a number of reasons. These past researches can enable us to develop a lens through which we can view the phenomenon under this important study [5].

Advances in technology have had a major impact on tracing, mainly by speeding up the transmission of information to huge numbers of people, according to the International Committee of the Red Cross (ICRC) Central Tracing Agency. The ICRC started tracing in the late 1800s to alert families to the whereabouts and well-being of detained relatives. It currently relays hundreds of thousands of messages linking families back together and providing the peace of mind and closure so often absent in times of crises. In 2009 alone, more than 253,000 messages were collected and delivered. Tracing assisted the repatriation of Congolese prisoners of war, and enabled nearly 200 video calls between detainees and their families[6].

Following Haiti's earthquake in January 2010, Google developed an open source web application, Person Finder, which is a registry and message board for survivors, family and friends to post and search for information about one another's whereabouts following a natural disaster. Up until now, following five natural disasters, the registry has collected more than 200,000 victim names [7].

The Dutch government has also adopted a mobile phone danger alert system that sends text messages to people who could be affected by natural disasters or terrorist attacks. The system, called Cell Broadcast, uses GSM technology to identify cell phone users in a particular area [8]. If a disaster occurs, a message is sent to all phones in the area, warning of the danger.

3. METHODOLOGY

The goal was to come up with a prototype of a solution for finding missing persons fast enough to find them safe and sound. The solution is an innovation leveraging on the use of the readily available mobile phone devices and the internet. This kind of approach has shown success in the past [9]. It is also intended to be a solution that takes into consideration privacy and other legally constraining issues that surround missing people [10]. The block diagram in figure 1 below represents the conceptual model of the solution.

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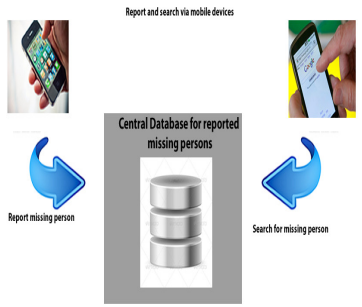

Figure 1. The Conceptual model

2.1 Reporting a Missing Person

In case a person goes missing, family members, friends or acquaintances should be able to report the case on the system. They should be able to do so by registering the person's details such as name, age, tribe, place of origin and description. This should give an exhaustive description of the missing person to increase chances of the reader spotting and reporting them.

2.2 Reporting a Found Person

A person having been reported as missing, can be reported as found if spotted anywhere. Anyone with the leading information should be able to post them on the system, about the person in question.

Even the missing people can report themselves in case they are able to access the system and in a condition that may allow them to do so. The current location and contact details of the missing person should be provided, as well as those of the person reporting the case. The reporter may need to be contacted for further details.

2.3 Sending Email Notification Alerts

In case there is a match between a missing and a found person the system will send email alerts to those who have reported missing cases and have subscribed to the service. The algorithm used to match involves some major details like names, gender and tribe of the missing person.

2.4 Search for a Missing Person

Users should be able to search for their missing loved ones on the system. The system provides a search criteria to make their search easier and relevant e.g name of missing person, tribe, age and gender.

The user is then able to see feeds or updates about the missing person they reported. There may be multiple entries about a single missing person, reported by different people at different times. All these updates should appear if they are associated with the missing person, as they may provide quality leading information to finding the missing person. Figure 2 below is a screen shot that captures the search results.

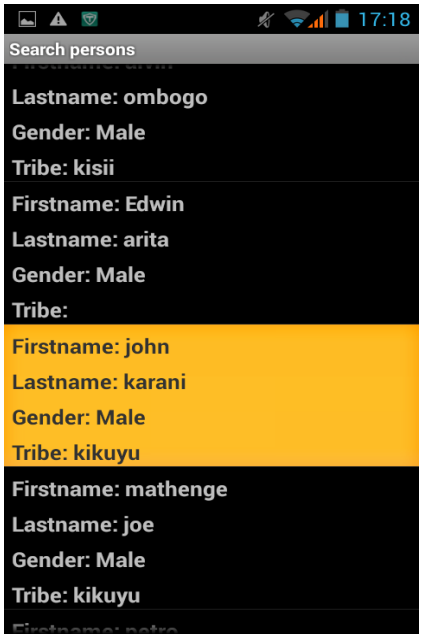

Figure 2. Screen shot showing search results of missing people

3. GENERAL PROCEDURE

The general procedure followed by the system is as illustrated in figure 3 below. A family member or friend reports a missing person case. Anyone with recovery details about the missing person updates the records by providing leading information. The missing case reporter keeps searching for any leading information from the system.

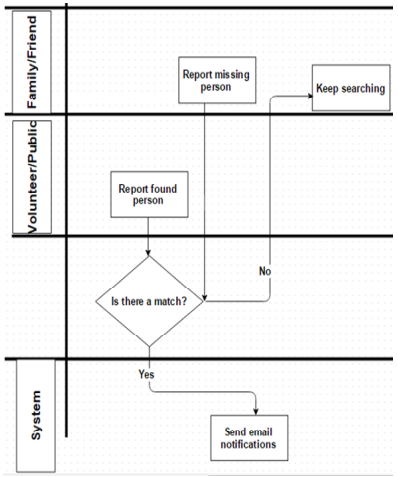

Fig 3. General procedure flow chart

The stakeholders of this emergency communication system include the lost case reporter, found case reporter and missing person. The lost case reporter may be a friend, family member of a person acquainted to the missing person.

4. RESULTS

After full implementation and testing of the system, evaluation of the prototype was done with the aim to determine if the developed system is delivering the expected results. The following areas were evaluated to provide answers to the research questions set at the feasibility study of the project, which are in line with the project objectives and requirements. This information was realized by use of both qualitative and quantitative methods during the collection of data [11].

4.1 Determining the search success rate

To determine this rate, 20 people were reported as missing in the prototype. The success rate was recorded in the database clearly showing matches of people reported as missing and those reported as found. Whenever there is a match, a notification alert is sent to the reporter of the missing person together with the leading information concerning the victim's current whereabouts. Table 1 below is a summary of the evaluation results.

Table 1. Summary of the evaluation results of finding missing persons

Cases reported	Search success	Search failure
20	16	4

The following pie chart in figure 4 illustrates the portion of success rate versus the failure rate.The success rate is significant enough to quaify the prototype as having satisfied the objectives and expectations of the study.

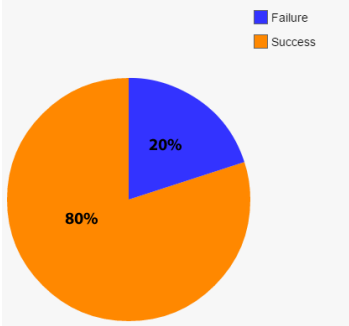

Figure 5. Pie Chart showing the success rate of finding missing people by using the mobile application

During the tests carried out in evaluation it was determined that reasons why a missing person may not be identified are:

- The person is not reported as missing in the system.
- The person may be reported with different names and other details from the ones used to search.

The prototype was tested under each of the following scenarios:

- **Unit testing -** Each functional module was tested during and after development to ensure that it meets the requirements. Additionally, basic validation has been done to ensure the correct input data on each module.
- **Integration testing -** This testing was done before, during and after integration of all the modules. It therefore checks that the system has the flow required, from the point of reporting lost cases to missing cases and outputting notification alerts.

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- **Acceptance testing -** We conducted a beta testing of the system on a sample of users. Some of the users disguised as lost case reporters while others as found case reporters. Wherever there is a match of records, email notifications are sent to the lost case reporters, providing them with the leading information about their missing people. The search function was also included in the test.

Besides, a computation of **F_1 score** test was conducted to measure the system's accuracy. This being a statistical analysis [12], the **F_1 score** considered both precision *p* and the recall *r* of the test to compute the score. *Precision(p)* is the number of correct results divided by the number of all returned results while *recall(r)* is the number of correct results divided by the number of correct results that should have been returned. The F_1 score can be interpreted as a weighted average of the precision and recall, where an F_1 score reaches its best value at 1 and worst score at 0.

After considering 20 search test cases in the system, the following results were yielded:
Total scenarios = 20
Successful searches = 16
Correct searches = 13
Precision = 13/16
Recall = 13/20
F1 = 2(0.528125/1.4626)

F1 = 0.72

4.2 Measuring access of web database

The measures of efficiency considered were:

- Successful lost case report
- Successful found case report
- Successful search for reported case
- Success in receiving notification alert emails

Twenty entries were done and data on the above measures was taken and recorded on Mysql server database table. Table 6 below is a summary of the client access efficiency data as analyzed.

Table 2. Database client access success measure

Access Efficiency Measures	Success	Failure
Lost case report	20	0
Found case report	20	0
Search for reported person	16	4
Notification alerts	16	4

4.3 Measuring rate of success in the identity levels of missing people

The users suggested that the system should include photos of the missing people to be able to identify them more easily. The use of a photo is significant as some people may recognize the missing person by view of their photo even when they do not have the additional descriptive details like the name.

It was also suggested that the identification details need to be more flexible and exhaustive in order to increase chances of identifying a missing person. For instance, the missing person's age should be a range of numbers rather than an absolute number because sometimes it's not easy to tell the exact age of a person. However, an age bracket consisting of a range of years may work better in this case for instance 25-30 years.

4.4 Discussion of results

The results indicate that the system accuracy is high when reporting the lost and found cases. This is simply because all that occurs at this point is to fill in the respective forms and submitting them.

However when it comes to searching for the missing persons, the accuracy goes down by 20 % because this step involves a search algorithm that takes into considerations many parameters. In the event that some parameters used during the search do not match with those used during the reporting of the lost or found case, the intended result returns null even when it should have retrieved the record. This results into a false negative. This is a common phenomenon in social research methods [13].

Consequently, the email alerts or notifications are affected by the result of the preceding step. The alerts step is equally affected by 20% and does not send notifications to all the recipients as it should.

In the general overview, the system achieves an accuracy level of approximately 80% which is impressive. Even in cases where a false positive or false negative is returned, repeated search with different parameters may increase chances of returning the desired true results.

From the results we can compare the performance of the new system with the pre-existing systems in the same domain. Being a mobile based application, its more convenient and accessible in comparison with the web based solutions like Google's person finder. The new patanisha application leverages on the readily available and accessible mobile devices and internet technology as opposed to dependency on desktop computers.

Additionally, unlike some of the legacy systems, the new application gives the public and in some cases even the lost person a chance to report themselves in case they are in the position to. Some legacy systems only allow the administrator

to enter the records of missing persons and this level of bureaucracy and limit of accessibility rights becomes a hindrance to the reporting of some missing cases.

The new system is also cost effective to develop and maintain as it does not involve much resources. It does not require the rather expensive hardware installation. Since its also based on an emphasis of good will from the public in the reporting and updates of missing cases, it does not require much administrative resources e.g human resources.

5. CONCLUSION

These findings are consistent with other studies. A significant number of missing people has been traced in developed countries like the United States in the last 3 years by using various technology based solutions like social media and personal phone location applications. Kenya is slowly adopting this strategy but there is need to do better. These results should be a wakeup call for us to embrace the readily available technology resources in solving our own problems.

The project was indeed a good opportunity to unveil what an innovation using the readily available and widely accepted mobile technology and the internet can achieve. Literature cited alludes that there exists a gap in prompt reporting, location and identification of missing people in this country. Indeed this research comes in handy as a technology that will allow for timely reporting and identification of missing people.

Results from the evaluations carried out verify that once a case has been reported, there is 72 % chance that the victim will be found. This is a significant improvement from the 30 % probability experienced by use of the old manual system.

The ultimate objective is to reunite friends and family who have been separated by natural disasters or other reasons. Evaluations carried out to measure the success level of users accessing the database returned positive results. Users could access the mobile application, register missing persons, report found persons and search for their loved ones.

It is recommended that the mobile phone based application that has been developed as a prototype should be optimized more and be adopted to locate actual missing persons. The application will then give an opportunity to friends and family members to report missing cases, where the public can view and revert with leading information regarding the missing people. In this manner, more families will be reunited with their missing loved ones and never have to worry again. The state humanitarian agencies should embrace and promote this system. This will increase publication of information about unidentified people and remains, enlisting the public to help maximise the chances of identification. This way, families and friends of the missing people will be empowered to play an active part in searching for their loved ones and bring vital closure if they are identified. The application will also feature general information around missing person investigations and is intended to be a valuable resource if well tapped on.

6. ACKNOWLEDGMENTS

I express my sincere gratitude to everyone who supported me throughout the course of this MSC project. I am thankful to God for using them to grant me inspiring guidance during the project work. I am sincerely grateful to them for sharing their truthful and illuminating views on a number of issues related to the research project.

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Fuzzy Optimization Method In The Search And Determination of Scholarship Recipients Systems at The University

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Abstract: Decision support system is an interactive system to support decision-making process through the alternatives derived from the processing of data, information and design models. In this research will build a decision support system modeling for the determination of admission scholarship, as long as this problem of determining admission scholarship often become obstacles in distribution and is not directed at the destination as expected. Therefore, in order to give a better result and overcome obstacles in the distribution of scholarships. The problems of determining admission scholarship will be resolved through Fuzzy approach to the Analytic Hierarchy Process (AHP) is modeled in a decision support system modeling. Where Fuzzy will perform the functions of representation based membership in the assessment criteria. So the results given Fuzzy will be approached with the weight vector given by the Analytic Hierarchy Process (AHP) which would then be carried out by the ranking process Analiytic Hierarchy Process (AHP) to determine the best alternative will be selected as scholarship recipients. After Fuzzy AHP approach in modeling decision support systems, particularly in the determination of admission scholarships and given very good results and focus on the goal as expected.

Keywords: scholarship, education, optimization, fuzzy method, tracer.

1. INTRODUCTION

Decision support system is an interactive system in support of the decision making process through alternative obtained from the processing of data, information and design models[1]. Decision-making is needed to accelerate the process of achieving a more focused goal. Decision support system has been widely used to resolve problems within an organization. Because the decision support system is considered capable of helping to solve any problems and provide better results. The concept of decision support systems are often used to solve the problem, because the decision support system is considered capable of giving a good decision in resolving the issue[2]. Many decision support system used to resolve problems using method such as topsis, Simple Additive Weighting (SAW) and Weight Product for grading problems with the aim to get the best alternative will be selected through a decision support system. That problem has been solved in many different cases with good results.

So far, the problem of determining admission scholarship often become obstacles in distribution and is not focused on the goal as expected, that the settlement is often solved using decision support systems[3]. To provide a good change and focused on the goals, especially in the determination of admission scholarship, is expected to give a good result and more efficiently through a decision support system. To give a good result, researchers will make a change to build a decision support system modeling approach to the fuzzy Analytic Hierarchy Process (AHP) to resolve the problem of determining admission scholarships through the assessment criteria of each alternative to determine the scholarship recipients.

Fuzzy set theory is a mathematical framework used for the present uncertainty, ambiguity, inaccuracy, lack of information and partial truth (Tettamanzi, 2001). While the Analytic Hierarchy Process (AHP) is a method to process multiple criteria complex problem into a hierarchical model (Warston school, 1970). Hierarchy is defined as a representation of a complex problem into a multi-level structure, where the first level is the goal, which is followed by the level of criteria, sub-criteria, and so on down to the last level is an alternative level[5].

In this study, will be developed a decision support system modeling is static on the assessment criteria with fuzzy approach and Analytic Hierarchy Process (AHP) in determining admission scholarship. The research conducted to determine the extent of change for the better given by the decision support system modeling approach to the fuzzy Analytic Hierarchy Process (AHP) in the evaluation of each criterion, so that with the decision support system modeling with fuzzy AHP[4], especially in the assessment criteria a criteria of each alternative to determine the best alternative would have been able to give a good result as expected.

2. METHODOLOGY

Build a decision support system modeling with fuzzy and Analytic Hierarchy Process (AHP) in determining admission scholarship it is necessary to provide a modeling as in figure 1.

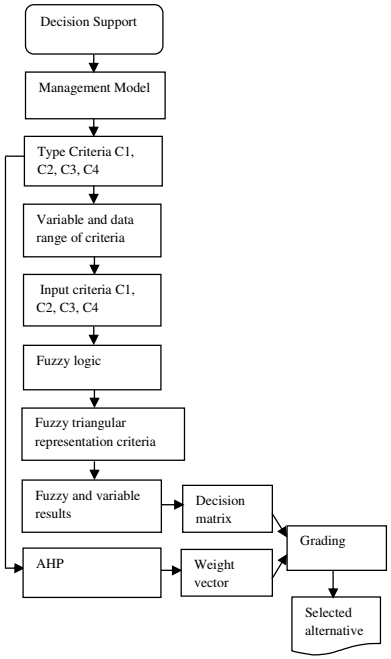

Figure 1. Model system in determining admission scholarship

The criteria will be assessed in determining acceptance of the scholarship are: criteria GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4). Based on the criteria assessed, the decision support will form a decision on any criteria table with the number of alternatives that will be tested are six alternatives[6], as Table 1 below:

Table 1. Decisions on each criterion for each alternative

	Criteria			
Alternative	GPA	Parental income	Dependent parents	Distance
A_1	3.00	1.500.000	2	10
A_2	3.50	1.300.000	6	20
A_3	3.30	2.000.000	4	16
A_4	3.00	3.600.000	6	20
A_5	3.80	1.500.000	4	23
A_6	3.65	2.000.000	3	7

1. The first Pase:

At first this pase, decision support will apply the concept of work of the fuzzy, fuzzy which would give preference to the assessment criteria C1, C2, C3, C4 which will be represented using triangular fuzzy[7], as in following table through IV below:

a. Criteria GPA (C1)

Table 2. Criteria GPA

variables	The range of data GPA
low	[0 – 2.90]
moderate	[2.70 – 3.20]
high	[3.00 – 4.00]

b. Criteria income parents (C2)

Table 3. Criteria income parents

variables	The range of parental income data
low	3.500.000 – 6.000.000
moderate	1.500.000 – 4.000.000
high	0 – 2.000.000

c. Criteria dependent parents (C3)

Table 4. Criteria dependent parents

variables	The range of data dependent parents
low	[1 – 3]
moderate	[2 – 5]
high	[4 – 7]

d. Criteria distance (C4)

Table 5. Criteria distance

variables	The range of distance data.
low	[0 – 10]
moderate	[6 – 15]
high	[11 – 30]

Based on the table above criteria and the range of existing data in each table, the next support will make a decision using fuzzy triangular representation for each assessment criteria on C1, C2, C3, C4, namely;

Triangular fuzzy representation can be seen in figure 2:

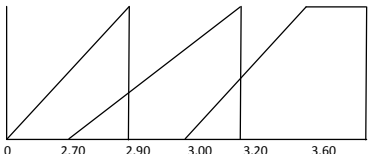

Figure 2. Representation of fuzzy triangles for GPA criteria

Membership functions for each of the criteria set GPA can be given as follows[9]:

$$\text{Low} \begin{cases} 0\,;\ x \le 0 \\ \dfrac{x}{2.90}\ ;\ 0 < x \le 2.90 \\ 1;\ x = 2.90 \end{cases}$$

$$\text{Moderate} \begin{cases} 0\,;\ x \le 2.70 \\ \dfrac{x - 2.70}{3.20 - 2.70}\ ;2.70 < x \le 3.20 \\ 1\,;\ x = 3.20 \end{cases}$$

$$\text{High} \begin{cases} 0\,;\ x \le 3.00 \\ \dfrac{x - 3.00}{3.60 - 3.00}\ ;\ 3.00 < x \le 3.60 \\ 1\,;\ 360 \le x \le 4.00 \end{cases}$$

For the next triangular fuzzy representations made on the criteria of parental income, dependent parents and distance in order to obtain the membership function of each criterion.

2. The second phase:

While in the second phase, decision support will give preference based on (Cheng, 1999) which direpsentasikan triangular fuzzy parameters u_i, α_i, β_i can be categorized as follows[11]:

Very high = (1 ; 0,8 ; 1)
High = (0,75 ; 0,6 ; 0,9)
Moderate = (0,5 ; 0,3 ; 0,7)
Low = (0,25 ; 0,05 ; 0,45)
Very low = (0 ; 0 ; 0,2)

Alternatives to - 1
C1 = Results triangular fuzzy representation = 0,6
Variable = moderate (0,3 ; 0,18 ; 0,42)
C2 = Results triangular fuzzy representation = 1
Variable = Moderate (0,5 ; 0,3 ; 0,07)
C3 = Results triangular fuzzy representation = 0,5
Variable = Low (0,125 ; 0,025 ; 0,225)
C4 = Results triangular fuzzy representation = 1
Variable = Low (0,25 ; 0,05 ; 0,45)

Alternatives to – 2
C1 = Results triangular fuzzy representation = 0,833
Variable = High (0,625 ; 0,499 ; 0,749)
C2 = Results triangular fuzzy representation = 0,7
Variable = High (0,525 ; 0,42 ; 0,63)
C3 = Results triangular fuzzy representation = 1
Variable = High (0,75 ; 0,6 ; 0,9)
C4 = Results triangular fuzzy representation = 0,642
Variable = High (0,482 ; 0,386 ; 0,578)

Based on the above parameters, parameter values taken by the decision support for the assessment of each criterion C1, C2, C3, C4 is low (0.25; 0.05; 0.45), moderate (0.5; 0.3; 0 , 7) and high (0.75; 0.6; 0.9). The results of triangular fuzzy representation in C1, C2, C3, C4 and every value that is given to the criteria C1, C2, C3, C4 and after adjusting the value of the parameter that is; low, medium and high, then the results are given for each alternative are as follows:

Results of triangular fuzzy representation for dependents of parents and distance criteria is also given as two alternatives above, so that under any of these alternatives[10], decision support will form a decision matrix as follows:

$$K = \begin{bmatrix} 0,3 & 0,5 & 0,125 & 0,25 \\ 0,625 & 0,525 & 0,75 & 0,482 \\ 0,375 & 0,4 & 0,333 & 0,268 \\ 0,3 & 0,24 & 0,75 & 0,482 \end{bmatrix}$$

3. The third Phase

While in the third phase, the next decision support will use Analytic Hierarchy Process (AHP) to determine the level of importance of each criterion in order to obtain the weight vector. Where Analytic Hierarchy Process (AHP) will determine the scale ratio of 1-9 for each criterion C1, C2, C3, C4. The scale of this comparison are in Table 6.

Table 6. Importance Criteria

scale	Pair	Information
1	1	equally important
3	$\frac{1}{3}$	Somewhat more important that one with the other
5	$\frac{1}{5}$	quite important
7	$\frac{1}{7}$	Crucial
9	$\frac{1}{9}$	Absolutely more important
2, 4, 6, 8	$\frac{1}{2}\ \frac{1}{4}\ \frac{1}{6}\ \frac{1}{8}$	The median

In Table 6 above, a table of the level of importance for each criterion will be assessed against four criteria previously set by the decision support that is GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4). The below shows the stages - steps being taken Analytic Hierarchy Process (AHP) to obtain the weight vector:

$$\begin{matrix} C_1 \\ C_2 \\ C_3 \\ C_4 \end{matrix} \begin{bmatrix} 9 \\ 7 \\ 5 \\ 3 \end{bmatrix} \text{ consistent => } \begin{bmatrix} 9 & \frac{9}{7} & \frac{9}{5} & \frac{9}{3} \\ 7 & 1 & \frac{7}{5} & \frac{7}{3} \\ 5 & \frac{5}{7} & 1 & \frac{5}{3} \\ 3 & \frac{3}{7} & \frac{3}{5} & 1 \end{bmatrix}$$

$$\begin{bmatrix} 9 & 1,28 & 1,8 & 3 \\ 7 & 1 & 1,4 & 2,33 \\ 5 & 0,71 & 1 & 1,66 \\ 3 & 0,42 & 0,6 & 1 \end{bmatrix}$$

number 24 3,41 4,8 7,99

After normalization becomes:

Then the value of the weight vector obtained:

W = [0,375 ; 0,291 ; 0,207 ; 0,124]

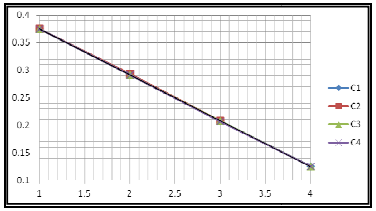

Figure 3. graphs of normality

After the weight vector is obtained, then a decision support will determine which alternative will be chosen, where the weight vector will be summed with the decision matrix using the following equation:

$$S_i = \sum_i (s_{ij})(w_j)$$

S1 = (0,3*0,375) + (0,5*0,291) + (0,125*0,207) + (0,25*0,124) = 0,314875

S2 = (0,625*0,375) + (0,525*0,291) + (0,75*0,207) + (0,482*0,124) = 0,602168

S3 = (0,375*0,375) + (0,4*0,291) + (0,333*0,207) + (0,268*0,124) = 0,359239

S4 = (0,3*0,375) + (0,24*0,291) + (0,75*0,207) + (0,482*0,124) = 0,397376

S5 = (0,75*0,375) + (0,5*0,291) + (0,333*0,207) + (0,643*0,124) = 0,575464

S6 = (0,75*0,375)+ (0,4*0,291) + (0,25*0,207) + (0,175*0,124) = 0,471100

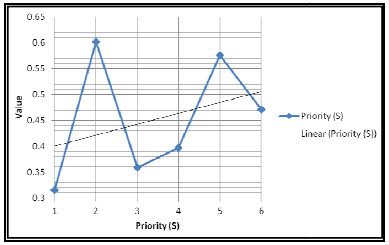

Figure 4. Decision matrix

After the grading of the six alternatives based on four criteria[12]: assessment GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4), the alternative chosen is an alternative that has the highest value is S2 = 0.602168.

3. RESULTS AND DISCUSSION

3.1 RESULTS

As for the implementation phase describes the results of a discussion of the results and fuzzy approach in modeling decisions with Analytic Hierarchy Process (AHP) to be given very good results. As the display using the programming language C ++ is shown below:

1) Display alternative input

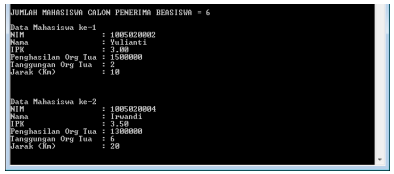

Figure 5. Display alternative input Tampilan

In Figure 5 above is a view of an alternative input to the data examined, namely 6 alternative. While the data are assessed at each alternative is GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4). As for nim and the name is only used as information to distinguish one alternative to other alternatives.

2) Display output decision matrix

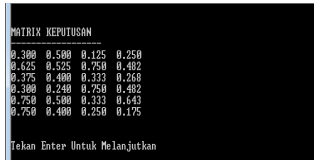

Figure 6. Display output decision matrix

Based on the above picture 6, of the two alternatives that have been previously inputted and selected, before the final results are given through the rankings, the first determination of the applicants program gives a result that is a decision matrix. Wherein the decision matrix is obtained based on the input values such as GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4), which previously represented by triangular fuzzy.

3) Display output of ranking results

Figure 7. Display output of ranking results

While in figure 7 above, is the final result given by the program determination of the applicants. As contained in the above image display program, is the end result after the decision matrix is obtained. At the end of this program describes the ranking process using Analytic Hierarchy Process (AHP).

3.2 DISCUSSION

In this study, related to the fuzzy approach in modeling support system with Analiytic Hierarcy Process for the settlement of the problem through the assessor criteria that is chosen is GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4). Particularly in this discussion after the authors analyze and implements in the C ++ programming language, it is given very good results of modeling decision support system in determining which alternative will be chosen based on the rank. Decision support in handling the problem through any assessment criteria selected criteria and the stage of completion is resolved and routed through a fuzzy, in which fuzzy in giving preference through assessment criteria C1, C2, C3, C4 are represented using triangular fuzzy. Decision support based on the results of a given triangle fuzzy representation and after adjusting the parameters, the next support will form a decision-making matrix. Where the latter matrix, the decision will be approached with the weight vector given by AHP.

Decision support also use Analytic Hierarchy Process (AHP) in determining the level of importance of each criterion GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4) in order to obtain a weight vector based matrices and after normalization, then obtained a weight vector that weight [0.375; 0.291; 0.207; 0.124], as shown in the figure above 6. After the weight vector is obtained, then the AHP will do the rankings is through the sum of the weight vector by a matrix decision with the aim of better results given in determining the alternative will be selected, as the output of the results of the rankings contained in Figure 5 above.

4. CONCLUSIONS

In this study, the result looks better given through a fuzzy approach to modeling decision support systems through the assessment criteria of GPA (C1), parental income (C2), a dependent parent (C3) and distance (C4) presented with triangular fuzzy and processes a ranking conducted by Analytic Hierarchy Process (AHP) to determine the best alternative will be selected.

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Pattern Recognition of Japanese Alphabet Katakana Using Airy Zeta Function

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Abstract: Character recognition is one of common pattern recognition study. There are many object used in pattern recognition, such as Japanese alphabet character, which is a very complex character compared to common Roman character. This research focus on pattern recognition of Japanese character handwriting, Katakana. The pattern recognition process of a letter of the alphabet uses Airy Zeta Function, with its input file is a .bmp file. User can write directly on an input device of the system. The testing of the system examines 460 letter characters. The first testing that examines 230 characters result in an accuracy of 55,65%, whilst the second testing that examines 460 characters produces an accuracy of 64,56% in recognizing the letters. These accuracy are much determined by the quantity of training. The approach of pattern recognition is a statistical approach, where more pattern of letters are trained and saved as a reference, more intelligent the system . The implementation of Airy zeta function methods in recognizing Japanese letter pattern is able to produce high accuracy level.

Keywords: Pattern recognition, katakana, airy zeta function, bitmap

1. INTRODUCTION

Advancement of information technology facilitates the way of working in various field of life. An issue that is main topic in present days research of information technology is image processing and computer vision. Both fields are researches in computer field to find a way or device to replace human eyes[1,2,3,].

Pattern recognition is a field of knowledge to classify or describe an object based on feature quantitative measurement or main characteristic of the object. Pattern is an defined entity and can be identified and given name. Pattern recognition can be executed on objects such as handwriting, eye, face and skin[4].

Pattern recognition can be applied to identify a peculiar character such as Japanese characters that is Katakana. The goal of character recognition of Japanese letter is as a learning[5].

Tool of studying Japanese for newcomers , especially in studying character Katakana. The simple use of the high recognition level of character can boost user attention in learning Japanese. Japanese character is a complex character compared to the common roman character, especially if the character is handwriting, where is produced various form of characters from different people[6].

One of the technology that is used in recognizing Japanese character Katakana is Airy Zeta Function. The first step in the recognition process is characteristic extracting, that is to find characteristic or special feature of an object.

In common, the pattern recognition using airy zeta function comprise of several step, that are image acquisition, grayscale process, segmentation using edge detection utilizing operator, identification using Airy Zeta Function method, and produces the result of Japanese character identification, Katakana.

The features in an image could be a pixel in a matrix that is from a digital image. This characteristic extraction process is implemented in pre-processing process on a digital image[7].

This is important for boosting the presence of successful matching of an object, such as the changing of size image in order to equalize the pixel of compared images, and thresholding process to make similar the pixel value of images along with abolishing existence of the noise[8].

After characteristic extraction process is done, the process of Katakana letter recognition starts using pattern recognition method. Structure of pattern recognition system is showed in figure 1. The system consists of censor (such as digital camera, the algorithm of feature searching, and algorithm for classification or recognition (depend on the approach). In addition, it is common that some classified datas is assumed already available to use in testing.

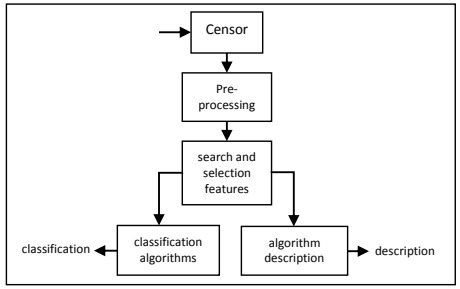

Figure 1. Structure of pattern recognition system

The steps in system training proses are :

1. Censor captures object from the real world and then change the object into digital signal, that is consist of a collection of number. This process is called digitalization.
2. Preprocessing is preparing images or signal in order to produces better characteristic at next level. In this stage, the information signal is bumped and the interfering signal is minimized.
3. Feature finding and feature selection is useful for finding distinguishing characteristic that represents main characteristic of signal along with reducing signal dimension into a collection of less number, although it is still representative
4. Classification algorithm is functional for clustering features into suitable class
5. Description algorithm is useful to present signal description[4].

2. STUDY DESIGN

This study identifies patterns of handwriting. By applying the method Airy Zeta Function simple and complex as the achievement kearusian level pattern recognition with a more accurate pattern recognition.
This study identifies patterns of handwriting. By applying the method Airy Zeta Function simple and complex as the achievement kearusian level pattern recognition with a more accurate pattern recognition.

2.1.Airy Zeta Function

By applying the method Airy Zeta Function to see the level of accuracy with the value of the Zeta Function Airy transformation method is to use the equation.

$$Ai(x) = \frac{1}{n}\int_0^{\infty} \cos\left(\frac{1}{3}t^3 + xt\right) dt$$

Specification :
Ai(x) : Airy Value
n : Index Citra Value
t : Index Citra Value on airy Value

For the Airy function zeta function is defined by a series of zero order.

$$\zeta Ai(s) = \sum_{i=1}^{\infty} \frac{F(i)}{|ai|^s}$$

This series converges when the real part of s is greater than 3/2, and can be extended by a further analysis for other values of s.[9]
Specification :
ζAi : Nilai airy zeta value
s : Transformation Index airy zeta function
$F(i)$: Index value images on airy zeta function

2.2. Letter Japanese Katakana

Katakana is derived from the Chinese characters are shortened and were used by Buddhist monks to show the proper pronunciation of Chinese characters in the 9th century. Katakana syllabary writing, consisting of 46 syllables and formerly called "paper man"[10].

Figure 2. Letter Basic Katakana

Collected reference on Image Processing and data required in the making of the application. Data or samples used in this study is a Japanese katakana letters pattern data scanning results of handwriting with a variant of the different writing difference[11]. The details are as follows:

1. Diagram Workflow System
Workflow diagrams which will be conducted in this study is illustrated in the following:

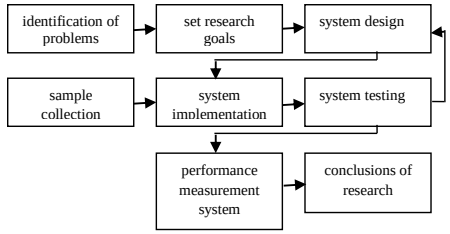

Figure 3. Workflow research in general.

2. System Scheme

The scheme of the overall system is as follows[7]:

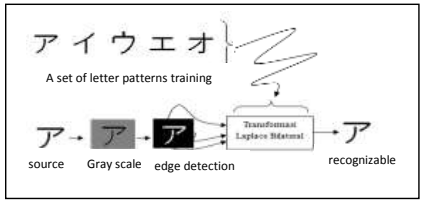

Figure 4. Schematic System Overall

The stages are performed after the system receives input is gray-scale stage, edge detection, and pattern recognition test letters through Airy Zeta Function. In the pre-processing stage, which becomes an input source image format file.bmp. In the main process, computing using Airy Zeta Function as follows[6]:

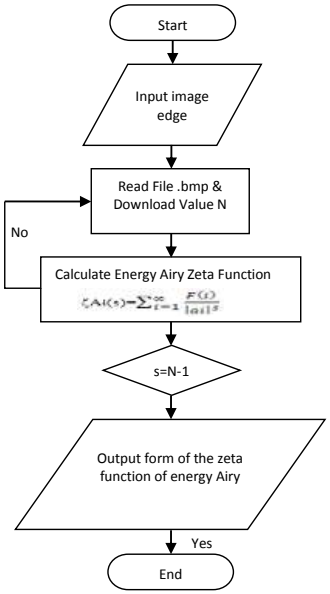

Figure 5. Process Flow Diagram Airy Zeta Function

3. ANALYSIS AND DISCUSSION

Samples of Japanese katakana letters training base used in this study gradually with the number of images from 230 training data with the data testing 460 then 460 training data with the data testing. The image of the pattern of Japanese katakana letters basis vectors that represent the characteristics of Japanese katakana letters pattern different basis. Figure 6 shows some sample patterns Japanese katakana letters are used as a training base. Training is done using the bilateral Laplace transform.

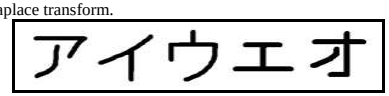

Figure 6. Some Japanese Katakana Sample Letter Writing Basics

3.1. Training Process

The process of training on this system will be described in repsentasi on the following pictures:

Figure 7. Process Painting Samples

Figure 7 illustrates the initial steps to be undertaken in this system that makes handwriting samples from the writings of different variants depending directly on the canvas that is available on the system. Generate output images of Japanese katakana character case basis with the rules of correct writing with bmp image formats.

After the painting process the sample, the following picture describes the process of training for extract characteristics of handwriting sample image of Japanese katakana letters that basis. Which further the values of the image will be saved into the database as a reference to an image pattern recognition.

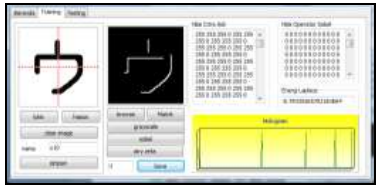

Figure 8. Direct Painting Process Training Samples

Direct Painting Process Training Samples describes sample letter patterns japanese katakana basic form of handwriting directly on the canvas that is available on this system.

The training process image input samples are as follows:

Figure 9. Sample Training Process Input Image

Figure 9 describes the process of training with the Japanese katakana letters pattern sample basis in the form of handwriting input image scan results.

3.2. Testing Process

Testing Process recognition system of Japanese katakana letters shown in the picture below base where in this process we will take a picture that has been painted and stored previously. Data testing is not the same image data with image data in the training process. And the form of handwritten images of different people, then the value of the image of the character pattern letters in this testing process will be compared with the value of the letters in the image of the character pattern prior training process. If energy is equal or close similarity of the pattern of the letters will be recognized and vice versa. The image data were tested as many as 460 images of Japanese katakana letters basic pattern.

Figure 10. Results of Pattern Recognition Letters Properly

Results Pattern Recognition Letters true of the testing process is case-sensitive pattern recognition. Where the Japanese katakana letters input in testing this basic form of handwritten images directly from the canvas are available in the system.

Figure 11. Results of Pattern Recognition Letters One

Figure 11 describes the results of the testing process pattern recognition incorrect letters. Where the Japanese katakana letters input in testing this basic form of handwritten images directly from the canvas are available in the system.

3.3. Work Systems

Measurement of the performance of the entire system is based measurement test data based on specifications or certain classification the correlated the number of training data is used.

Some of the results of the performance measurement system to test on letter recognition is presented as follows.

Table 1. Results of Performance Systems Pattern Recognition Letters

Jumlah Citra Pelatihan	Jumlah Citra Pengujian	Jumlah Pengenalan Pola yang Benar		Jumlah Pengenalan Pola yang Salah	
230	460	256	55,65 %	204	44,34 %
460	460	297	64,56 %	163	35,43 %

Test results for 46 Japanese katakana character letter basis, shows that the greater number of correct training data stored in the database as the image of a pattern recognition energy letter, the higher the level of accuracy of the letter pattern recognition. The following figure shows a graph of the results of the performance of the pattern recognition system of Japanese katakana letters basis. The graph Percentage Accuracy

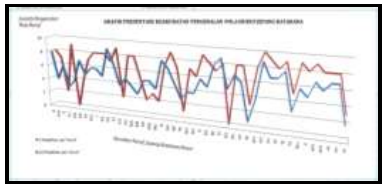

Figure 12. Graph Percentage Accuracy Japanese Katakana Basic Introduction Letter

Illustrating the accuracy of pattern recognition Japanese katakana letters training data base of 5 and 10 training data letter. It can be seen that the process of training data 5 average grade level each letter pattern recognition accuracy is lower than in the 10 training data. However, seeing a percentage a character letters on the 10 training data there are some letters that lower the level of accuracy of the process with 5 training data. This is due to the level of similarity approach or the energy generated from the same case characters are almost the same even there, the more the comparison value in the training system the harder it will take a decision to classify her character recognition letter patterns so that there was an error that letter pattern recognition. The highest level of accuracy contained in the letter patterns ***SO*** with an average accuracy rate of 95%. The graph Percentage inaccuracies are.

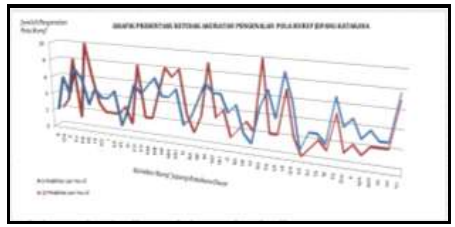

Figure 13. Percentage Graph inaccuracies Japanese Katakana Basic Introduction Letter

While in figure 13 above the level of illustrating inaccuracies Japanese katakana letters pattern recognition basis of training data 5 and 10 training data. It can be seen that the process of training data 5 average value inaccuracies rate each letter pattern recognition is higher than in the 10 training data. However, seeing a percentage character letters on the 10 training data there are some letters that lack accurated higher level than the process with 5 training data. This is due to the level of similarity approach or the energy generated from the same case characters are almost the same even there, the more the comparison value in the training system the harder it will take a decision to classify her character recognition letter patterns so that there was an error that letter pattern recognition. Accurate accuracy lack highest level found in the pattern of letters ***HA, NI*** and ***SE*** with an average error rate of 80%.

4. CONCLUSION

From the results of research and discussion that has been done, can be summed up as follows:

1. The pattern recognition system of Japanese katakana handwritten letters using Zeta Function Airy pattern recognition accuracy levels ranging from 55.65% to 64.56%. It is clear percentage handwriting pattern recognition truth Japanese katakana letters are very influential on the basis of training data.
2. The pattern recognition approach is a statistical approach, where a growing number of letters in the training pattern and stored as a reference, then the system will be more intelligent and percentage accuracy shows that Airy Zeta Function can be used as one method of pattern recognition on handwritten image.

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The Statement of Conjunctive and Disjunctive Queries in Object Oriented Database with Using Fuzzy Logic

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Abstract: Entrance of object orienting concept in database caused the relation database gradually to replace with object oriented database in various fields. On the other hand for solving the problem of real world uncertain data, several methods were presented. One of these methods for modeling database is an approach wich couples object-oriented database modeling with fuzzy logic. Many queries that users to pose are expressed on the basis of linguistic variables. Because of classical databases are not able to support these variables, leads to fuzzy approaches are considered. We investigate databases queries in this study both simple and complex ways. In the complex way, we use conjunctive and disjunctive queries. In the following, we use the XML labels to express inqueries into fuzzy. We can also communicate with other sections of software by entering into XML world as the most reliable opportunity. Also we want to correct conjunctive and disjunctive queries related to fuzzy object oriented database using the concept of dependency measure and weight, and weight be assigned to different phrases of a query based on user emphasis. The other aim of this research is mapping fuzzy queries to fuzzy-XML. It is expected to be simple implement of query, and output of execution of queries be greatly closer to users' needs and fulfill her expect. The results show that the proposed method explains the possible conjunctive and disjunctive queries the database in the form of Fuzzy-XML.

Keywords: Object Oriented Database, Fuzzy Database, Fuzzy Object Oriented Database, Fuzzy query, Tag XML.

1. INTRODUCTION

Relational database model doesn't satisfy the need of users that intend to work with uncertain data. Therefore, they combined fuzzy approach (to support uncertainty and linguistic variable) and object-oriented approach to each other and created a powerful database in the name of object-oriented database. The fuzzy object-oriented database models in a logical level afford with data uncertainty as well as combined objects existing in the real world. Upon defining some main concepts of database such as objects, classes, object-class relations, subclass-superclass and inheritance under fuzzy environment, a few queries can be propounded to giver more well-suited responses. The responses in this type of database with a degree of membership may belong to the response range and this subject is very useful, because the responses may be limited to a threshold range and return results to the user so that their closeness to the response to be appropriate for that user, whilst in the classic database, no user is able to do it and could observe responses that exactly satisfied all query conditions, and not a part of conditions. This inflexibility for returning the responses always bothered the users.

What is important in the meantime is quality of queries expression for combination of two object-oriented and fuzzy approaches. The queries must be expressed benefitting from language variables and the objects appearing in the response are graded (sorted) by belonging degree.

In second part of this paper, the background and in third part related works and in fourth part, proposed method were presented. In the proposed method of this paper, fuzzy queries in addition to being expressed by disjunctive and conjunctive may be stored by XML labels. Fifth part was allocated to case study and sixth part to conclusion.

2. BACKGROUND

Background of this study includes fuzzy set, fuzzy object-oriented database, XML.

2.1 Fuzzy sets

Fuzzy sets and fuzzy logics theory was introduced in 1965 by Professor zadeh. As a result, in 1977, possibility theory was founded. This theory is used for encountering most real world phenomena therein uncertainty exists [1].

In the classic logic, membership in a set is assumed as zero and one so that if a member exists in a set is shown by 1 and otherwise by 0. In fact, membership degree is a function that its range is member of {0,1}. On the other side, in fuzzy logics, the concept of membership degree in a set is extended to range [0,1]. The concept of fuzzy logics is taken into consideration because in the real world, plenty of man arguments and reasons are uncertain and approximate.

2.2 Fuzzy object oriented database

In order to simulate uncertain data and multivalued attributes as well as complex relationships between objects in the object oriented database, current efforts are focused on conceptual data model and object oriented database with uncertain data. For the first time, Milano and Zicari (1990) introduced incomplete information about uncertain data modeling in object oriented database, in the name of null [2].

From then on, combination of uncertain data in object oriented database was noticed increasingly, there in ambiguity in sample objects and class hierarchy is observable. Encapsulating inaccurate and unspecified information in the database model was one of important subjects in the database researches. Therefore, fuzzy object oriented database (FOOD) is presented to afford with inaccurate and complex objects in the real world in a logical level. Some main concepts such as objects, classes, objects-classes relationships, subclass, superclass and polymorphisms are extended in FOOD under fuzzy data environment. Ultimately, an overall model is presented for FOOD.

2.3 XML (extensible markup language)

This language was established in 1996 by web consortium (W3C) to eliminate the existing restrictions in HTML and adding new options [3]. XML is a simple subset of standard generalized markup language (SGML) that is a general and complex for marking the data. XML is able to keep the structure of stored data along with their meaning. Features of XML and its elements converted this language to portable and standard language for different users. From one side, XML upon storing its files in textual format and using markup signs makes the stored data understandable for man and on the other hand, provides these files in structured form to the programs to simplify its processing for computer [4].

3. RELATED WORKS

Recently, a lot of works have been created for fuzzy data modeling and working on object oriented database. Medina et al [5] to implement the extended fuzzy relational database show the needed elements. Basis for this database is a relational database that was extended for including fuzzy data. The most important factor of this process is simplicity of implementation.

Ma Zoung could develop an object oriented database model based on possibility distribution and semantic criterion of fuzzy data to use inaccurate and complex objects in the real world. In addition, a few main concepts in object oriented database such as objects, classes, object-class relationships, subclass-superclass and polymorphism were extended under fuzzy data environment [6].

Harounabadi et al [7] used uncertain systems for modeling. This extended version includes the both structure and behavior aspects in the system.

In [4], fuzzy extension of XML was proposed for modeling inaccurate data.

Cavalcante et al [8] offered new fuzzy database architecture. Commonly, fuzzy database stores the data and metadata to incorporate a concept in the name of total range of different storable samples in this database. They introduced a new method for offering fuzzy metadata base that simplifies the tasks of data management. The main advantage of this new exhibition is simplicity in understanding, implementation, use and support. This new metadata base organizes the data using XML format that adds more advantage to probability.

Gupta et al [9] presented a method for use of fuzzy data in a traditional database.

Pourbehzadi [10] allocating a weight to different parts of query and possibility of determining accepted threshold value for each queried attribute, allows the user to extract its needed objects from database and presents a model that explains fuzzy query as more significant responses and closer to the query.

4. THE PROPOSED METHOD

The proposed method is that fuzzy queries are mapped to fuzzy-XML. An object oriented database is designed and fuzzy values are applied thereon and on the queries. In this paper, fuzzy queries in addition to being expressed by disjunctive and conjunctive proposition have the possibility of being stored by XML labels. Upon combining XML labels and fuzzy-making techniques, labels may be presented for support of fuzzy object oriented database queries.

4.1 Definition of class structure in XML document

To define class structure in XML, respective class must be shown in XML schema. For this purpose, class exhibition must be mapped to DTD schema.

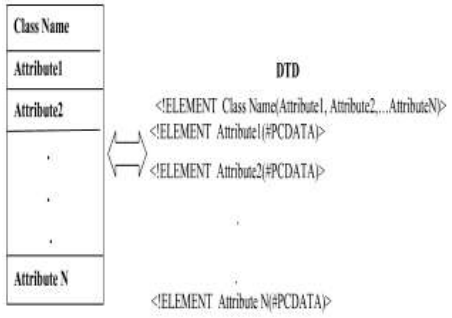
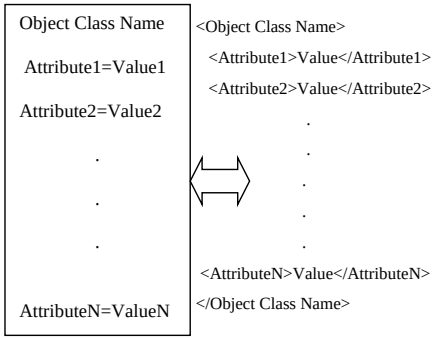


Figure 1. Class mapping by DTD

4.2 Exhibition of samples of class in XML document

Whereas class was formed based on XML schema, at this stage, the defined samples of class may be easily shown in XML document as below:



4.3 Exhibition of fuzzy data in XML documents

XML data is shown in a special structure and aiding XML ambiguous and uncertain data may be exhibited using intrinsic characteristics of XML. Fuzzy values have the capability of showing uncertain data and are exhibited aiding a defined fuzzy structure in XML.

To show the concept of uncertainty in XML, solutions must be presented for attributing membership degree to element as well as possibility distribution of elements attributes. At first, the concept of attributing a membership degree to XML element must be specified. This subject may have ambiguities because elements may be placed in nested and hierarchical form, and each one of elements has membership degree. In fact, membership degree of each element shows that element's occurrence possibility and all subtree elements with the root of the same element. Figure 2, shows a membership function that has two linguistic variables:

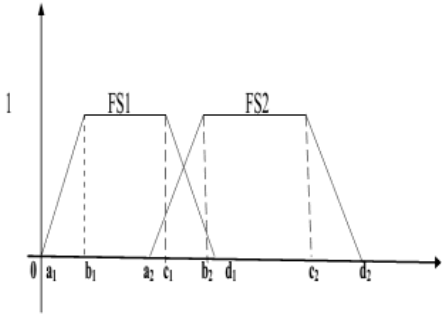


Figure 2. membership function diagram

In consideration of membership function as per figure 2, an exhibition of that function may be in XML document.

```
< Fuzzy Info>
  < LinguisticVariable     Name = " LV Name">
    <FuzzySet  Name = " FS1"   range = "a1, b1, c1, d1 ">
                          </FuzzySet>
    <FuzzySet  Name = " FS2"   range = "a2, b2, c2, d2 ">
                          </FuzzySet>
  </  LinguisticVariable>
</ Fuzzy Info>
```

4.3 Query procedure

Query processing in fuzzy object oriented database refers to a procedure therein objects are selected from classes that simultaneously satisfy the given threshold as well as satisfy given condition in the condition threshold. It is obvious that queries have threshold in fuzzy object oriented database that are connected to choices of threshold.

In the method proposed by Ma Zoung, it was not possible for the user to prioritize its respective attributes in query and only membership of each object in relative class (μ) as well as fuzzy degree of respective attribute was analyzed.

In the proposed method of this paper, upon allocating the weight to queried attributes, determination of priority of each attribute in query is assigned to the user. Therefore, syntax rule of a SQL query based on fuzzy object oriented database model is as follows:

SELECT <attribute list> FROM <$class_1$,…, $class_m$> WHERE <query condition WITH threshold>

(1)

In the above equation, attribute list includes attributes that are going to be appeared in the output and related to the objects that satisfy he user condition. The classes that are written in front of From include those that browsing operation is implemented there in. Query condition is a fuzzy condition that user expects to be satisfied in the respective threshold mentioned in front of it. Furthermore, all thresholds include numbers within range [1,0]. Queries related to fuzzy object oriented database may be written in XML format that a sample thereof is shown in figure 3:

```
<Query  Name = "SELECT">
        <AttributeList>
          <Attribute> Value1</ Attribute>
          < Attribute>Value2</ Attribute>
                .
                .
          < Attribute> ValueN</ Attribute>
        </AttributeList>
  <FROM>
      <Class> Name1</Class>
      <Class> Name2</Class>
  </FROM>
  <WHERE>
    <ConditionAttribute  Name= "Value1"  Operand="Value2"
          Threshold="Value3" Operatore="Value4" >
      <Operator> </Operator>
    </ConditionAttribute  >
  </WHERE>
</Query>
```

Figure 3. Exhibition of Select query using XML

The user should define three cases for each query condition:

1. The amount of an attribute (which can be fuzzy such as age attribute and amount "teenager")
2. Threshold of attribute membership degree (for example, with a threshold of 0.6 it can belong to teenager class)
3. Attribute weight (this weight represent the level of importance or priority of each attribute for the user).

As soon as the query by user, final threshold value is calculated using values appeared in query and following equation:

$$Threshold_{final} = \frac{\sum_{i=1}^{n}(T_i * W_i)}{\sum_{i=1}^{n}(W_i)} \quad (1)$$

In above equation, T_i denotes defined threshold for attribute i and W_i denotes the respective weight for attribute i in the query.

Now, the requested μ values are calculated for each object separately and using functions written formerly in the database and in the class of said object. After calculating it is multiplied by W related to same attribute raised in the query and so μ_{final} value is calculated for each object using following equation:

$$\mu_{final}(Obja) = \frac{\sum_{i=1}^{n}(\mu_i * W_i)}{\sum_{i=1}^{n}(W_i)} \quad (2)$$

In the above equation, μi is the degree of belonging object a to an attribute 1, μj is the degree of belonging object a to attribute 2 and μk is the degree of belonging object a to attribute n and μfinal (obj.a) is the final belonging degree of object a to the set of answers. In this stage, for any object we have a degree of belonging and we should compare this degree of final belonging to the query required threshold and if the degree of final belonging is higher than the query threshold or equal to it, we can bring this object in the answer set. It means only the objects will be appeared in the answer set where they achieve the mentioned condition in following equation:

$$\mu_{final} \geq Threshold_{final} \quad (3)$$

5. Case study

In the case study of this paper, book information registration system has been taken into consideration. In this system, the user registers the books through entering initial information of book together with its author's name in the database of library. In this system, possibility of fuzzy search based on weight and price or the both is provided and the user will have the fuzzy search possibility based on weight, price or the both.

The classes related to book information registration system include two classes Book and Author that its specifications are as follows:

```
Class Book {
Int ID;
String Title;
String ISBN;
String Publisher;
Date Date;
double Price;   // Fuzzy Linguistic Variable
Float Weight;   // Fuzzy Linguistic Variable
String Subject;
Author Author; //Object as Data in Object Oriented Database
}
Class Author{
String FirstName;
String LastName;
}
```

According to the defined classes and proposed method, a mapping to DTD model must be applied to obtain XML document related to respective system, easily.

```
<!ELEMENT Book(ID, Title, ISBN, Publisher, date, Price, Weight, Subject, author)>
<!ATTLIST Book ID CDATA #REQUIRED>
<!ELEMENT Title (#PCDATA)>
<!ELEMENT ISBN (#PCDATA)>
<!ELEMENT Publisher (#PCDATA)>
<!ELEMENT Date (#PCDATA)>
<!ELEMENT Price (#PCDATA)>
<!ELEMENT Weight (#PCDATA)>
<!ELEMENT Subject (#PCDATA)>
<!ELEMENT Author(FirstName, LastName)>
<!ELEMENT FirstName (#PCDATA)>
<!ELEMENT LastName (#PCDATA)>
```

Considering fuzzy data in the studied system including price and weight features, membership functions are shown as below:

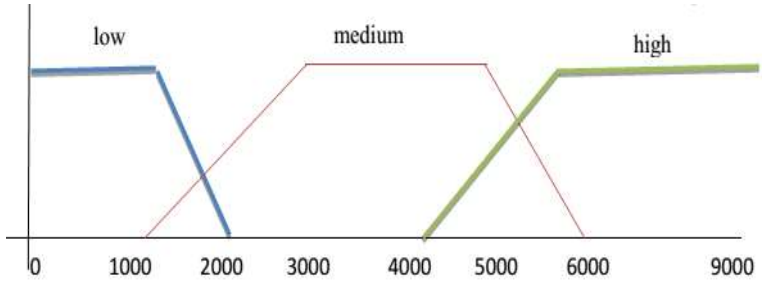


Figure 4. Membership function of price linguistic variable

```
<LinguisticVariablename="Price">
        <FuzzySetname="Low"range="0 0 1000 3000"> </FuzzySet>
        <FuzzySetname="Medium"range="2000 3000 5000 6000">     </FuzzySet>
        <FuzzySetname="High"range="4000 6000 9000 9000">   </FuzzySet>
</LinguisticVariable>
```

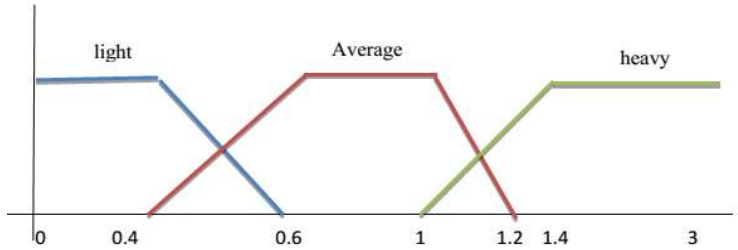


Figure 5. Membership function of weight linguistic variable

```
<LinguisticVariablename="Weight">
        <FuzzySetname="Light"range="0 0  0.4  0.6"></FuzzySet>
        <FuzzySetname="Average"range="0.4 0.6  1  1.2 "> </FuzzySet>
        <FuzzySetname="Heavy"range="1  1.4  3  3"></FuzzySet>
</LinguisticVariable>
```

A sample of fuzzy search environment related to the studied system is exhibited in the following figure. As per this figure, search operation is performed based on field and value (threshold range).

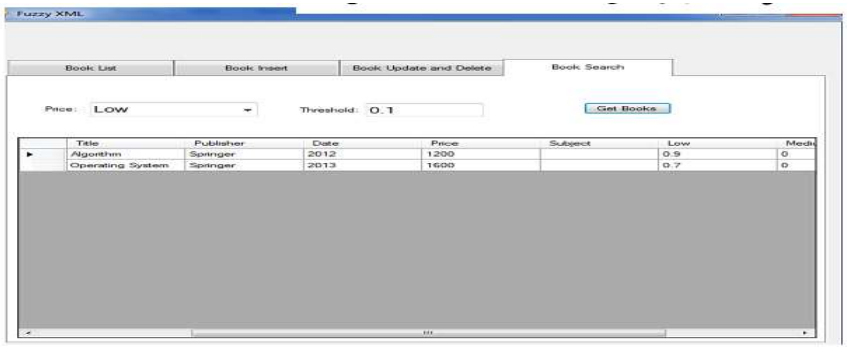


Figure 6. Display form of fuzzy search result

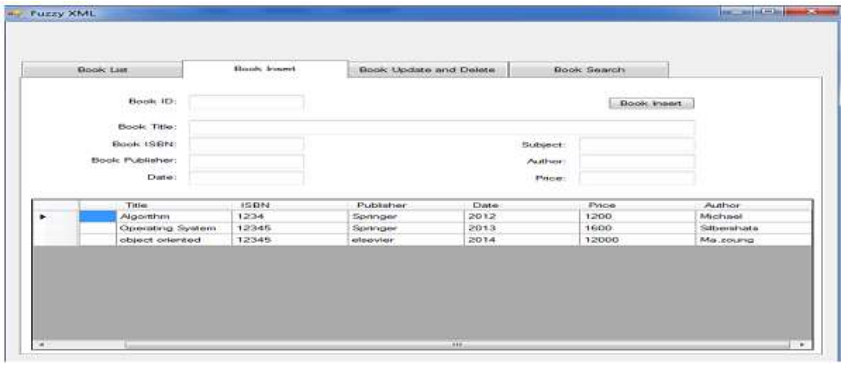


Figure 7. Display form of book insertion

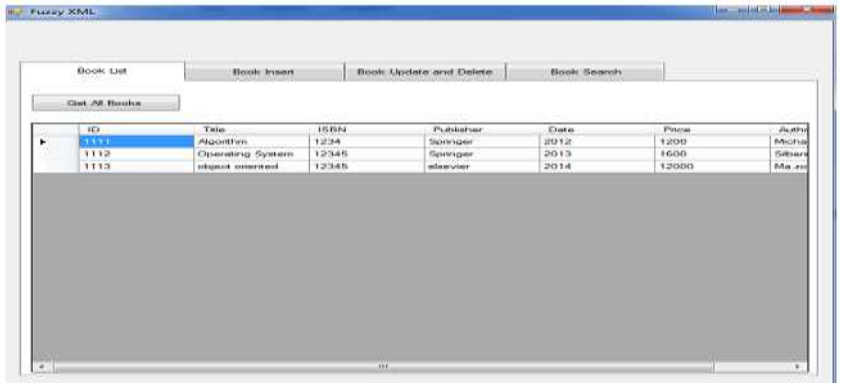


Figure 8. Display form of book list

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6. Conclusion

In this paper, a method was implemented for improvement of fuzzy queries in the object oriented database. Fuzzy queries in addition to being expressed by disjunctive and injunctive proposition, can be stored with XML labels. The queries in the object oriented database were amended using the concept of membership degree and weight. Fuzzy data was stored as XML tags and fuzzy queries converted to Fuzzy-XML.

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A Review of Data Access Optimization T in a Distributed DMatabase Management System

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Abstract: In today's computing world, accessing and managing data has become one of the most significant elements. Applications as varied as weather satellite feedback to military operation details employ huge databases that store graphics images, text and forms of data. The main concern in maintaining this information is to access it in an efficient manner. Database optimization techniques have been derived to address this issue that may otherwise limit the performance of a database to an unacceptable level of vul We therefore discuss the aspects of performance optimization related to data access in distributed databases. We further looked at the effect of these optimization techniques

Keywords: Data; Distributed database; Performance; TSQLANN

1. INTRODUCTION

It•s a known fact that the amount of data that enterprise storing and managing is growing rapidly. Industry estimates indicate that data volume is doubling every 3 2 years. The rapid growth of data presents frightening challenges for IT, both in cost and for our study, performance. Although the cost of storage keeps declining, fast growing data volumes make storage one of the costliest elements of most IT budgets. In addition, the accelerating growth of data makes it difficult to meet performance requirements while staying within budget.

When a database based application performs slowly, there is a 90% probability that, the data access routines of that application are not written in the best possible way or optimized, In this paper we will discuss Data access performance optimization in transactional SQL Server databases and will also consider the performance of a very large database with and without our suggested optimization. Though the optimization techniques are suggested for transactional SQL Server databases but most of the techniques are roughly the same for other database platforms. In oracle 12c, Automatic Data Optimization (ADO) automatically moves and compresses data according to user defined policies based on the information collected by Heat Map, [1].

1.1 Performance Optimization Techniques

It is worth mentioning here that all forms of optimization actually enhances the performance of the database and below are some of the techniques employed.

Indexing in the table column:

We need to create primary key in every table of the database. When we create a primary key in a table, a clustered index tree is created and all data pages containing the table rows are physically sorted in the file system according to their primary key values. Each data page contains rows which are also sorted within the data page according to their primary key values. [2], pointed that each time any row from the table is asked for; the database server finds the corresponding data page first using the clustered index tree and then finds the desired row within the data page that contains the primary key value.

The intermediate nodes contain range of values and direct the SQL engine where to go while searching for a specific index value in the tree starting from the root node. The leaf nodes are the nodes which contain the actual indexes. If this is a clustered index tree, the leaf nodes are the physical data pages. If this is a non clustered index tree, the leaf nodes contain index values along with clustered index keys (Which the database engine uses to find the corresponding row in the clustered index tree). Usually, finding a desired value in the index tree and jumping to the actual row from there takes an extremely small amount of time for the database engine. So, indexing generally improves the data retrieval operations which a performance enhancement strategy, [3].

Movement from application into the database server of SQL Codes:

Moving the SQLs from application and implementing these using stored procedures/ Views/ Functions/ Triggers will enable us to eliminate any duplicate SQLs in our application. This will also ensure reusability of our TSQL codes. Implementing all TSQLs using the database objects will enable us to analyze the TSQLs more easily to find possible inefficient codes that are responsible for slow performance. Also, this will let us manage our TSQL codes from a central point, [4].

Doing this will also enable us to re-factor our TSQL codes to take advantage of some advanced indexing techniques. Also, this will help us to write more ‚Set based• SQLs along with eliminating any ‚Procedural• SQLs that we might have already written in our application. Despite the fact that indexing will let us troubleshoot the performance problems in our application in a quick time, following this step might not give us a real performance boost instantly. But, this will mainly enable us to perform other subsequent optimization steps and apply different other techniques easily to further optimize our data access routines.

1.2 Covering Index:

If we know that our application will be performing the same query over and over on the same table, we should consider creating a covering index on the table. A covering index,

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which is a form of a composite index, includes all of the columns referenced in SELECT, JOIN, and WHERE clauses of a query. Because of this, the index contains the data we are looking for and SQL Server doesn't have to look up the actual data in the table, reducing logical and/or physical I/O, and boosting performance.

1.3 File Organization in groups and files in the database:

When an SQL Server database is created, the database server internally creates a number of files in the file system. Every database related object that gets created later in the database are actually being stored inside these files. An SQL Server database has the following three kinds of files, [5];

mdf file: This is the primary data file. There could be only one primary data file for each database. All system objects resides in the primary data file and if a secondary data file is not created, all user objects (User created database objects) also takes place in the primary data file.

ndf file: These are the secondary data files, which are optional. These files also contain user created objects.

ldf file: These are the Transaction log files. These files could be one or many in number. It contains transaction logs. Database files are logically grouped for better performance and improvement of administration on large databases. When a new SQL Server database is created, the primary file group is created and the primary data file is included in the primary file group. Also, the primary group is marked as the default group. As a result, every newly created user objects are automatically placed inside the primary file group (More specifically, inside the files in the primary file group). If our database has a tendency to grow larger (Say, over 1000 MB) in size, we can (and should) do a little tweaking in the file/file group organizations in the database to enhance the database performance. Here are some of the best practices we can follow:

The primary file group must be totally separate and should be left to have only system objects and no user defined object should be created on this primary file group. Also, the primary file group should not be set as the default file group. Separating the system objects from other user objects will increase performance and enhance ability to access tables in the case of serious data failures, [8].

If there are N physical disk drives available in the system, then we should try to create N files per file group and put each one in a separate disk. This will allow Distributing disk I/O loads over multiple disks and will increase performance.

For frequently accessed tables containing indexes we should put the tables and the indexes in separate file groups. This would enable to read the index and table data faster.

We should put the transaction log file on a different physical disk that is not used by the data files. The logging operation (Transaction log writing operation) is more write intensive, and hence, it is important to have the log on the disk that has good I/O performance.

Inefficient TSQLs identification and re-factoring best practices application:

Knowing the best practices is not enough at all. The most important part is we have to make sure that we follow the best practices while writing TSQLs. Some TSQL Best practices are described here [6]:

We should not use ‚SELECT *• in SQL Query because then unnecessary columns may get fetched that adds expense to the data retrieval time and the Database engine cannot utilize the benefit of ‚Covered Index• hence, query performs slowly.

We should not use COUNT() aggregate in a sub query to do an existence check because when we use COUNT(), SQL Server does not know that we are doing an existence check. It counts all matching values, either by doing a table scan or by scanning the smallest non clustered index. But if we use EXISTS, SQL Server knows you are doing an existence check. When it finds the first matching value, it returns TRUE and stops looking.

We should try to avoid joining between two types of columns because when joining between two columns of different data types, one of the columns must be converted to the type of the other. The column whose type is lower is the one that is converted. If we are joining tables with incompatible types, one of them can use an index, but the query optimizer cannot choose an index on the column that it converts.

We should try to avoid the use of Temporary Tables unless really required. Rather, try to use Table variables. Almost in 99% case, Table variables reside in memory; hence, it is a lot faster. But, Temporary tables reside in ‚TempDb• database. So, operating on Temporary table requires inter db communication and hence, slower.

We should try to avoid deadlock. We should always access tables in the same order in all our stored procedures and triggers consistently and keep our transactions as short as possible. Also should touch as few data as possible during a transaction and should never, ever wait for user input in the middle of a transaction.

We should write TSQLs using ‚Set based approach• rather than using Procedural approach•. The database engine is optimized for set based SQLs. Hence, procedural approach (Use of Cursor, or, UDF to process rows in a result set) should be avoided when large result set has to be processed. By using inline sub queries to replace User Defined Functions and by using correlated sub queries to replace Cursor based codes we can get rid of ‚Procedural SQLs•

We should use Full Text Search for searching textual data instead of LIKE search as Full text search always outperforms the LIKE search. Full text search will enable us to implement complex search criteria that can•t be implemented using the LIKE search such as searching on a single word or phrase, searching on a word or phrase close to another word or phrase, or searching on synonymous forms of a specific word.

We should try to use ‚UNION• instead of ‚OR• in the query. If distinguished result is not required we better use ‚UNION ALL• because ‚UNION ALL• is faster than ‚UNION• as it does not have to sort the result set to find out the distinguished values. Here we worked on millions of data with some complex query and got the results in seconds.

1.4 Partitioning the big fat tables

Table partitioning means nothing but splitting a large table into multiple smaller tables so that, queries access to scan less amount data while retrieving. That is ‚Divide and conquer•. When we have a large (In fact, very large, possibly having more than millions of rows) table in our database we should consider portioning this table to improve performance, [7].

Suppose we have a table containing 10 millions of rows, let•s assume that, the table has an auto increment primary key field

(Say, ID). So, we can divide the table's data into 10 separate portioning tables where each partition will contain 1 million rows and the partition will be based upon the value of the ID field. That is, First partition will contain those rows which have a primary key value in the range 1–1000000, and, Second partition will contain those rows which have a primary key value in the range 1000001–2000000 and so on.

2. RELATED WORK

Review of most literature on database optimization pointed to the fact that optimization is always considered in relation to databases but performance is always relegated to the background or not mentioned at all.

[9], emphasized more on optimization techniques without mention of performance.

[7], in Optimization Techniques of Queries with Expensive Methods, studied queries that contain time consuming methods.

He carefully defined a query cost framework that incorporates selectivity and cost estimates for selection. A lot of other details on queries were dealt with but without mention of how performance is further enhanced by optimizing the queries.

In The Principles of Query Optimization in Relational Database Management Systems, Johann Christopher Freytag describe a wide variety of different optimization algorithms for query languages.

3. INFORMATION LIFECYCLE (ILM)

Information Lifecycle Management (ILM) is intended to address challenges of accessing data by storing it in different storage and compression tiers, according to the enterprise's current business and performance needs. This approach offers the possibility of optimizing storage for both cost savings and maximum performance.

In Oracle Database 12c, two new ILM-related features have been added to the Advanced Compression Option. Heat Map automatically tracks modification and query timestamps at the row and segment levels, providing detailed insights into how data is being accessed. Automatic Data Optimization (ADO) automatically moves and compresses data according to user defined policies based on the information collected by Heat Map.

Heat Map and ADO make it easy to use existing innovations in Oracle Database Compression and Partitioning technologies, which help reduce the cost of managing large amounts of data, while also improving application and database performance. Together these capabilities help to implement first-class Information Lifecycle Management (ILM) in Oracle Database.

3.1 Storage Tiering and Compression Tiering

An enterprise (or even a single application) does not access all its data equally: the most critical or frequently accessed data will need the best available performance and availability. To provide this best access quality to all the data would be costly, inefficient, and is often architecturally impossible. Instead, IT organizations implement storage tiering, by deploying their data on different tiers of storage so that less accessed (‚colder') data are migrated away from the costliest and fastest storage – still available, but at slower speeds, whose effect on the overall application performance is minimal, due to the rarity of accessing those ‚colder' data. Colder data may also be compressed in storage. We use the term Information Lifecycle Management (ILM)1 to name the managing of data from creation/acquisition to archival or deletion.

Fig1: Partitioning, Advanced Compression and Hybrid Columnar Compression

Figure 2 shows the most active data located on a high performance tier and the less active data/historical data on lower-cost tiers. In this scenario, the business is meeting all of its performance, reliability, and security requirements, but at a significantly lower cost than in a configuration where all data is located on high performance (tier 1) storage. The illustration shows that compression can be applied to the less active and historical storage tiers, further improving the cost savings while also improving performance for queries that scan the less active data.

In addition to storage tiering, it is also possible to use different types of compression to suit different access patterns. For example, colder data may be compressed more at the cost of slower access.

Oracle, even with the right storage and compression capabilities, deciding which data should reside where and when to migrate data from one tier to another remains a serious challenge. Oracle Database 12c addresses this challenge with functionality that automatically discovers data access patterns (‚Heat Map') and uses Heat Map information to automatically optimize data organization (‚Automatic Data Optimization'). The rest of this document explains the Oracle Database technologies that enable storage and compression tiering, and how to use them to support Information Lifecycle Management.

3.2 Heat Map: Fine-grained Data Usage Tracking

Heat Map is a new feature in Oracle Database 12c that automatically tracks usage information at the row and segment levels.2 Data modification times are tracked at the row level and aggregated to the block level, and modification times, full table scan times, and index lookup times are tracked at the segment level. Heat Map gives you a detailed view of how your data is being accessed, and how access patterns are changing over time. Programmatic access to Heat Map data is available through a set of PL/SQL table functions, as well as through data dictionary views as in figure 3 below

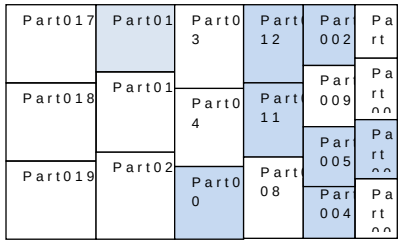

Fig 2. Heat Map data for access patterns to a partitioned table

Database rows are stored in database blocks, which are grouped in extents. A segment is a set of extents that contains all the data for a logical storage structure within a table space, i.e. a table or partition. The colour code is as detailed below for clarity;

GREY	WHITE	SKY BLUE
Part017	Part018	Part016
Part015	Part020	Part010
Part019	Part013	Part012
Part006	Part014	Part011
Part008	Part002	
Part009	Part005	
Part003	Part004	
Part007	Part001	

3.3 Automatic Data Optimization

Automatic Data Optimization (ADO) allows you to create policies for data compression (Smart Compression) and data movement, to implement storage and compression tiering. Smart Compression refers to the ability to utilize Heat Map information to associate compression policies, and compression levels, with actual data usage. Oracle Database periodically evaluates ADO policies, and uses the information collected by Heat Map to determine when to move and / or compress data. All ADO operations are executed automatically and in the background, without user intervention.

ADO policies can be specified at the segment or row level for tables and table partitions. Policies will be evaluated and executed automatically in the background during the maintenance window. ADO policies can also be evaluated and executed anytime by a DBA, manually or via a script.

ADO policies specify what conditions (of data access) will initiate an ADO operation – such as no access, or no modification, or creation time – and when the policy will take effect – for example, after n days or months or years. Conditions in ADO policies are not limited to Heat Map data: you can also create custom conditions using PL/SQL functions, extending the flexibility of ADO to use your own data and logic to determine when to move or compress data.

3.4 Automatic Data Optimization Examples

The following examples assume there is an orders table containing sales orders, and the table is range partitioned by order date.

In the first example, a segment-level ADO policy is created to automatically compress partitions using Advanced Row Compression after there have been no modifications for 30 days. This will automatically reduce storage used by older sales data, as well as improve performance of queries that scan through large numbers of rows in the older partitions of the table.

```
ALTER TABLE orders ILM ADD POLICY ROW STORE
COMPRESS ADVANCED SEGMENT AFTER 30 DAYS
OF NO MODIFICATION;
```

Sometimes it is necessary to load data at the highest possible speed, which requires creating a table without any compression enabled. It would be useful to later compress the data in the table, on a more granular basis than entire partitions. With ADO, you can create a row-level ADO policy to automatically compress blocks in the table (using Advanced Row Compression) after no row in a given block has been modified for at least 3 days. This is an example of OLTP background compression, in which rows are inserted uncompressed, and then later moved to Advanced Row Compression on a per-block basis. Note that this policy uses the ROW keyword instead of the SEGMENT keyword.

```
ALTER TABLE orders ILM ADD POLICY ROW STORE
COMPRESS ADVANCED ROW AFTER 3 DAYS OF NO
MODIFICATION;
```

With the above policy in place, Oracle Database will evaluate blocks in the orders table during the maintenance window, and any blocks that qualify will be compressed in place, freeing up space for new rows as they are inserted. This allows you to achieve the highest possible performance for data loads, but also get the storage savings and performance benefits of compression without having to wait for an entire partition to be ready for compression.

In addition to Smart Compression, ADO policy actions include data movement to other storage tiers, including lower cost storage tiers or storage tiers with other compression capabilities such as Oracle's Hybrid Columnar Compression (HCC).

In the following example, a tablespace-level ADO policy automatically moves partitions to a different tablespace when the current tablespace runs low on space. The ‚tier to' keywords indicate that data will be moved to a new tablespace when the current tablespace becomes too full. The user has control over the threshold that triggers storage tiering actions with PL/SQL-based ILM admin functions. The ‚low_cost_store' tablespace was created on a lower cost storage tier. Note that it is possible to add a custom condition to tiering policies, allowing you to trigger movement of data based on conditions other than how full the tablespace is.

ALTER TABLE orders ILM ADD POLICY tier to low_cost_store;

In the following example, a segment-level ADO policy is created to automatically compress partitions using Hybrid Columnar Compression after there have been no modifications for 30 days. This makes sense when HCC is available, and when the data will no longer be updated, but will continue to be queried; moving to HCC will save a lot of storage AND give a big boost to query performance.

ALTER TABLE orders ILM ADD POLICY COLUMN STORE COMPRESS FOR QUERY HIGH SEGMENT AFTER 30 DAYS OF NO MODIFICATION;

Another option when moving a segment to another tablespace is to set the target tablespace to READ ONLY after the object is moved. This is beneficial for historical data and during backups, since subsequent RMAN full database backups will skip READ ONLY tablespaces.

3.5 Automatic Data Optimization for OLTP.

The previous examples show individual ADO policies that implement one action €compression tiering (Smart Compression) or storage tiering. The following example shows how to combing multiple ADO policies for an OLTP application.

In OLTP applications, you should use Advanced Compression for the most active tables/partitions, to ensure that newly added or updated data will be compressed as DML operations are performed against the active tables/partitions.

For cold or historic data within the OLTP tables, either Warehouse or Archive Hybrid Columnar Compression. This ensures that data which is infrequently or never changed is compressed to the highest level€ compression ratios of 6x to 15x are typical with Hybrid Columnar Compression, whereas 2x to 4x compression ratios are typical with Advanced Row Compression.

To implement this approach with ADO, use the following policies:

Figure 4. Advanced Row Compression, Hybrid Columnar Compression, and tiering.

ALTER TABLE orders ILM ADD POLICY COLUMN STORE COMPRESS FOR QUERY HIGH SEGMENT AFTER 30 DAYS OF NO MODIFICATION;

ALTER TABLE orders ILM ADD POLICY COLUMN STORE COMPRESS FOR ARCHIVE HIGH SEGMENT AFTER 90 DAYS OF NO MODIFICATION;

ALTER TABLE orders ILM ADD POLICY tier to low_cost_store;

In this example of Smart Compression and storage tiering, we assume that the orders table is defined with Advanced Row Compression enabled, so that rows are compressed at that level when they are first inserted. Oracle Database will automatically evaluate the ADO policies to determine when each partition is eligible to be moved to a higher compression level, and when each partition is eligible to be moved to a lower cost storage tier. As discussed earlier, storage tiering is primarily triggered when the current tablespace comes too full, but can be customized to occur based on user-defined conditions.

The capabilities of Heat Map and ADO in Oracle Database 12c make it easy for DBAs to implement ILM for OLTP applications, and enable the use of HCC with OLTP data. With HCC, DBAs can significantly reduce the amount of storage space used by OLTP data, while increasing the performance of reports and analytics.

3.5.1 Automatic Data Optimization and Data Warehousing

In data warehousing applications on Exadata or on Oracle Storage that supports HCC, Warehouse Compression should be used for heavily queried tables/partitions. For cold or historic data within the data warehousing application, using Archive Compression ensures that data which is infrequently accessed is compressed to the highest level€ compression ratios of 15x to 50x are typical with Archive Compression.

Fig5. Partitioning and Hybrid Columnar Compression.

To implement this approach with ADO, use the following statements:

ALTER TABLE orders ILM ADD POLICY COLUMN STORE COMPRESS FOR ARCHIVE HIGH SEGMENT AFTER 90 DAYS OF NO MODIFICATION;

ALTER TABLE orders ILM ADD POLICY tier to lessactivetbs;

In this example, we assume that the orders table is defined with Warehouse Compression enabled, so that rows are compressed at that level when they are first inserted. Oracle Database will automatically evaluate the ADO policies to determine when each partition is eligible to be moved to a higher compression level, and when each partition is eligible to be moved to a different tablespace. As with the previous Smart Compression example for OLTP, the automatic capabilities of ADO in Oracle Database 12c make it simple and easy for DBAs to implement ILM for Data Warehousing, and significantly reduce the amount of time and effort DBAs need to spend optimizing storage usage and storage performance.

4. CONCLUSION

Information Lifecycle Management (ILM) should enable organizations to understand how their data are accessed over time, and manage the data accordingly. However, most ILM solutions for databases lack two key capabilities: automatic classification of data, and automatic data compression and movement across storage tiers.

The Heat Map and Automatic Data Optimization features of Oracle Database 12c support comprehensive and automated ILM solutions that minimize costs while maximizing performance. In combination with the comprehensive compression features in Oracle Database 12c, Oracle Database 12c provides an ideal platform for implementing ILM.

Furthermore in this paper we have suggested very few other performance optimization techniques in transactional (OLTP) SQL Server databases. Optimization is a ‚Mindset', rather than an automatic occurrence. In order to optimize access in our database performance, first we have to believe that, optimization is possible. Then we need to give our best effort and apply knowledge and best practices to optimize. The most important part is, we have to try to prevent any possible performance issue that may take place later, by applying our knowledge before or along with our development activity, rather than trying to recover after the problem occurs.

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VANET Security against Sybil Attack by Using New SRAN Routing Protocol

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Abstract: A VANET facilitates communicate between vehicles and between vehicles and infrastructure. Vehicular Ad-Hoc Network is a sub type of Mobile Ad-Hoc Network i.e. MANET. Now days, road traffic activities are one of the most important daily routines worldwide. VANET provides you most of information that are required for better safety and driving such as an accurate weather description or early warnings of upcoming dangers. To successfully deploy VANET, security is one of the major challenges such as protection from selfish vehicles that may block or mess traffic, bogus notifications etc. that may harm and losses lives, that must be addressed. Sybil attacks have become a serious threat as they can affect the functionality of VANETs for the benefit of the attacker. The Sybil attack is the case where a single faulty entity, called a malicious node, can create multiple identities known as Sybil nodes or fake nodes. This project detects and prevents the Sybil attack using "Secure Routing for Ad Hoc Network" (SRAN) routing protocol. SRAN is based on AODV protocol. In our proposed work, we have developed SRAN protocol to maintain routing information and route discovery in such manner that will detect as well as prevent Sybil Attack. Each node will have a unique identity and their entry in route table. SRAN Protocol easily detects such route that is not valid anymore for communication. It deletes all the related entries from the routing table for those invalid routes.

Keywords: VANET, ITS, V2V, V2I/V2R, Sybil attack, Routing Protocols.

1. INTRODUCTION

The vehicular ad hoc network (VANET) is a special communication pattern to provide communication information within the roadside-to-vehicles and inter-vehicle with the aid of wireless network and information technology. Road traffic activities are one of the most daily routines of common men. The increasing road accidents and traffic congestion are becoming major problems. VANET, a sub type of Mobile Ad hoc Networks is developed to solve these problems which provides scalable and cost-effective solutions for applications such as safety messaging, dynamic routing. VANETs are used in many safeties, critical applications; one of the applications considered in this paper is secure safety routing which is meant for cooperative driving and avoidance of accidents. Sybil attack is more dangerous than any other threat. It injects malicious vehicles on the road.

2. VANET

VANET is considered as a subgroup of Mobile Ad-hoc Networks (MANETs) in which all nodes are vehicles that move at various speeds. The main objective of VANET is to enable communication between vehicle to vehicle and in between vehicle to infrastructure. Transportation system's safety, security and efficiency are improved by using Intelligent Transportation Systems (ITS). ITS consist of various technologies like communications, information processing and control. The integration of ITS technologies with VANET systems is intended to save time, money and lives. There are two types of VANET, used for communication. First, Inter-vehicular communication refers to the kind of communication in which vehicles communicate with each other via wireless technology, also referred to as Vehicle-to-Vehicle communication (V2V) as shown in Fig. 1. It shows when a vehicle breaks down, immediately, the vehicle begins the information dissemination process using the broadcast communication mode. The vehicles that are near to the vehicle, which has broken down, re-transmit the message. In this way vehicles are notified and can take alternative routes, avoiding a possible problem of traffic congestion. In second type vehicles and fixed infrastructure exchange information. This communication mode is referred to as Vehicle-to-Infrastructure (V2I) or Vehicle to Roadside (V2R) communication. V2R is the direct wireless exchange of relevant information between vehicles and the communication units placed on the side of roads and avenues as shown in Fig. 2 [1].

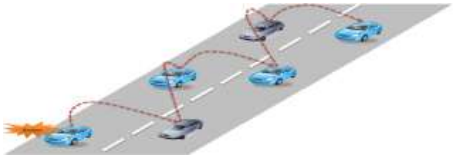

Figure 1: V2V [1]

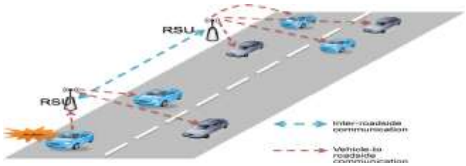

Figure 2: V2R/V2I [1]

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3. SECURITY IN VANET

As VANET is becoming more popular, a serious challenge in this environment is security. As we mentioned previously, VANET is sub branch of MANET. Consequently, VANETs inherit all the security issues associated with MANETs. The malicious behavior of users, such as the modification of the messages, could be fatal to the other vehicular users, etc. Security and privacy in vehicular networks are important for their acceptance. VANETs' architectures and communication schemes provide developers an environment for the deployment of a wide variety of applications. However, major concerns of such environments are privacy and security. Strong security mechanisms are required to protect both applications and users from possible attacks. Therefore, powerful schemes are required to protect users' private information.

VANETs' security is of great importance because any vulnerability could lead to disastrous accidents where people's integrity may be put at risk. Security mechanisms and schemes guarantee the protection of personal data transmitted through VANET but not to identity, location, and destination, among others. In VANET, multiple threats or attacks are possible. One of them is Sybil attack which is considered as major threat.

The Sybil attack is a well-known harmful attack. In this attack malicious vehicles are injected into same network. This attack is very dangerous since a malicious vehicle can present in different positions at the same time, thereby creating massive security risks in the network. The Sybil attack harms the network topologies and connections as well as network lives. In Fig.3, an attacker 'A' sends multiple messages with different identities to the other vehicles. Thus, other vehicles understand that there is heavy traffic. In ad hoc networks, there are three common types of security against sybil attacks which are registration, radio resource testing, and position verification. Registration itself is not sufficient to prevent Sybil attacks, because a fake node has possibility to entry with multiple identities by non-technical means such as stealing. However, a strict registration may lead to serious privacy problem. Radio resource testing is based on the assumption that all physical entities are limited in resources. In position verification the position of nodes will be verified. The goal is to make sure that each physical or original node refers to one and only one identity [2].

Figure 3: Traffic Congestion [2]

4. EXISTING SYSTEMS

In VANET highly challenging tasks is to transporting information from one vehicle to another or all vehicles within specified area. There are several routing protocols defined to transporting information (2014) [2], (2012) [5]. In VANET, the routing protocols are classified as:

In VANET, the routing protocols are classified into four categories. These protocols are characterized on the basis of area where they are most suitable [3], [4].

4.1 Topology Based Routing Protocols

These routing protocols use association information that exists in the network to perform packet forwarding. This protocol further divided into three types.

4.1.1. Proactive routing protocols: Proactive routing protocols continuously try to maintain up-to-date routing information on every node in the network.

Advantage: Routing information is already available when the first packet is sent so connection times are fast.

Disadvantage: When there is no traffic, continuously use resources to communicate routing information.

Types: DSDV, OLSR, CGSR.

4.1.2. Reactive/Ad hoc based routing: Reactive routing opens the route only when it is necessary for a node to communicate with other nodes. Reactive routing consists of route discovery phase so that the query packets are flooded into the network for the path search and this phase completes when route is found.

Types: AODV, PGB, DSR, TORA, and JARR.

4.1.3 Hybrid Protocols: It is combination of proactive and reactive routing protocols. The hybrid protocols are used to reduce the control overhead of proactive routing protocols and decrease the initial route discovery delay in reactive routing protocols.

Types: ZRP, HARP.

4.2 Geographical Routing Protocols

Some routing protocols make use of geographical information, such as GPS coordinates. Typically, nodes communicate their location through the network, so that other nodes can determine shortest path. Select shortest path by using this geographical information.

Disadvantage: Each node need to know its location.

4.3 Cluster Based Routing Protocols

Cluster based routing is like in clusters. Cluster consists of the group of nodes that identifies themselves to be a part of cluster and a node is designated as cluster head will broadcast the packet to cluster. Good scalability is essential characteristic that can be provided for large networks but network delays and overhead are occurred when forming clusters in highly mobile VANET.

Types: COIN, LORA-CBF, TIBCRPH, and CBDRP.

4.4 Broadcast Based Routing Protocols:

In certain applications, the host has to send packets to many or all other hosts. Sending a packet to all destinations at a time is called Broadcasting. This broadcast based routing protocols used in VANET for sharing weather, traffic, emergency and road conditions among all the vehicles.

Types: BROADCOMM, UMB, V-TRADE, and DV-CAST.

Also, there are several secure routing protocols are available and there comparison is shown in Table I [5].

Table 1: Analysis of Secure Routing Protocol

Protocol Attack & Parameters affected	Strength	Weakness	Future Scope
SEAD. 2008. DoS. Scalability, mobility or capability of Packets Delivery Ratio, End-to end Delay. Control Overhead, End-to-end Delay.	1. Lightweight secure routing protocol. 2. They avoid asymmetric cryptography to protect against DoS attack and to overcome limited CPU processing capability. 3. Used efficient one-way hash functions to provide authentication for both the sequence number and metric field in each routing entry.	1. It does not prevent an attacker from tampering other fields or from using the learned metric and sequence number to send new routing updates.	1. Propose a secure routing protocol with the least time cost.
Ariadne. 2005. DoS. Packet Delivery Ratio, Packet Overhead, Byte Overhead, Mean Latency, Path Optimality	1. Ariadne provides point-to-point authentication of a routing message using a message authentication code (MAC) and a shared key between the pair of communicating nodes.	1. It is very much immune to Worm Hole attacks through clock synchronization between nodes, but not in all.	
SRP. 2003. DoS and Blackhole. Packets Delivery Ratio, End-to end Delay.	1. low overhead 2.capable of operating without the existence of an on-line certification authority or the complete knowledge of keys of all network nodes 3. The protocol introduces a set of features, such as the requirement that the query verifiably arrives at the destination, the explicit binding of network and routing layer functionality, the consequent verifiable return of the query response over the reverse of the query propagation route, the acceptance of route error messages only when generated by nodes on the actual route, the query/reply identification by a dual identifier, the replay protection of the source and destination nodes and the regulation of the query propagation.	1. Not handle Wormhole attacks. However, it can nevertheless prevent them.	1. It would be interesting to investigate whether the use of soft state at intermediate nodes would further contribute to the protocol efficiency in a non-benign environment.
ARAN. 2010. Packets Delivery Ratio, End-to end Delay.	1. It introduces authentication, message integrity and non-repudiation to an ad hoc environment as a part of a minimal security policy. 2. The route maintenance is done through special error messages 3. It prevents impersonation attacks by providing end-to-end and hop-to-hop authentication of route discovery & reply messages.	1. Does not have any mechanism that deals with black hole attack, wormhole attack, Denial of service attack 2.ARAN does not guarantee a shortest path, but offers a quickest path	1.Areas in secure ad hoc network routing that have been explored are trust establishment, key generation, nodes that maliciously do not forward packets, and security requirements for forwarding nodes.
SAODV. 2009. DoS and Wormhole. The impact of delayed verification, Adaptive reply decision.	1. It uses a central key management in its routing topology. 2. Digital signatures are used to authenticate at node level and hash chain is used to prevent the altering of node counts. 3. Includes cryptographic operations that can have a significant impact on performance.	1.It requires heavyweight asymmetric cryptographic operations 2.This gets worse when the double signature mechanism is used	1. Evaluate the behavior of SAODV and of the proposed optimizations under attack

5. PROPOSED WORK

In VANET, Security is most important factor for secure communication. Sybil attack is one of the major threats in the network. It injects multiple malicious vehicle nodes in the network and that harms the networks or loosing life. We are proposing new secure routing protocol named as Secure Routing for Ad hoc Network (SRAN) routing protocol. This SRAN protocol detects as well as prevents Sybil attack. SRAN is based on AODV. This SRAN protocol does not allow Sybil node into Route discovery, hence Sybil node is eliminated from the route. Also using RSU we can remove this Sybil node from the Network. In SRAN protocol we consider the following factors.

5.1 Route Request Packet format:

In SRAN routing protocol, if source wants to send message to destination then it first broadcasts the route request (RREQ) to its neighbors. Neighboring node receives RREQ, if receiving node is not destination and does not have route to the destination then it rebroadcast the RREQ and same time backward route is created to the source. If the receiving node is destination node or it has current route to the destination then Route Reply (RREP) is generated.

1) *RREQ ID:* A sequence number uniquely identifying the particular RREQ when taken in association with the source node's IP address.
2) *Source IP Address:* The IP address of the Source.
3) *Source Sequence Number:* The Sequence number of Source.
4) *Source Unique ID:* The Unique Identification of Source.
5) *Destination IP Address:* The IP address of the destination for which a route is selected.
6) *Destination Sequence Number:*The latest sequence number received in the past by the source for any route towards the destination.
7) *Destination Unique ID:* The Unique Identification of Destination.
8) *Hop Count:* Number of hops needed to reach destination.

5.2 Route Reply Packet format:

RREP is unicast and it is hop by hop fashion to source. In RREP each intermediate node creates the route to the destination. When source node receives RREP then it records the forward route to the destination and starts sending message. If multiple RREP's is received by source then depending upon hop count shortest path is selected.

1) *Destination IP Address:* The IP address of the destination for which a route is given.
2) *Destination Sequence Number:* The Destination sequence number associated to the route.
3) *Destination Unique ID:* The Unique Identification of Destination.
4) *Source IP Address:* The IP address of the Source.
5) *Source Unique ID:* The Unique Identification of Source.
6) *Lifetime:* Time to reach to the next Destination.
7) *Hop Count:* Number of Hops needed to reach the Destination.

5.3 Route Error Packet format

When link break down is detected, RERR is generated and send to the source node in hop by hop fashion. When each intermediate node invalidates route to an unreachable destinations or Sybil node is detected then RERR is sent towards source node. When source node receives RERR then it starts reinitiates route discovery.

1) *Unreachable Destination IP Address:* The IP address of the destination that has become unreachable due to a link break.
2) *Unreachable Destination Sequence Number:* The sequence number in the route table entry for the destination listed in the previous Unreachable Destination IP Address field.
3) Sybil Node: The information about sybil node which detected.

5.4 Route Maintenance

Once route is defined then route maintenance is also required. It is to provide information about link of the route as well as route to be modified due to movement of one or more nodes in the route. Every time route is used to send packet then its expiry time is updated by adding current time and Active Route Timeout (ART). ART is a constant value that defines how long new route is kept into routing table of node after last transmission done. ART defines both source and intermediate node. If route is not used in the predefined period then node can't be sure that route is still valid or not and then this route is removed from routing table. It ensures that no any unnecessary packet loss.

5.5 MATHEMATICAL MODEL

In our SRAN routing protocol we provide Unique Identity (UID) field in routing table of each node. When source node broadcasts then all nodes in the network will be verified original node or Sybil node by using UID. From Eq. 1 we can identify the original node and get unique identity of node.

A = {x | x=1 then it is original node}

B = {x | x=2 then it is malicious node}

Where, x = Unique Identity of node.

If 'A' condition is true then original route is follow and if 'B' condition is true then route is automatically eliminated.

5.6 Flow chart of Sybil attack Algorithm

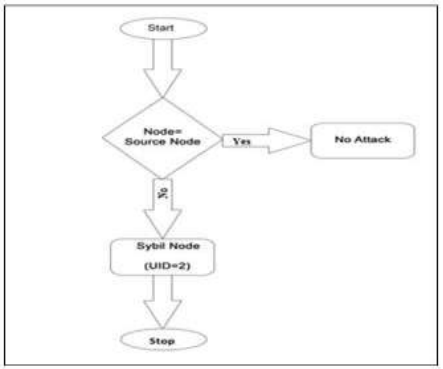

Figure 4: Flow of Sybil attack algorithm.

Considering analysis of secure routing protocols use different techniques to detect as well as prevent attacks. Sybil attack gets all the properties of original node. When Sybil attack is performed into this network then it first identifies the node as source node, if yes then no attack is performed on that node. If node is not source node then perform Sybil attack on that node. In this attack one or more Sybil nodes are injected into the network. This Sybil node can get all the properties of original node but automatically increase the value of Unique Identity as shown in Fig. 4. So when performing route discovery each node can check UID value when it is one then this node become a part of route. When UID value is not one then this node is Sybil node that means it detects the Sybil node and not gets into the route. So this Sybil node is automatically prevented from the route.

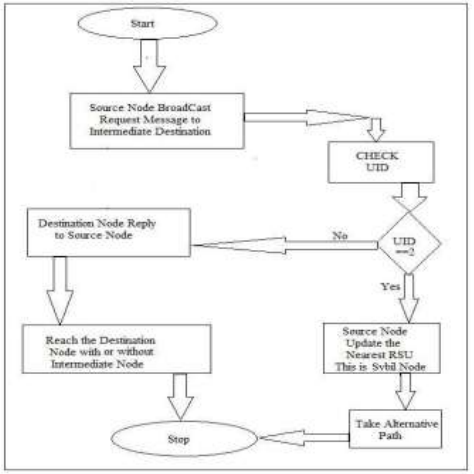

Figure 5: Execution of SRAN Protocol

6. EXPECTED RESULTS

In SRAN protocol separate mechanisms are not used to detect as well as to prevent sybil attack. So it improves the performance of all route activities. It prevents those Sybil nodes to come into that route. It shows total number of packets have been successfully received from source to destination and it also increases the throughputs. In Table II shows RREQ in which UID field consider to identify original node and fake node. Also it has very less delay because of on demand route selection.

Table 2: RREQ

Source ID	Dest. ID	Source IP	Dest. IP	UID
2	4	168.192.10.10	168.192.10.16	1
4	3	168.192.10.16	121.11.10.15	2
4	1	168.192.10.16	121.11.10.17	1

7. CONCLUSIONS

Secure communication is one of the important challenges in VANET. If communication is not secure then it can cause fake messages delivery by malicious nodes, misguiding nodes in the network. This may cause accidents or traffic jam on road. Most of the routing protocols are not providing security for data transmission. Instead of providing separate techniques for attack detection and prevention we can provide in routing protocols. It improves performance of VANET. This SRAN protocol is designed for Sybil attack. SRAN routing protocol provides unique identity to each node in its route table. Then this SRAN routing protocol can easily identify fake node and original node. Also it detects and prevents Sybil attack and gives high performance.

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Congestion Control Clustering a Review Paper

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Abstract: Wireless Sensor Networks consists of sensor nodes which are scattered in the environment, gather data and transmit it to a base station for processing. Energy conservation in the Wireless Sensor Networks (WSN) is a very important task because of their limited battery power. The related works so far have been done have tried to solve the problem keeping in the mind the constraints of WSNs. In this paper, a priority based application specific congestion control clustering (PASCCC) protocol has been studied, which often integrates the range of motion and heterogeneity of the nodes to detect congestion in a very network. Moreover a comparison of the various clustering techniques has been done. From the survey it has been found that none of the protocol is efficient for energy conservation. Hence the paper ends with future scope to overcome these issues.

Keywords: clustering, PASCCC, Data Aggregation, Sensor Node, WSNs

1. INTRODUCTION

A WSN contains a wide array of nodes which can be tightly or arbitrarily deployed in a location by which they have interest. There is Base Stations (BS) situated to sensing area. The bottom station having major function in WSN as sink send queries to nodes while nodes sense the asked queries and send the sensed information in a joint way reverse to Base station. Base station also serves as an entrance for outer surface system i.e. Internet. And so the number of information and send only relevant data to customer via internet is performed by Base station. Because it is known nodes have little batteries which are hard to change or recharge. So to check out such structural design to improve power saving.

Clustering techniques in wireless sensor networks aims at gathering data among sets of nodes, which elect leaders among themselves. The first choice or cluster-heads has got the role of aggregating the data and reporting the data to the BS. The advantages with this scheme is so it reduces energy usage of each node and communication cost. The clustering algorithms which can be made is founded on homogeneity and heterogeneity of nodes. One of many earliest work proposing this process in WSNs is LEACH (Low Energy Adaptive Clustering Hierarchy). Recently, there has been plenty of other clustering techniques which are mostly variants of LEACH protocol with slight improvement and different application scenarios. DEEC (Design of a distributed energy-efficient clustering), EDACH (Energy-Driven Adaptive Clustering Hierarchy) and EEUC (An Energy-Efficient Unequal Clustering Mechanism) are all clustering techniques proposed with the objective of minimizing energy usage, while extending network life time. Clustered sensor network could be classified into two main types: homogeneous and heterogeneous sensor network. While energy efficiency in WSNs remains a function of uniform distribution of energy among sensor nodes, classifying clustering techniques is dependent upon the objectives in mind. The Optimal clustering technique may be the technique for the heterogeneity nodes.

2. Clustering Objectives

Various objectives have been pursued by different literatures in designing clustering architecture for WSN. Most objectives are set to meet the application form constraints.

(i) *Maximizing Network Life-time*

Unlike in cellular networks, where mobile gadgets (e.g. phones) can quickly be recharged constantly after battery drainage, thus power management in these networks remains a secondary issue. However, WSN is heavily constrained in this regard, apart from being infrastructure-less system their electric batteries is quite limited. All of the sensor nodes are equipped with minimal power source. Thus, power efficiency will remain of growing concern and will remain one of the main design objectives of WSN. To be able to cope with energy management in WSN, clustering scheme has been pursued, to extend network life-time and help ease the burden of each node transmitting straight to BS as in conventional protocols like Direct Transmission. When some nodes which are receiving less energy in the WSN then aim is to offer the vitality to that nodes before they declared to be fully dead nodes.

(ii)*Fault Tolerance*

The failure of an alarm node needs to have a small elect on the entire network system. The truth that sensor nodes will undoubtedly be deployed in harsh environmental conditions, there's tendency that some nodes may fail or be physically damaged. Some clustering techniques have been proposed to address the problem of node failure by using proxy cluster-heads, in case of failure of the original elected cluster-head or have minimal power for transmission. Various other literatures have employed adaptive clustering scheme, to deal with node failures such as for example rotating the cluster-head. Tolerating node failure is one of the other design goals of clustering protocols.

(iii)*Load Balancing*

Load balancing technique might be another design goal of clustering schemes. It is always necessary to not over burden the cluster-heads as this could deplete their energies faster. So, it is important to have even distribution of nodes in each cluster. Especially in cases where cluster-heads are performing data aggregation and other signal processing task, an uneven characterization can extend the latency or communication delay to the base station.

3. PASCC: PRIORITY BASED APPLICATION SPECIFIC CONGESTION CONTROL CLUSTERING

In this section, reveal description of distributed cluster-based routing protocol is given. To the most effective of knowledge, PASCCC is the very first protocol of its kind to take into account mobility, heterogeneity, and congestion detection and mitigation utilizing a cluster hierarchy. Many studies have addressed congestion detection and mitigation, but they're either generic or specifically linked to the transport layer. Following assumptions about the PASCCC are created:-

1. Nodes are deployed randomly in the field with a different group of energy values.
2. Nodes can handle adjusting their transmission power to be able to reach a very distant CH throughout a specific round.
3. The positioning of a BS isn't fixed and it may be either within or beyond your sensor field.
4. Nodes can handle moving across the field to cover vacant spaces utilizing the random waypoint mobility model with a rate V, where the value of V ranges between Vmin and Vmax. Hence, complete coverage of the sensor field is guaranteed.

In PASCCC, the nodes can handle moving across the field if required to be able to cover vacant regions. Mobility ensures complete coverage and connectivity at all times. Hence, it is less likely that generated events should go unreported. In PASCCC, 10% of the nodes are advanced. These nodes have higher energy levels compared with normal nodes, thereby creating a heterogeneous number of nodes in the network. PASCCC is an application-specific protocol. In scheme, two application parameters are considered using PASCCC: temperature and humidity PASCCC acts as a reactive protocol for temperature monitoring and as a proactive protocol for humidity. In reactive routing protocols, the nodes react immediately to sudden and drastic changes in the values of sensed events, and they're suited to time-critical applications. In proactive routing protocols, the nodes turn on their transmitters, sense the environmental surroundings, and report captured data periodically to the BS. These protocols are suited to applications that require periodic data transmission

4. LITERATURE REVIEW

Ramli, Aizat, and David Grace [1] presented two novel distributed clustering algorithms that exploit cognitive radio based principles as they are able to learn from the received signal strength indicator (RSSI) beacons, to form clusters which reduce the average distance between nodes and cluster head, and also reduce the level of overlap between clusters. One proposed method is based on a new multiple summation of RSSI values, while the other is based on a multiple in the last sensed RSSI benefit. Nodes become a cluster head, with the winning nodes which are located in an area of locally high node density. It has been shown that the two learning based approaches have same performance, that are significantly better than LEACH and a no learning algorithm. Gautam, Navin, and Jae-Young Pyun [2] proposed a new hierarchical routing protocol, distance aware intelligent clustering protocol (DAIC), with all the key concept involving dividing the multilevel into tiers in addition to selecting the substantial energy CHs in the nearest distance through the BS. They have observed that a considerable amount of energy can be conserved by selecting CHs at the nearest distance from the BS. Likewise, the number of CHs continues to be computed dynamically to avoid selecting unnecessarily large number of CHs in your network. The simulation results showed that this proposed DAIC outperforms LEACH in addition to LEACH-C by 63. 28% in addition to 36. 27% with energy conservation respectively. Xunbo, Li et al. [3] introduced a function to raise the problem. This function employs the relative long distance between nodes in addition to base station along with the round number because its parameters. Therefore, the distribution associated with cluster head may be symmetrical through changing parameters of the function, and. With the increasing of running time, every node within the network has the opportunity to be a cluster head, that is, the energy consumption may very well be balance. The results of simulation showed that the lifetime of Wireless Sensor Network (WSN) has been prolonged about 14%. Wei, Dali [4] proposed a distributed clustering algorithm, Energy-efficient Clustering (EC), that determines suitable cluster sizes depending on the hop distance for the data sink, although achieving approximate equalization associated with node lifetimes in addition to reduced energy ingestion levels. They additionally propose an effective energy-efficient multihop facts collection protocol to evaluate the potency of EC and calculate the end-to-end energy utilization of this protocol; yet EC works for any facts collection protocol that targets on energy conservation. Performance results exhibited that EC provides network lifetime in addition to achieves energy equalization better than two well-known clustering algorithms, HEED and UCR. Lai, Yen-Cheng [5] suggested a Region-based Clustering Mechanism (RCM) being applied in these kind of MAC protocols. They proposed analytical models to investigate the performance from the RCM, which are validated from the simulation experiments.. Klaoudatou, Eleni et al. [6] grouped the WSNs application environments into two major categories and have examined: a) which of the cluster-based Group Key Agreement (GKA) protocols that appear in the literature are applicable to each category, and b) to which degree these protocols impact the systems' performance and energy consumption. In order to answer these questions they have calculated the complexity of each protocol and the energy cost it will add to the system. The evaluation of all discussed protocols has been presented in a generalized way and can therefore serve as a reference point for future evaluations and for the design of new, improved GKA protocols. Yoo, Jong-Woon, and Kyu Ho Park [7] proposed a novel energy preserving approach that intrusions the multiradio attribute of recent cellular phones equipped with WLAN and Bluetooth interfaces. This work is based on clustering. In this work, a cluster is a Bluetooth Personal Area Network (PAN), which consists of a cluster head and several regular nodes. The cluster head is a gateway between the PAN and the WLAN, which further enables the regular nodes to access the WLAN infrastructure through the low-power Bluetooth. They presented a distributed clustering protocol, Cooperative Networking protocol (CONET), which dynamically reforms clusters according to each node bandwidth requirement, energy, and applications. Tong, Hui, and Jun Zheng [8] proposed an energy-efficient clustering protocol for wireless sensor networks (WSNs). Unlike LEACH and other existing clustering protocols, the proposed clustering protocol considers both the residual energy of a sensor node and the distance between the sensor node and the sink in electing a cluster head and a sensor node with more residual energy and closer to the sink has a higher probability to become a cluster head. Simulation results showed that compared with LEACH the proposed clustering protocol can better balance the energy consumption among sensor nodes and can thus effectively reduce the energy consumption and

prolong the lifetime of a WSN. Deng, S.[9] proposed a mobility-based clustering (MBC) protocol, which is used for wireless sensor networks with mobile nodes. The proposed clustering protocol, a sensor node elects itself as a cluster head dependant on its residual energy and mobility. A non-cluster-head node is aimed at its link stability that has a cluster head during clustering in line with the estimated connection moment. Each non-cluster-head node is allocated a timeslot for data transmission inside ascending order in the time division multiple address (TDMA) schedule based on the estimated connection moment. In the steady-state cycle, a sensor node transmits its sensed files in its timeslot and also broadcasts a articulation request message to become listed on in a new cluster and avoid more packet loss when it offers lost or is going to lose its connection with its cluster head. Simulation results show how the MBC protocol can slow up the packet loss by 25% compared with the cluster-based routing (CBR) protocol and 50% compared with the low-energy adaptive clustering hierarchy-mobile (LEACH-mobile) protocol. Moreover, it outperforms both the CBR protocol and the LEACH-mobile protocol in terms of average energy consumption and average control overhead. Hoang, Duc et al. [10] presented a design and implementation of an energy-efficient cluster based protocol for wireless sensor networks. The formation of clusters is to balance energy usage by sensor nodes within each cluster of the cluster-based WSNs. This leads to energy savings for the sensor nodes in order to obtain this objective, the fuzzy C-means (FCM) clustering algorithm is incorporated in the protocol. The protocol is realized on hardware with the support of the embedded operating system, TinyOS. Experimental results obtained from a scale-down laboratory based hardware with up to 50 sensor nodes are provided to illustrate the efficacy of the WSNs using the proposed protocol and compared with the well-known cluster-based protocols such as Low Energy Adaptive Clustering Hierarchy. Many experts have shown that the FCM protocol will be able to achieve better organization in the network and so can extend it's lifetime under diverse operating conditions sufficient reason for different number of nodes. Ganesh, Subramanian, and Ramachandran Amutha [11] modified the ad-hoc on demand distance vector routing by signal-to-noise ratio (SNR) based dynamic clustering. The proposed scheme, which is secure routing protocol for wireless sensor networks through SNR-based dynamic clustering (ESRPSDC) mechanisms, can partition the nodes into clusters and select the cluster head (CH) one of the nodes using the energy, and non CH nodes join with a specific CH using the SNR values. Error recovery has become implemented during this inter-cluster routing to avoid end-to-end error healing. Security has been recently achieved by separating the malicious nodes making use of sink-based routing style analysis. Extensive investigation studies by using a global mobile simulator have demonstrated that this cross ESRP significantly improves the action efficiency and supply reception rate in comparison with the SNR ignorant routing algorithms such as the low energy conscious adaptive clustering hierarchy and power efficient gathering in sensor information systems. Jan, Mian Ahmad et ing. [12] proposed any priority-based application specific congestion control clustering (PASCCC) standard protocol, which integrates this mobility and heterogeneity from the nodes to detect congestion inside a network. PASCCC decreases the job cycle of just about every node by keeping threshold levels pertaining to various applications. The transmitter of an sensor node is triggered once the reading of a certain captured event exceeds a certain threshold level. Time-critical packets are prioritized during congestion in order to maintain their timeliness prerequisites. In their planned approach, CHs assure coverage fidelity simply by prioritizing the packets associated with distant nodes around those of close by nodes. A novel queue scheduling mechanism is actually proposed for CHs to accomplish coverage fidelity, which helps to ensure that the extra sources consumed by distant nodes are employed effectively. The effectiveness associated with PASCCC was evaluated dependant on comparisons with current clustering protocols. The experimental final results demonstrated that PASCCC attained better performance with regards to the network life, energy consumption, files transmission, and other QoS metrics in contrast to existing approaches.. Tarhani, Mehdi et al. [13] proposed a new distributed algorithm named scalable energy efficient clustering hierarchy (SEECH), It is shown that the FCM protocol has the ability to achieve better organization in the network and thus can extend their lifetime under different operating condition which selects CHs and relays separately and determined by nodes eligibilities. Like this, high and reduced degree nodes are usually, respectively, employed as CHs and relays. In just one or two past researches, CHs and relays vary, but their objective was mainly mitigation of CHs energy burden which can be intrinsically satisfied from the proposed mechanism. To consider uniformity of CHs to be able to balance clusters, SEECH relies on a new distance-based criteria. Comparisons with LEACH and also TCAC protocols present obvious better performance of SEECH throughout term of life. To evaluate the scalability of SEECH tactic, simulations are done in three unique network size examples. Hoang, D. [14] proposed a framework that permits practical development involving centralized cluster-based standards supported by optimization means of the WSNs. Based on this framework, a new protocol using harmony search algorithm (HSA), a new music-based meta-heuristic optimization method, is designed and implemented in real time for the WSNs. It can be expected to limit the intra-cluster distances between the cluster members and also their cluster mind (CHs) and optimize the vitality distribution of the WSNs. The study involving HSA cluster-based protocol is carried out in a real case the location where the WSNs equipped with the proposed protocol are deployed in a indoor environment to be able to monitor the ambient temperature for fireplace detection. A comparison is manufactured with the well-known cluster-based protocols developed for WSNs like low-energy adaptive clustering hierarchy-centralized (LEACH-C) along with a cluster-based protocol using Fuzzy C-Means (FCM) clustering algorithm. Experimental results demonstrate that this proposed protocol using HSA can be realized in centralized cluster-based WSNs pertaining to safety and security applications in constructing environments. From the particular obtained experimental test out results, it sometimes appears that the WSNs lifetime continues to be extended using the particular proposed HSA protocol which have a practical that of LEACH-C in addition to FCM protocols. Kumar, Dilip [15] planned and evaluated two new clustering-based protocols for heterogeneous WSNs, that happen to be called single-hop energy-efficient clustering protocol (S-EECP) and multi-hop energy-efficient clustering protocol (M-EECP). In S-EECP, the cluster brains (CHs) are elected by way of weighted probability based on the ratio between residual energy of each one node and average energy on the network. The nodes with high initial electricity and residual energy should have more chances being elected as CHs as compared to nodes with lower energy whereas in M-EECP, the elected CHs communicate your data packets to the base station via multi-hop communication approach. To analyze the time of the network, the authors assume three

types of sensor nodes pre-loaded with different battery electricity. Finally, simulation results indicate that this authors protocols increase network lifetime, and achieve load balance one of the CHs better versus existing clustering protocols. Farouk, Fifi et al. [16] proposed a reliable and energy-efficient clustering (SEEC) protocol for heterogeneous WSNs. Furthermore, the extension to be able to multi-level of SEEC is usually presented. It will depend on the network structure that is divided into groups. Each cluster has a powerful advanced node and a few normal nodes deployed randomly within this cluster. In the particular multi-level architectures, stronger supper nodes are assigned to pay distant sensing locations. Each type involving nodes has its role from the sensing, aggregation or transmission for the base station. At each amount of heterogeneity, the optimum quantity of powerful nodes that will achieve the minimum energy utilization of the network is usually obtained. The proposed protocol is really a heterogeneous awareness to be able to prolong the stableness period, which is necessary for many apps. The performance on the proposed protocol is usually compared by existing homogeneous and heterogeneous protocols. Simulation results show that this proposed protocol offers a longer stability period of time, more energy efficiency and higher average throughput versus existing protocols.

5. CONCLUSION AND FUTURE SCOPE

In this paper, a survey on various clustering protocols has been done. The existing methods has used queuing model which may restrict the performance of the congestion control algorithm. The behavior of the queue has been neglected for coverage fidelity, queuing thresholds, number of queues, blocking probabilities etc. The nature of the traffic arrival process exhibits a bursty and correlated behavior, which totally degrade the network performance. Therefore it has been found that none of the technique performs better in all fields.

To overcome this problem, PASCCC will be improved further by using leaky bucket algorithm instead of priority queues

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Calculation of Leakage Water and Forecast Actual Water Delivery in Town Drinking Water Supply Systems

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Abstract: Almost all proposals present forecast data of the variables in focus and conclude the results. However, some variables such as water can change its volume during the traverse from source to end. Such of these variables need to be studied with loss parameters also. This loss parameter here is leakage water. Water demand forecast can be calculated for the coming years, but leakage water also need to be calculated and then actually delivered water to the end users has to be forecast. This paper proposed a model of piping pattern, leakage locations. Calculated leakage water and forecast the actual delivery of water to end users. On the application side, the results of this paper help administrators take decisions on improving infrastructure of water distributions system and take precautions to care the maintenance of the infrastructure. The ideas and methods presented in this paper can be applied to other projects of similar nature. On the academic research side, this formulation helps further in-depth analysis to be carried out to calculate exact leakage water volumes. Water works departments can also benefit from this research.

Keywords: Water Demand, Leakage Water, Forecast, Extrapolation, Least Squares

1. INTRODUCTION

Problem addressed in this research paper is to calculate water wastage due to leakages and forecast how much water is actually delivered to end users.

As water demand increases, water supply management requires changes. For the last few decades water requirement has been increasing both due to an increase in water usage and reduced water supply. Water leakage reduction in public water systems is a crucial part of water demand management. Especially water supply systems managed by Municipalities, Corporation and other Government organizations pose more threats due to poor management.

Usually, leakage is the largest component of distribution loss yet it is not subject to focus other than management decision by utilities. Leakage in public water supply systems results in loss of purified drinking water but also means of wasting the money and material resources used in abstraction, transportation and treatment. It results in secondary economic loss also, in the form of, damage to the pipe network. Public health concerns as it increases the risk of bacterial contamination of drinking water resources in the cities for human consumption, and can increase pollution loads into the environment.

Figure 1: A Trivial Water leakage Location

Most countries have recognized the need to replace the present Water Infrastructure and their Challenges. Million kilometers of pipes beneath the streets need to be replaced because as pipes age, the problems of in-filtration and ex-filtration due to leaks increase in sewer pipes and can lead to potential problems such as the collapse of a pipeline or damages to nearby assets [1].

City / town population is continuously increasing every year, it has an impact on the increased clean water consumption. Therefore, the actual data of water volumes is required for the demand fulfillment of how much the water is needed. Data analysis tool is highly needed in the measurement, control processes, formulate information from the available data, and help make decisions based on the available data and predictions [2].

On primary estimates of requirements of lactating women who engage in moderate physical activity in above-average temperatures, a minimum of 7.5 liters per capita per day will meet the requirements of most people under most conditions. This water needs to be of a quality that represents a tolerable level of risk. However, in an emergency situation, a minimum of 15 liters is required. A higher quantity of about 20 liters per capita per day should be assured to take care of basic hygiene needs and basic food hygiene. Laundry / bathing might require higher amounts unless carried out at source.

Local government drinking systems, which manages the distribution of water in towns / cities and their catchment areas. Distribution of clean water from a number of sources is not fully established in some developing countries. This is due to the limited volume of water availability and the lack distribution system management or financial difficulties. The water distribution department must be able to distribute sufficient quantity of quality water in to all users to meet their needs [3].

Most government departments are not implementing the

forecast tools for determining the quantity of water to distribute. Therefore, the effectiveness and efficiency of water distribution is very low, moreover, it has been causing water distribution leakage that can affect the availability of the water to the end users. This condition would be harmful to the Municipalities as they can not fulfill the users' needs. The unsatisfied users with the service provided can cause a bad image on the Municipalities and their functioning.

The supply source, distribution, wastage water, etc require a properly designed strategy with the placement of the shape of the desired input and output. In this paper we introduce essential pipeline patterns to identify and calculate the water leakages and then forecast actually delivered water amounts, in general and for particular cases.

First of all, what is the relationship among Planning Level, Water Utility Decision Problems and Forecast Attributes for short, medium and long horizons? They are categorized [4] in the below table.

Table 1: Planning Levels and Forecast Horizons

Planning Level	Decision Problem	Forecast Horizon	Forecast Periodicity
Operational	System operation management and optimization	Short-term (less than 1 year)	Hourly, Daily, Weekly, Monthly
Tactical	Revenue forecast, Investment planning, Staging system improvement	Medium term (1-10 years)	Monthly, Annual
Strategic	Capacity expansion	Long term (more than 10 years)	Annual

Long term planning / strategies can rely on Regression Least Squares [5] to predict the future state through available data in the past and forecast the events in the future on the basis of patterns. The system developed can be added as an extra added system or anew. By combining the expertise of information technology, especially in the field of system forecasting, it is expected to solve the existing problems. Furthermore, decision support systems [6] in water distribution aims to help decision makers utilize particular data and models to solve various problems which are not structured.

2. WATER LEAKAGE PATTERNS

The water leakage is as severe as the demand of water; we need to identify potential leakage locations. The potential leakage locations are identified in the below Figure 2.

This is generalized pattern and leaks or holes in the pipes are not considered in the Figure, leaks at junctions are stage 1 leakage potentials.

2.1. Leakage Points

In view of water distribution need, we needed information

WS: Water Source
LP: Leak Point
TJ: Over Head Tank Junction
OHT: Over Head Tank
AJ: Area Junction, covered by a certain OHT
STR: Street
IH: Individual House

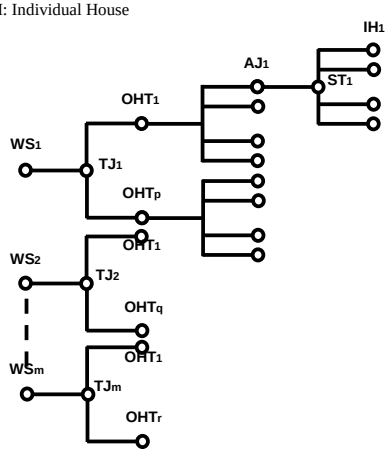


Figure 2: Piping Patterns and Leakage Segments

Segment 1: Pipes between WS and TJ
Segment 2: Pipes between TJ and OHT
Segment 3: Pipes between OHT and AJ
Segment 4: Pipes between AJ and STR
Segment 5: Pipes between STR and IH

2.2. Math Formulation

From the section 2.1, we can formulate a generalized model for leakage of water.
Total amount of leakage water in the amount of water supplied from Source 1 can be calculated as below.

The number of potential leakage segments can be identified as minimum 5 as shown in Section 2.1. Then we can formulate the total leakage water (TLW) for one water source WS1 as
Amount of leakage water in Segment 1 = a * TJ
Amount of leakage water in Segment 2 = b * OHT
Amount of leakage water in Segment 3 = c * AJ
Amount of leakage water in Segment 4 = d * ST
Amount of leakage water in Segment 5 = e * IH

TLW = a*TJ + b*OHT + c*AJ + d*ST + e*IH → (Eq.1)

This can be written as a non-linear polynomial as below

$$TLW = \sum_{i=1}^{a} TJ_i + \sum_{j=1}^{b} OHT_j + \sum_{k=1}^{c} AJ_k + \sum_{l=1}^{d} ST_l + \sum_{m=1}^{e} IH_m$$

This non-linear polynomial is of many degrees of freedom and difficult to solve for minimum solutions. In order to find a set of feasible solutions for this model, we assume TJ, OHT and AJs are of type "fast running faucets", ST and IH are of type "dripping faucets". We calculated the leakage water in Section 3.3.

With the non-linear feasible solution, we create a linear equation for forecasting the actually delivered water as below:

Y = A * X + (TLW + E) → (Eq.2)

Where,
Y is total amount of water pumped at Water Source
X is the total amount of water actually delivered to end users
TLW is the total amount of water wasted through leakages.
E is residual, which can be ignored at the moment.
A is controlling constant also known as slope.
The above equation can be expressed as below

$$Y_i = AX_i + (TLW + E_i)$$

Where Ei is residual of data point i. This Ei is not focused in this paper hence we reduce the equation to without Ei. Then our task became simpler, to find best fit of a line with the following characteristics
- it minimizes the sum of the squared residuals,
- the sum of the residuals is zero, and
- the point (mean(x), mean(y)) falls on the line.

Transforming this equation for best solution, we get

$$\min_{\forall i, TLW} (Y_i \sim X_i) \quad \rightarrow \text{(Eq.3)}$$

3. CALCULATE and FORECAST OF WATERS USING PARTICULAR DATA

World Bank has granted funds to execute water improvement projects in four municipalities in Andhra Pradesh [9].
F1: Andhra Pradesh Municipal Development Project: resettlement plan (Vol. 4): Resettlement action plan for comprehensive water supply service improvements to Guntur Municipal Corporation - packages one and three (English)
Document Type: Resettlement Plan Report No.: RP824
Document Date: JAN 01, 2014
F2: Andhra Pradesh Municipal Development Project: resettlement plan (Vol. 3): Resettlement action plan for comprehensive water supply service improvements to Manuguru Municipality (English)
Document Type: Resettlement Plan Report No.: RP824
Document Date: JUL 01, 2013
F3: Andhra Pradesh Municipal Development Project: resettlement plan (Vol. 2): Resettlement action plan for comprehensive water supply service improvements to Vizianagaram municipality (English)
Document Type: Resettlement Plan Report No.: RP824
Document Date: APR 01, 2013
F4: Andhra Pradesh Municipal Development Project: resettlement plan : Key guidelines for resettlement action planning and management (English)
Document Type: Resettlement Plan Report No.: RP824
Document Date: MAY 27, 2009

Out of these four, Vizianagaram Municipality is located in very backward area, where maintenance and management is surveyed very poor and hence prone to much water leakages and wastage of water. We will focus on this project and calculate water wastages and actual water can be delivered to create awareness on the need of proper maintenance and water leakage management processes.

3.1. Population Analysis

The projected population of Vizianagaram (VZM) is given in below table, (Ref. F1 document) [6][8].

Table 2: Projected Population of VZM for 30 Years

VZM Pop	Town	Villages	Total
2011	200177	27330	227507
2026	257445	39861	297306
2041	331097	58137	389234

Here, projection / forecast interval is taken 15 years, which is too large, predictions cannot be accurate or near accurate, so we need to consider for a shorter interval of 5 year. Using extrapolation method, we calculate necessary data from the below equations

$$Y(x) = Y_{k-1} + (\frac{x - X_{k-1}}{X_k - X_{k-1}})(Y_k - Y_{k-1}) \quad \rightarrow \text{(Eq.4)}$$

Where $(X_{k-1}, Y_{k-1}) and (X_k, Y_k)$ are two nearest data points to the data point in focus. We calculated data using Extrapolation equation given in (Eq.3) and summarized in below table. This data is for an interval of 5 years of the total period 30 years projection given in F2.

Table 3: Calculated Population Data of VZM Unit

Year	Town	Villages	Total
2011	200177	27330	227507
2016	219045	-31729	250774
2021	238177	-35863	274040
2026	257445	39861	297306
2031	282937	45012	327949
2036	306605	51987	358592
2041	331097	58137	389234

The advantage of using data of shorter intervals is shown in the below figure. Red circles are projected by VZM and blue circles are our extrapolated data for shorter periods. Note that we get them not on red straight line but on blue Spline curve.

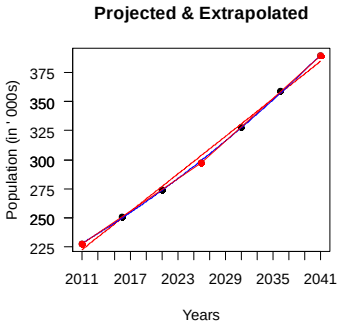


Figure 3: Projected and Extrapolated Population of VZM

3.2. Water Requirement in VZM

The projected water requirement of VZM as forecasted in F2 is recalculated for shorter periods and the new data is given in

below table for 3 states of requirements Minimum, Moderate and Full requirements [7].

Table 4: Calculated Water Demand in VZM Unit for 3 States

Yearly	Minimum	Moderate	Full Use
	7.5L/day	50L/day	135L/day
2011	1706303	11375350	30713445
2016	1880805	12538700	33854490
2021	2055300	13702000	36995400
2026	2229795	14865300	40136310
2031	2459618	16397450	44273115
2036	2689440	17929600	48409920
2041	2919255	19461700	52546590

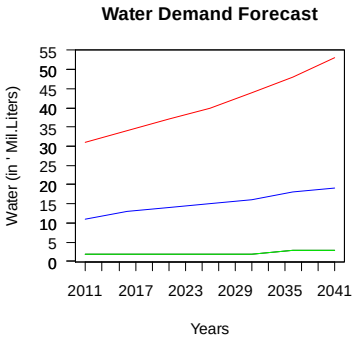


Figure 4: Water Requirement Forecast for 3-States

Green color is for 7.5L/day, Blue is for 50L/day and Red is for 135L/day estimates for an year.

3.3. Water Leakage Calculations

Now we will calculate the water leakages for the described water leakage patterns in Section 2. For the given water requirements and we calculate water leakage for the leakage patterns described in Section 2.1. We categorize the pipes into two types for calculating leakage amounts purpose. Pipes, Method, Time / Volume in the said segments are considered as given in the below table.

Table 5: Fast Running and Dripping Faucets in Patterns

Segment	Type	Method	Time/Volume
Segment 1	Type 1	Fast Running	10 sec
Segment 2	Type 1		20 sec
Segment 3	Type 1		30 sec
Segment 4	Type 2	Dripping	3 drops
Segment 5	Type 2		5 drops

Type 1: Fast Running Faucets
For larger/more rapid leaks - hold an 8 ounce cup under the dripping fixture and time, in seconds, how long it takes to fill the cup (8oz = 0.2369 liters).

Type 2: Dripping Faucets
For smaller/slower leaks - count the number of drips in one minute from the leaky fixture. Note: 5 drips per second amounts to a steady stream.

With the formula: rate Z = (3/5)M means that in 5 minutes 3 ounce of water is wasted through leakages. We now calculate how much water is expected to go out through leakages for days, months and years as shown in the below table.

Table 6: Liters for given time per period

	Per / Ltr	Day	Month	Year
Sg1	8oz/10 Sec	2044	61323	746103
Sg2	8oz/20 Sec	1022	30661	373051
Sg3	8oz/30 Sec	681	20441.1	248700
Sg4	3 drop/min	1.64	49.2	598.6
Sg5	5 drops/min	2.73	81.9	996.45
Total		3751.37	112556.2	1369449.1

This is just one set of solutions for the Eq.1 formulated in Section 2.2. We go ahead with whatever data we have in our hand. Now we have the water leakage information for one water source.

Similarly, we can calculate water leakage information for other water sources for the described piping patterns given in Section 2.1. However, we do not consider the solutions for all Water Sources now. To do this we need to extend the research to more complicated mathematical formulations or more assumptions.

3.4. Forecast Actual Water Delivery

Now we have data for water demand and data for leakage water on hand. We can now forecast actual water that will be delivered to the end users, after expected leakages for the given 3-states, Minimum, Moderate and Full requirement. The calculated data is given in the below table.

Table 7: Actual Delivered Water to The End Users

Year	Minimum	Moderate	Full
for	7.5L/day	50L/day	135L/day
2011	336854	10005901	29343996
2016	511356	11169251	32485041
2021	685851	12332551	35625951
2026	860346	13495851	38766861
2031	1090169	15028001	42903666
2036	1319991	16560151	47040471
2041	1549806	18092251	51177141

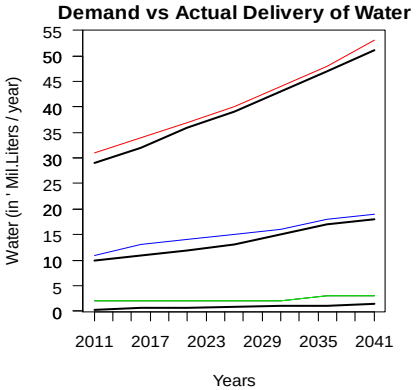


Figure 5: Actual Amount of Water Delivered to End Users

Demanded water curves are shown as Green: 7.5L, Blue: 50L, Red: 135L. The thick black curves show the actual water delivery.

The usual regression least squares method and mathematical calculations are used to find the controlling parameter values for "A" in Eq. 2. Further analyzed for crucial values and are summarized in the below table.

Table 8: Analysis Results

	State	7.5 L	50 L	135 L
Correlation	Demand	0.791	0.994	0.995
	Delivery	0.959	0.990	0.999
Intercept	Demand	-70.071	-505.828	-1.421e+03
	Delivery	-67.159	-550.671	-1.451e+03
p-value	Demand	0.034	5.601e-06	3.404e-06
	Delivery	0.00063	1.928e-05	7.396e-08

3.5. Summary of Analysis Results for VZM

From Table 8, one can observe the correlation values for demand and actual delivery is near 1. A correlation of 1.00, whether it's positive or negative, is a perfect correlation. It means that as volumes on one of the two variables increase or decrease, the volumes on the other variable increase or decrease by the same magnitude.

If X in Eq.2 (total water of actually delivery) never = 0, then the intercept has no intrinsic meaning. But if all water pumped at Water Source is leaked out in any segments of type 1, we get no water to actual delivery, here X becomes 0. So intercept is calculated for this model. From these values we can observe more difference in intercept for Demand and Delivery for case 50L. Other cases do not show much greater difference.

A small p-value (typically ≤ 0.05) indicates strong evidence against the null hypothesis, so you reject the null hypothesis. A large p-value (> 0.05) indicates weak evidence against the null hypothesis, so you fail to reject the null hypothesis. p-values very close to the cutoff (0.05) are considered to be marginal (could go either way). So, we report the p-value for readers can draw their own conclusions. p-values in Table 8 for all the three cases, show strong evidence against the null-hypothesis.

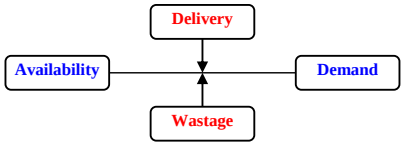
It means that there is a strong relationship between Demand and Delivery through Leakage Water volumes.

3.2. Extension to Other 3 Projects

We need to design the piping patterns in the distribution system and calculate the leakage water volumes and forecast the volumes of water actual delivery to end users for the remaining three projects: F1 - Guntur Municipal Corporation, F2 - Munuguru Municipality and F4 - resettlement plan, to effectively utilize the water available at Water Sources.

4. DISCUSSIONS

Availability and Demand are key issues to the administrators and decision makers. Wastage and Delivery are importance to us hence induced into the system as shown in the below depiction.



Water distribution systems are not necessarily same in all cases, but an essential pattern is same everywhere. Leakage Water is not a straightforward calculation, involves many unknown variable, hence becomes a non-linear in nature.

But linearization of such non-linear systems provided insight and calculation feasibility. Forecasting and analyzing the calculated results are comparable to any other similar systems published so far, however, the superiority of our methods came from the consideration of ignored variables Leakage Water and Actual Delivery together in one system.

5. CONCLUSIONS

Most projects funded by global organizations, consider the need or demand and proposed solutions as primary concepts and the intrinsic maintenance plans and strategies left secondary, or in most cases are neglected / ignored. The projects that forecast water demand for coming years also fall into the same category and less measured. As described in the previous sections, administrators just see the Demand and Availability, but researchers see differently, In this research, we identified that Wastage and Delivery play a great role in the supply cycle. We studied the problem in researcher view and modeled the scenario, forecast and analysis of Wastage and Delivery issues are presented.

First of all, What if we have less (population and water requirement) data available? To address this, we need to use extrapolation methods to create required data. To study the problem, we have very less data of population projections available from the project proposals. Using extrapolation methods, we created more necessary data for shorter intervals. Then, what if we have missing parameters? We identified the missing parameters, Wastage as Leakage Water, Delivery as Actual Delivery to consumers.

And then, what if we don't have a model of infrastructure information? To workout with such scenarios, we created a model of piping patterns and a model of water traverse. If you have enough data, just calculations can give some results,

however, ideas, methodology and mathematical formulation provide scientific results. This is what we did in sections 2 and 3. After all, if you don't analyze the results administrators or decision makers don't understand the perfection of the model presented. We did this analysis in Analysis section.

The ideas and methodologies presented in this research paper can be used with scenario matching modifications to identify and avoid most of the leakage problems and can deliver more water to the consumers. The application of the results can be extended to municipalities or distribution agencies, who distribute the clean water to the consumers.

Finally, we conclude the paper with some avenues for further extension. There is lot of scope for research using the proposed methodologies. To specify some directions, we can extend (1) to handle multiple Water Sources, (2) to compute data for the complexity (nonlinearity) of number of leakage points and a variety of faucets with uniform & non-uniform leakage volumes, (3) to introduce environmental parameters, etc. Further study on these issues gives more accurate results, but we need to pay time and money.

6. ACKNOWLEDGEMENTS

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A Reliable Routing Technique for Wireless Sensor Networks

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Abstract: Wireless Sensor Network (WSN) consists of very large number of sensor nodes which are deployed close to the area which is to be monitored so as to sense various environmental conditions. WSN is a data-driven network which produces large amount of data and also sensor nodes are energy-limited devices and their energy consumption is mainly associated with data routing. Therefore it is necessary to perform redundant data aggregation so as to save energy. In this work data aggregation is achieved with the help of two key approaches namely Clustering approach and In-network data aggregation. These two approaches help to save energy and thereby increasing the lifetime of the network. The proposed work has some key features like reliable cluster formation, high data aggregation rate, priority of packets, minimized overhead, multiple routes, reduced energy consumption which enhance the network lifetime. The performance evaluation of the proposed approach is carried out using Network Simulator- version 2.

Keywords: sensor network; data routing; ns-2; sleep mode nodes; clustering; alternate path.

1. INTRODUCTION

The WSN is made up of very enormous number of wireless sensor nodes, which are deployed in space and capable of sensing the physical and environmental factors like pressure, vibration, temperature, heat content and sound close to the area where they are deployed. Wireless Sensor Network has become an important emerging area in wireless communication field. It is a very popular area for research, because of their vast usefulness in variety of applications[1].

Wireless sensor network (WSN) possess the ability of detecting (sense) the data, processing it and communicating the processed data, thereby enabling the connection of the physical word with the environment and many other inaccessible areas. The sensor nodes are placed close to the region, where the information has to be sensed. Each of these nodes senses the data which is required and forwards the data obtained after processing (if required) to other nodes to form the network [2].

The protocols and algorithms designed for wireless Sensor network must exhibit self-organizing capabilities which is one of the main requirements. The other special feature of WSNS is the co-operative operation exhibited by the sensor nodes. These nodes do not send the raw information instead, makes utilization of their dispensation abilities to perform simple computations required nearby and merely the necessary, important and moderately treated data will be transmitted to the destination.

The major limitations in the scenario of WSNs are limited capacity of the battery power source, physical size of the device, limited storage capacity, cost constraints, limitation of the processing capability of the sensors. Therefore the algorithms designed for WSNs must consider these key parameters as their main conception[3].

Figure 1 shows the routing of data in WSN

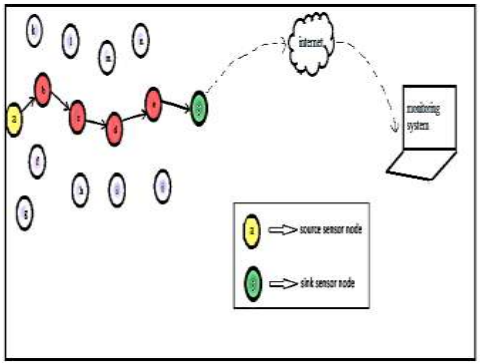


Figure 1: data routing in WSN

As presented in the above the nodes are placed close to area which is to be sensed. The deployment can follow any network topology as per the requirement. Here node named as 'a' is the source node as it senses the data in the first event. It processes the data being sensed and performs certain additional computations required. In the next step it stores the processed information if it is necessary for future references.

Now the processed data is ready to be communicated with the neighbor nodes. Source node finds the neighbor based on certain criteria and then forwards the processed data. The same procedure is continued unit the destination (sink node) is reached. From the sink node data can be obtained for further references [7].

2. RELATED WORK

The algorithms developed for routing data in WSN are mainly divided into three types. They are

- Tree based algorithms
- Structure less algorithms
- Cluster based algorithms

Tree based algorithms is based on hierarchical organization of the nodes in which a routing tree is build first and is used to route the data and also to aggregate the packets at intermediate nodes. The cluster-based approach is also similar but in this nodes are divided into groups called clusters. A special node called cluster-head is elected among the group members and this node performs aggregation of data locally and forwards the aggregated packet towards the sink node. Whereas in structure-less approach a random path will be chosen to route the data and here opportunistic aggregation of data occurs [3].

Few main approaches coming under the above algorithms are explained below.

2.1 Directed Diffusion

It comes under tree based approach. The Directed Diffusion [7] protocol is one of the most primitive characteristic based data transmitting approach. In this case, information fusion occurs opportunistically, that is only when the data packets meet at any intermediate nodes of the routing tree path.

2.2 Shortest Path Tree (SPT) algorithm

It comes under tree based approach, [5] wherein every node that detects an event reports its collected data by using a shortest path towards the sink node. The data aggregation occurs whenever routing paths overlap.

In tree based algorithm

- If at any movement, whenever a data is not found at a definite part of the routing path, say for example because of the damages present in the channel, data is vanished from the remaining whole part of the tree as well.

- A mechanism for fault tolerance is required for Tree-based algorithms in order to forward the aggregated information in a reliable manner.

2.3 Data-Aware Anycast (DAA) approach

It comes under the structure less algorithm [4]. This makes use of any of the path in order to route the data to its neighbor nodes which are at single hop from it and consists of data for information fusion. The main notion of this approach is, in place of developing a routing configuration in prior for fusion of information that is not possible lacking the knowledge of the topological configuration of the network, a self-governing group between the source nodes is designed. These sensors in the group play the lead as data fusion sockets.

The above algorithm is suitable only for event-based applications and these do not assure the fusion of every data.

2.4 LEACH algorithm

The important feature of Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol [2] is the inclusion of special node called as cluster head to condense the power charge of conveying data from normal sensing nodules to a monitoring Station which is far away. In this protocol, the sensor nodes themselves arrange into the group called as cluster.

Then any one of the members in the cluster becomes Cluster Head (CH). The main function of the CH node is to carry out aggregation of the data packets transmitted by members of the cluster and to route the gathered data towards sink.

Leach algorithm ascertain that the destination is reachable by just in single jump and which restricts the dimension of the system and for large areas the protocol is not applicable.
The proposed algorithm is also a cluster based approach and it overcomes the above disadvantages.

3 THE PROPOSED ALGORITHM

3.1 Objective

The main aim of the projected protocol is to establish a routing path which is shortest and which links all the source sensors to the destination sensor node, by using the shortest paths and also to increase the rate of aggregation of sensed data.

3.2 Key techniques

The key techniques used in the protocol

- Clustering process: sensor nodes which sense or detect the same kind of event are divided into groups and those groups are called as clusters. Each of these clusters is managed and leaded by a special type of node which is called by the name cluster head [3].
- In-network information fusion: the sensors are those devices with limited energy source and the most of the energy that is spent is mainly associated with data gathering process as well the data routing process.

A possible technique in order to optimize the way of performing the data forwarding job is 'in-network aggregation of data'. Here if the data packets from more than one sensor node arrives at any intermediate node (which is a part of any routing tree), then the data will be aggregated at the intermediate node, after aggregation a single data packet will be produced. This reduces the energy consumption and avoids the redundant data if present in the network.

4. MODULES OF THE PROJECT

In the algorithm considered, the different roles of the nodes are considered and they are

- **Collaborator (member of the cluster)**: A sensor node which is present in the cluster and which finds an event and informs about the collected information to the lead or controller.
- **Coordinator (head of the cluster)**: A sensor node which also detects an occasion and which is liable for collecting all the processed information transferred by collaborators, uniting them and forwarding the aggregated summarized outcome towards the destination sensor or sink.
- **Relay (intermediate nodule)**: A node which forwards received information packets on the way to the destination node.
- **Sink node**: it is one which involved in accepting data from a clutch of collaborators and coordinator.

The projected algorithm is divided into five modules. They are:

Module 1: Constructing the hop distance from the sink: In this module [3] the distance of each of the nodes from the destination node is found in terms of hops. The phase is initiated by the sink node. Algorithm for this module is given below

step1. Consider N number of nodes. Sink is one among N nodes. Sink begins the hop tree construction by broadcasting Hop Construction Message (Hop variable= 1), HCM into the network,

Step 2. for n ∈ N (except sink) find

begin

If Hop value of n > Hop value of HCM, then

Id of HCM → next hop of n

Hop value of HCM + 1 → Hop value of n

// node n configures the HCM broadcasts it as follows

Step 3. Id of n → Id of HCM

Hop value of n → Hop value of HCM

Else

n ignores the HCM received.

end

Module 2:cluster formation and lead selection:In this module, the nodes sensing the same event are grouped into cluster and the lead called as 'cluster head' is selected. this is shown in figure 2.

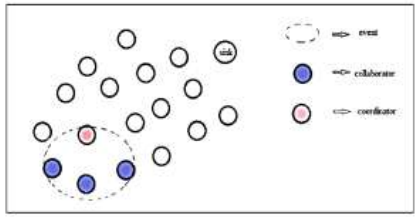


Figure 2: cluster formation

Module 3: **Route establishment**: In this module route is established from the cluster head to sink (BS-Base Station) via the relay(intermediate node) and then data transmission occurs. This module is shown in figure 3

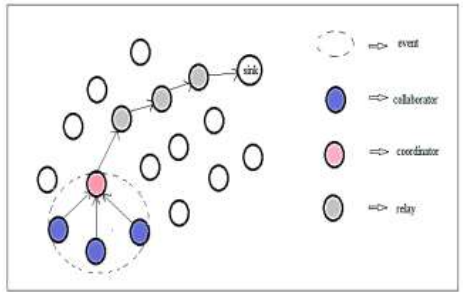


Figure 3: route establishment

Module 4: **Repairing of the failed routes**: The failure of the routes created may be caused due to less energy, communication failures, faulty nodes and physical destruction. To avoid such routes energy of the nodes will be checked regularly during data forwarding, if there is any reduction in energy or any other problem then the new nearest better node will be chosen and except the failed node the rest path is same as the previous route. This stage is presented in the figure 4 and figure 5.

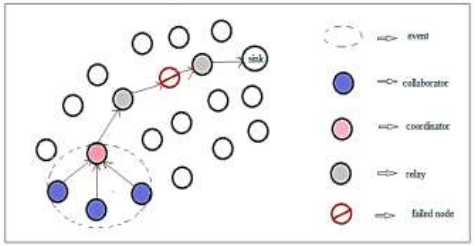


Figure 4. route failure

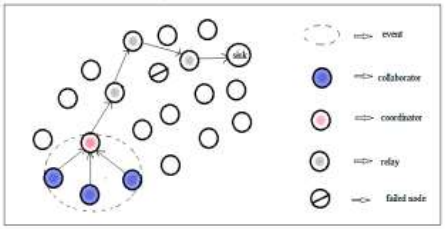


Figure 5. route repairing

Module 5: Scheduling the sleep and active duration and creating the alternate path to route the urgent data

Whenever any member of the cluster, sends the same data repeatedly for particular duration of time, then that particular node will be send to the sleep node for a while. This is done to

conserve the energy and in doing so increasing the lifespan of the sensor node.

In some emergency situation it is necessary to collect the data as early as possible but the clustering and data gathering process introduces certain delay so in order to ensure the fast delivery of such urgent priority data packets a separate path will be created to route these packets whenever necessary thereby increasing the reliability. The alternate path is created in the same way as the route establishment process of module 3. The alternate route to route urgent data is shown below in figure 6.

The **module 5** is done as the part of enhancement work of the paper under consideration.

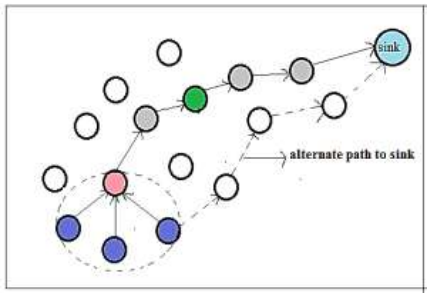


Figure 6: alternate path for routing urgent packets

4. RESULTS AND ANALYSIS

The performance evaluation of the approach under consideration is done using the network simulation tool (NS-2) and the results are compared with the basic communication network of the sensor nodes, in which the source nodule senses the information and route the processed data to the destination node without performing any data aggregation or cluster formation.

The evaluation of the performance of the projected algorithm is done under the following performance parameters:

Packet delivery ratio: It is defined as the ratio between the numbers of data packets received by the sink to the total number of data packets transmitted, in the overall simulation scenario. It signifies the efficiency of the algorithm. This is because lower the packet delivery ratio, higher will be the data aggregation rate.

Total hop counts: It is the entire figure of hops required for all the packets transmitted to go from source sensing devices to the destination sensor.

Average delay: It is the total average time involved for all the packets generated to move from source sensing devices to the destination sensor. Also the number of transmitted data packets and received data packets can be calculated.

4.1 The network animator outputs are shown below.

```
From Node 6 = 21 8 0 Count to sink :3
From Node 7 = 23 12 0 Count to sink :3
From Node 8 = 0 Count to sink :1
From Node 9 = 56 0 Count to sink :2
From Node 10 = 11 33 8 0 Count to sink :4
From Node 11 = 33 8 0 Count to sink :3
From Node 12 = 0 Count to sink :1
From Node 13 = 42 8 0 Count to sink :3
From Node 14 = 5 12 0 Count to sink :3
From Node 15 = 5 12 0 Count to sink :3
From Node 16 = 12 0 Count to sink :2
From Node 17 = 21 8 0 Count to sink :3
From Node 18 = 36 5 12 0 Count to sink :4
From Node 19 = 10 11 33 8 0 Count to sink :5
From Node 20 = 17 21 8 0 Count to sink :4
From Node 21 = 8 0 Count to sink :2
From Node 22 = 21 8 0 Count to sink :3
From Node 23 = 12 0 Count to sink :2
From Node 24 = 27 21 8 0 Count to sink :4
From Node 25 = 3 33 8 0 Count to sink :4
From Node 26 = 3 33 8 0 Count to sink :4
From Node 27 = 21 8 0 Count to sink :3
From Node 28 = 0 Count to sink :1
From Node 29 = 17 21 8 0 Count to sink :4
From Node 30 = 56 0 Count to sink :2
From Node 31 = 12 0 Count to sink :2
```

Figure 7: output of module 1(hop distance between every node to the sink node)

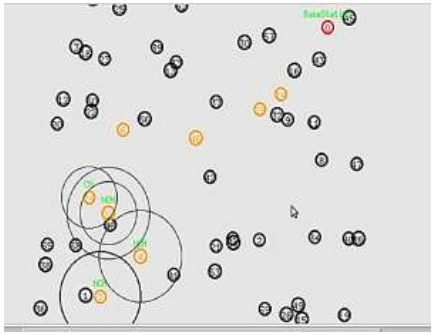


Figure 8: cluster formation and route building

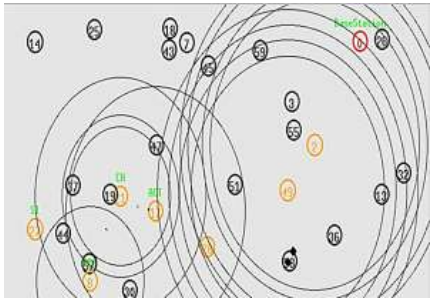


Figure 9: active and sleep mode scheduling (sl-sleep)

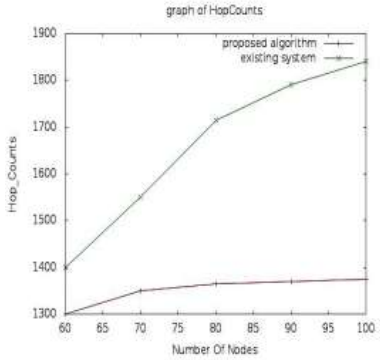
In figure 8 the route established is

24(CH) ⇨ 6 ⇨ 46 ⇨ 29 ⇨ 14 ⇨ 0(BS)

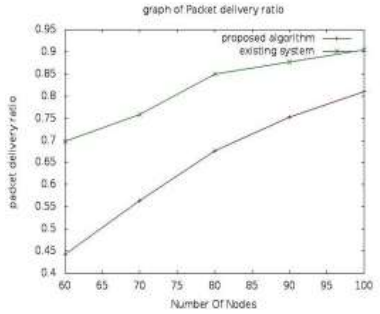
In figure 9 sl indicates the sleep status of the node. ACT indicates the active mode. In this scenario, the nodes 27, 8, 21, 17 form the cluster and 21 becomes CH. Here node number 27 is sending the same data for particular period, hence it is pushed to sleep mode. As we can notice from the figure node 27 is sending any data but the other members are sending data to CH.

4.2 Analysis of graphical results

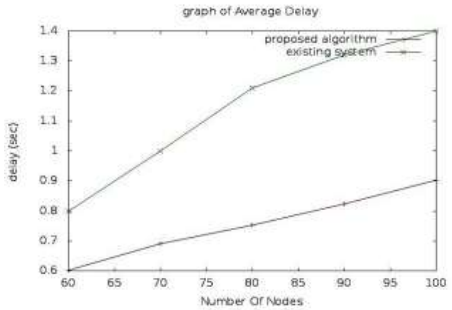
- **effect of the size of the network**



From the below graph we can infer that the total number of hop counts required increase as the number of nodes increases. This is obvious but we can notice that in case of the proposed algorithm the increase is very less when compared to the one without data fusion. This parameter is directly related with the energy, hence lesser number of hop counts indicates lesser energy intake and enhanced life time of the network.



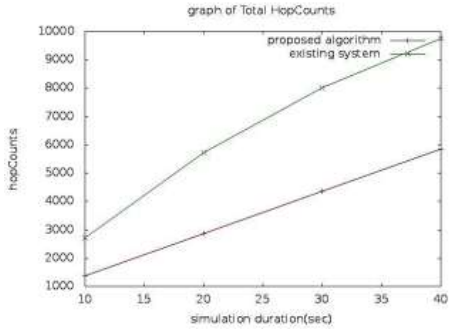
From the above graph we can notice that the packet delivery ratio increases with increase in the number of node for both the systems, but it is lesser for proposed system. This is because lower the packet delivery ratio, higher will be aggregation effect. Hence lower is the power intake.

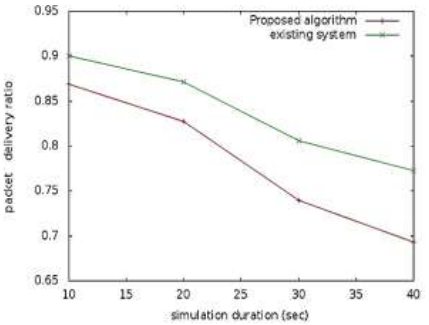


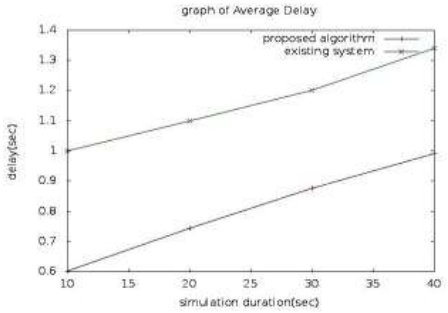
From the above graph, we can see that delay requirement is lower for the approach under consideration than that the approach without data aggregation.

- **Effect of the simulation time**

In WSN scenarios in order to verify the working of the approach under consideration, it is required to check the behavior under various simulation conditions. In the next part, we have considered the behavior with respect to simulation time. Under this situation the approach is giving the desired results as shown below.







5. CONCLUSION

The project presents a reliable and efficient approach for data routing in WSNs. The projected work is simulated and compared with the existing system with respect to different performance parameters.

The various simulation scenarios such as number of events, different simulation time and the different size of the network are considered. The obtained consequences show that the proposed work is performing better when compared the approach without data aggregation in all the scenarios and therefore this forms a reliable protocol to be used for WSNs.

As **future work**, different schemes may be designed in order to regulate the period of waiting of coordinator nodes on the basis of spatial and semantics event correlation. Along with this security can be included for the data that is being routed in the network

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Effects of Supply Chain Management Practices On The Performance Of Banks In Kenya: A Case Of Postbank

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ABSTRACT

The paper examines the adoption of the Supply Chain Management practices on the performance of Banks in Kenya. This research conceptualizes and develops four dimensions of SCM practice (outsourcing of goods & services, information & communication technology, strategic supplier partnership, and globalization) and tests the relationships between SCM practices, and organizational performance. The study employed descriptive design. Data for the study was collected using a self-administered questionnaire procedure, where the questionnaires were administered to the selected respondents through drop and pick later technique. A sample size of 33 respondents was drawn from the sample frame using simple stratified random sampling technique to promote the needs for efficiency and representativeness from various branches and outlets of Postbank as an organization in Nairobi County and the relationships proposed in the framework was tested using Chi-square, T-test among other statistical tools. Data was analyzed by aid of Statistical Package for Social Sciences (SPSS). The study will be useful in the academic circles as it will contribute immensely towards filling the gaps in knowledge in the area of service industry. The study found that outsourcing was important to the banks only when the appropriate methods are employed. It also found that ICT had a major role in determining the performance of banks as it dictated the mode of transaction and data they displayed to clients. Strategic partnership was also important based on what it intended to achieve in enhancing the performance of banks. Lastly, globalization is equally vital as it increases competition and exposes local banks to global scene to experience how performance of banks can be improved. The study recommends that correct ICT methods should be applied to promote the competitiveness of banks and improve performance. Also it recommends that outsourcing be done only if they promote the objectives and goals of the banking institute.

Key words: *Outsourcing, information and communication Technology, partnership and Globalization*

1. BACKGROUND OF THE STUDY

Supply chain Management (SCM) entails managing a network of interconnected businesses involved in the ultimate provision of products and services or service packages required by the end users (Harland, 1996). Supply Chain Management practices are increasingly becoming an important feature in the attainment of competitive advantage in most service organizations in the global markets today. The number of competitors is increasing and expanding both locally and globally, organizations not only have to re-establish their operations to produce goods and services of increased quality which will greatly differentiate them from others and make them respond to the changing market dynamics through the efficient and effective management of the Supply Chain (Stock and Boyer, 2009) .

Supply Chain (SC) encompasses all activities associated with the flow of goods and services from raw Hmaterials stage to the final product usable by client and the supply chain management emphasizes on the integration of supply chain activities and information flows associated with them to achieve a competitive advantage of continuity and reliability (Zuckerman, 2004).

Many organizations aim at achieving survival, global leadership and to increase innovation; this will only be achieved by implementing a quality supply chain and continuous improvement of customer management through distinguished services (Ngugi, 2007)

Some supply chain management applications can be based on an open data models that support the sharing of both inside and outside the enterprise i.e. the extended enterprise which includes key suppliers, manufacturers and end customers of a specific company. Hadfield (1999) pointed out that, SCM joins all actions with a stream and changing of products from raw materials inward to the end user connecting the information streams.

Over the years the nature of supply chain management has changed to the extent that organizations no longer compete against companies on the basis of quality as it was practiced in the 90s (Faucette et al, 2007), however, the new source of business competition lies outside the walls of the firm, it is determined by how effectively these organizations link their operations with the supply chain partners. Being able to create effective business relationships with their customers, suppliers and other strategic partners anchored on long term commitment (Mattson, 2002).

The financial sector in Kenya has experienced rapid growth in the post-independence period making it one of the strongest financial markets in the region. The number of licensed commercial banks has risen from 9 in 1963 to 60 by the end of 2012. In addition to the commercial banks, Kenya's financial sector has got over 18 non-bank commercial institutions, 5 building societies and 4 mortgage financing companies. The Kenya's banking industry has continued to be dominated by two multinational banks which are; Barclays Bank and the Standard Chartered Bank, one of the Government controlled bank, and Kenya Commercial Bank (KCB) has also been dominating the market as a local Bank. The three top banks control over 50% of the total deposits in the country's banking sector (Ministry of finance, 2013). Kenya's financial sector has remained fairly very liberal and competitive. Entry into the market by foreign investors has remained largely unrestricted. However to start a new bank, foreign investors were required to have Ksh.150 Million as the minimum core capital. The 1999 budget made large upward adjustments to this minimum core capital. The budget raised the figures to Ksh.500Million for banks and mortgage finances companies and Ksh.375Million for non-bank institutions and Ksh.150Million for building societies (Republic of Kenya, 1999 Budget).

In Kenya's financial sector, supply chain management performs various functions which include; receiving and processing of goods and services from user departments, coordinating the preparation of annual procurement plans as submitted by the respective departments, preparation

of annual procurement plans as submitted by the respective departments, advertisement of tenders, preparation and processing of quotations, preparation of tender documents in consultation with the user departments, preparation of the letter of awards, notification and contract agreements as well as management of contracts, order follow up or processing of goods, delivering schedules to user departments, performance of market research and price survey on items and services required by the respective financial institution, maintenance of the updated supplier register and files for the purposes of performance rating and preparation of annual reports. Banking organizations procure various items within different categories of the requirements which include; stationery, printing services, cleaning materials, food stuff, consultancy services, legal services, clearing and forwarding services, security services, computer accessories, vehicles and machinery, insurance services, ticketing and travel services amongst others.

Statement of the Problem

Many researches on supply chain management have been done both locally and internationally and majorly processing and manufacturing sectors. Studies by Blowfield& Dolan (2010), Apopa (2012), (Roath, 2012) and Kasomi (2012) have found varied impacts of SCM on organizational performance. Some of the findings includes, but not limited to; enhanced performance measurement, improvement and management organizational processes. However, the supply chain management within the banking sector has not been well covered.

Effective supply chain management practices in organizations require total understanding of the day to day transactions to collaborate trade chain and the practices enabling SCM facilities and direct organizational performance. This has not been the case in the banking industry especially in Kenya in the recent past. In modern banking sectors, SCM is an important business integration technique which creates a strategic advantage for the organization (Sahan and Mohan, 2011).

Poor accountability in the internal audit of many organizations in the banking sector, have hampered the essential standards of SCM services that make organizations realize their goals and objectives (Woods, 2009). The core and critical challenge mostly experienced by various banks in Kenya include application of ineffective SCM practices and procedures. Poor integration of Information and Communication Technology (ICT) among others. Richard, (2008) observed that with the increased globalization and internationalization of firms, Banks within technologically efficient countries have entered the market hence making competition levels at its peak. As such, Kenyan Banking organizations should adopt the best SCM practices identified in this study i.e. Globalization, implementation of ICT, outsourcing and strategic partnership with key investors.

Several studies have focused on SCM practices but most have failed in their quest to provide enough information on the best practices and their effects on performance of banking organizations. As Richard (2008) states, no emphasis has been made by banks in the sector in managing and creating efficiency in SCM. This justifies the existence of SC flaws and problems in the banking sector in Kenya inhibiting the achievement of competitive advantages and the set goals. It is against this backdrop that the study thus strove to bridge the gap between SCM practices and organizational performance by evaluating the relationship between the SCM variables and the Kenyan banking organization performance.

Research design

The study adopted descriptive research design in order to provide a framework to examine the characteristics of the independent variables (Outsourcing, Information and Communication

Technology, Partnership and globalization). This was appropriate to obtain information concerning the status of the phenomenon, to describe what the current situation is with respect to the variable of the study. Ghauri and Gronhaug (2005) asserts that in descriptive design the problem is structured and well understood a fact that Mugenda and Mugenda (2003) agrees that descriptive design is most preferred because it gives a report on things as they actually are. Thus this study used this design to get clear information from the respondents with much ease.

Sample and sampling technique
This study will use stratified random sampling, to sample staff of POSBANK by cadre, because it enabled the generalization of a larger sample size of percentage of the total population. A sample size of 33 respondents will be drawn from the sample frame using simple stratified random sampling to promote the needs for efficiency and representativeness. This is justifiable by what Kothari (2004) stated that a representative sample could be 30% of target population

Data Collection Instruments
The data collection instruments to be used will be questionnaire which will be designed using the variables identified as important for meeting the study objectives. A closed- ended and open - ended questionnaire will be administered to the respondents. The questionnaire will be used since it will be easy to administer and with data to be obtained will be easy to analyze, Mugenda and Mugenda (2003). Secondary data will also be used to collect data from existing sources in the organization.

Data collection procedure
The questionnaire will be administered using a drop and pick later method. The respondents in the questionnaire will be 33 employees. The primary source of data collection method to be used in the study included use of questionnaire that will be used to source for crucial information. The questionnaire is both open and closed ended questions in order to enable effective data collection filled in the questionnaire.

RESULTS AND DISCUSSION

Effects of outsourcing on bank performance
The Findings of Pen and Littleton (2001) show that effective communication is a key requirement for effective strategy implementation. In this study outsourcing of goods and services was measured using indicators such as expertise and quality of services.

Slightly 42.42% strongly agreed as they said that outsourcing has greatly improved organization performance. 39.39% of the respondents agreed that outsourcing has had great effect on organization performance while only 9.09% of the respondents saying they did not agree that outsourcing has in anyway affected organization performance. 6.06% of the respondents were indifferent to the fact that outsourcing improved organization performance. We therefore note that a majority of the respondents agreed that outsourcing has greatly positively affected performance.

ICT and its role in SCM
The distinctive competencies of any firm arises from two sources, that are its resources(man, machine, materials, land, state of art, methods) and capabilities. A differentiating competency ability that allows banking institutions to achieve superior efficiency, quality, innovation or customer responsiveness through. ICT and thereby attain a competitive advantage (Nguyen,

2008). The primary objective of any firm is sustain competitive advantage by maintaining strong growth rate and high profitability. In this Study, indicators such as adoption of ICT were used to realize this specific objective.

Majority of the respondents (over 57%) said that the main role of ICT in Postbank was to facilitate the faster processing of transactions in the bank, slightly over 33% of the respondents averred that the major role of ICT was to enhance efficient data management of client information, whereas 9.09% said that ICT was intended to prevent fraudulent activities in the banks.
This clearly shows that ICT plays a major role in enhancing and entrenching the SCM practices in the bank.

Strategic Partnership and its extent
Supply Chain Management has been defined to explicitly recognize the strategic nature of coordination between trading partners and to explain the dual purpose of Supply Chain Management: to improve the performance of an individual organization and to improve the performance of the whole supply chain (Li et al, 2006). Okumu (2001) contends that strategy implementation must be owned by everyone, and to achieve this staff meetings are very necessary. Aosa (2002) notes that lack of compatibility of strategy and culture can lead to resistance to change and frustrate strategy implementation efforts. In this study, indicators such as partnership, practices, were used to realize this desired objective.

Majority of the respondents were of the opinion that partnerships were important to the organization in fact 26 (78.8%) of the respondents said that partnerships were either important, very important or extremely important. The remaining 6 (21.2%) were either non-committal or cited the unimportance of the partnership to organizations

Organization performance and Supply Chain management practices.

We further conducted a study to try establishing whether there is any relationship between the performance of the organization and their supply chain management practices. In the study we asked every person whether they agreed with the statement. And evaluated how the company has performed ever since they started actively implementing the supply chain management practices included in the study

From the findings above, 45.5% (15) of the respondents strongly agreed with the statement, 33.3% (11) respondents agreed with the statement whilst 15.15% (5) respondents were not sure whether there was any positive relationship between organization performance and the supply chain management practices only 6% (2) of the respondents disagreed with the statement that there was any positive relationship between organization performance and supply chain management practices.

Globalization of SCM
Globalization has dramatically changed how manufacturers operate, offering an opportunity to reach new customers in new markets while at the same time exposing firms to greater competition. Meanwhile, raw materials and supplier relationships must now be managed on a global scale. Just as there are benefits and costs of globalization, there are similar pros and cons of a global supply chain (Chan & Lee, 2005). In particular, companies need to manage the related risks. With the

onset of globalization, managing supply chains has become more complex and business critical than ever before thus the need for effective risk management along the supply chain for manufacturers to minimize disruptions and resume normal business conditions quickly in the event of an outage.

Another interestingly important fact noted were that majority of the employees thought that the main reason for globalization was it was meant to increase global competition in the sector. More specifically 39.4% whilst only 5 (15.2%) were of the opinion that the main reason for globalization wasdevelopment of government assistance in developing treaties and better global environment.

Conclusion

From the study findings, it is concluded that outsourcing, ICT, strategic partnership and globalization affected performance of the banks in the banking sector. In terms of outsourcing; lack of expertise, improved quality services and strict timelines influenced performance in great extent; lack of expertise in the banking institutions affected performance of banks in mobilization to executing competitive strategies. The role of ICT therefore influenced the implementation of competitive strategies in the banks as it determined the adoption and the appropriate roles that improved performance of the banks. Proper strategic partnership affected performance of banks. Finally, globalization affected performance through its advantages and its roles.

Recommendations

From the study findings, it is concluded that outsourcing, ICT, strategic partnership and globalization affected performance of the banks in the banking sector. In terms of outsourcing; lack of expertise, improved quality services and strict timelines influenced performance in great extent; lack of expertise in the banking institutions affected performance of banks in mobilization to executing competitive strategies. The role of ICT therefore influenced the implementation of competitive strategies in the banks as it determined the adoption and the appropriate roles that improved performance of the banks. Proper strategic partnership affected performance of banks. Finally, globalization affected performance through its advantages and its roles.

Suggestions for further study

The study recommends that further study be done on Integrated ICT tools as most of the existing supply chain packages have a Performance Measurement module as part of it. Future performance measurement systems will have enterprise wide, integrated ICT tools that will extract, collect and elaborate data characterizing their business in the bank as future performance management systems in the SCM will be more ICT dependent.

It is recommended that further studies be conducted on Integration of Operation Research since there have been attempts to integrate multi criteria decision making tools like Analytical Hierarchical Process (AHP) and Data Envelopment Analysis (DEA) with existing PMS frameworks to enhance effectiveness of future SCM.

Additionally, it is recommended that further studies is done on emerging themes in supply chain performance management systems such as: Measure and manage risk in extended supply networks; Aligning performance measures to achieve strategic objectives; Recognizing and incorporating the varying cultural elements in the supply network; and Response to a volatile demand led environment that may include lean and agile elements.

Lastly, further studies should be conducted in the area of Soft Issues as there is a need to develop deeper understanding of the soft issues that make or ruin supply network management and development. There will be more focus on the central relationship between culture and performance measurement and how this varies in different countries in a global context.

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Techniques for Smart Traffic Control: An In-depth Review

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Abstract: Inadequate space and funds for the construction of new roads and the steady increase in number of vehicles has prompted scholars to investigate other solutions to traffic congestion. One area gaining interest is the use of smart traffic control systems (STCS) to make traffic routing decisions. These systems use real time data and try to mimic human reasoning thus prove promising in vehicle traffic control and management. This paper is a review on the motivations behind the emergence of STCS and the different types of these systems in use today for road traffic management. They include – fuzzy expert systems (FES), artificial neural networks (ANN) and wireless sensor networks (WSN). We give an in depth study on the design, benefits and limitations of each technique. The paper cites and analyses a number of successfully tested and implemented STCS. From these reviews we are able to derive comparisons of the STCS discussed in this paper. For instance, for a learning or adaptive system, ANN is the best approach; for a system that just routes traffic based on real time data and does not need to derive any data patterns afterwards, then FES is the best approach; for a cheaper alternative to the FES, then WSN is the least costly approach. All prove effective in traffic control and management with respect to the context in which each of them is used.

Keywords: smart cities, intelligent traffic systems, artificial intelligent system, WSN, FES, ANN, traffic lights, road traffic

1. INTRODUCTION

The steady increase in the number of vehicles on the road has increased traffic congestion in most urban cities of the world. One approach most countries are taking to address this issue is the expansion of roadways. However, this approach still comes with its share of challenges. Demolition of older roads can be quite costly. Most urban cities lack the free space required for such a venture. Even with the improvements in road infrastructure, it is evident that the rate at which travelers buy vehicles has surpassed that of new infrastructure development. Also due to expansions, roads are able to serve more vehicles; consequently utilizing the additional capacity. This is consistent with the 'fundamental law of highway congestion' suggested by Downs [1] who avers that increasing road supply invariably increases vehicle traffic.

With inadequate space and funds for the construction of new roads, and the growing imbalance between traffic demand and transportation resources; it is increasingly obvious that countries must move beyond the traditional model of just building roads to solve traffic problems [2]. This is demonstrated in a survey done by CBT in Britain. The report supports that expansion and building of new roads will do very little to help solve the congestion issue. CBT survey found that nearby local roads suffered up to 137% more traffic after the bypasses opened, and reductions on the roads intended to be relieved were less than expected [18].

Therefore, managing of traffic flow needs to be a combination of physical infrastructure, new ways of thinking and new technologies. Smarter transport transcends infrastructure [2]. In light of this, smart traffic control systems have gained a lot of interest.

These smart traffic control systems use advanced technologies such as image processing, computer vision, intelligent controls and artificial intelligence to make traffic routing decisions; a task typically done by traffic officers e.g. policemen or traffic marshals. Other application areas include: surveillance, management of freeway and arterial networks, intersection traffic light control, congestion and incident management [3].

1.1 Background and motivation

Other than inadequate infrastructure developments, other factors that have prompted scholars to further investigate use of smart traffic control systems include:

1.1.1 Weakness in current traffic control systems:

Almost all urban cities in the world use traffic lights to control the traffic on the roads. The lights switch from red, which means stop, to green, which means move. Over time there has been developments of different types of traffic light control systems, the most commonly used being static traffic lights and vehicle actuated lights.

Static traffic lights' timing and switching patterns are predetermined despite prevailing traffic conditions for the different lanes. They do not operate with real time data. Consequently this means they do not take into account the non-uniform and ever changing nature of traffic conditions. It does not matter whether at a particular period of time route one has more cars than route two; the green light allocation time and pattern still remains the same for all routes. The lack of intelligent strategies in these devices does very little in improving the road network performance and traffic congestion levels.

This was demonstrated in Kenya when the country recently experienced a setback when the Nairobi County Government pulled out policemen from the roads to test the newly automated traffic lights that had an additional counter feature – that counts down from one light to the other. This meant

that the motorists could then know how long to wait before moving [4]. However, this operation was not successful; there was a traffic gridlock in most parts of the city with some motorists spending close to 4 hours in bumper to bumper traffic. [4]

Vehicle-actuated traffic lights were an attempt to enhance the static lights. They combine preset time cycles with proximity sensors. These sensors can activate a change in the cycle time or the lights when cars are present. This is due to the assumption that roads with fewer cars may not need a regular cycle of green lights. However the downside of these traffic lights is that they are not adaptive. They depend on having some prior knowledge of traffic flow patterns at the intersection so that signal cycle times and placement of proximity sensors may be customized for the intersection. This means that the signal time/extension is still a fixed value. Also proximity sensors will only activate a change in signal light when cars are present, they do not count cars. [10]

1.1.2 Advancements in the field of Artificial Intelligence (A.I):

A.I. is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence [5]. The ability of these systems to emulate human intelligence has therefore led to artificial intelligent systems pervading our everyday life. For instance, A.I. is used in a number of scenarios e.g.: banks – automatic check readers, signature verification systems; digital cameras and mobile phones – automated face/voice detection and focusing; web – automatic location recognition from your web surfing, automatic fraud detection just to mention a few.

Consequently scholars; especially in developed countries are now interested in investigating the application of A.I in vehicle traffic management systems. The basic idea behind this being, if these systems can mimic human reasoning, then they can effectively be used to control traffic in place of traffic officers.

Developing countries are also catching up with this approach. IBM opened a commercial technology research facility in Nairobi, the first of its kind in Africa. The lab's research agenda includes the development of cognitive computing technologies which integrate learning and reasoning capabilities enabling experts to make better decisions in search for solutions to Africa's most pressing challenges [6]. In an effort to tackle the traffic congestion problem, IBM partnered with a Kenyan internet service provider, Access Kenya, to develop a pilot solution to enable Nairobi commuters to use their mobile phones to get advice on driving routes through the city depending on estimates of traffic congestion. The project dubbed Twende-Twende is a mobile application that uses specialized algorithms to do image processing and interpret visual data received from closed-circuit television (CCTV) cameras positioned around Nairobi. Motorists are then able to get information on a) what areas to avoid because of congestion by suggesting alternative routes and b) updates on road conditions to allow them get from point A to point B safely. This information is retrieved via an SMS-based query for basic phones and on smart phones the service is accessed via an application through which users can view a map of the city showing route options and potential traffic hotspots. The project's main focus is data collection, analysis and information dissemination, it does not actively control traffic on the roads [7].

1.1.3 Sensor Networks:

Advancement in very large scale integration (VLSI) and semiconductor technologies have enabled the development of smaller, tiny, low power, and inexpensive sensors and controllers/microprocessors. Furthermore, developments in wireless technologies have made it possible for the use of sensors to collect large amounts of environmental data at minimal costs. These networks comprise of many sensors that cooperate to monitor and collect data about traffic conditions on the roads.

Although sensor network technology for highway and traffic management is a relatively new solution to alleviating highway congestion; they have potential to be one of the sustainable solutions to road congestion. These networks have gained popularity because they provide a cheaper alternative to that of expansion of roadways and implementation of A.I systems, especially in emerging economies.

Pascale et al. [8], introduce an intelligent transport system (ITS) that uses a wireless sensor network (WSN) to monitor traffic. Their system comprises of a network of traffic sensors deployed throughout the roads that collect and forward measurements to a remote server. The server aggregates and processes macro-parameters of the traffic flows arising from heterogeneous monitoring systems, then distributes the data to traffic management centers, road control units (RCU) and information providers. The macro-parameters can be used for traffic analysis and management [8].

In this paper we present the motivations behind emergence and use of smart traffic control systems in road traffic management; we further describe the design, benefits and the limitations of the different types of smart traffic control system (STCS) in use today. The outline of the paper is as follows. In section I we have described what STCS are and the factors that influenced their application in road traffic management. Section II describes the methods used as well as parameters considered when selecting and analyzing the related works reviewed in this paper. In section III we present the different types of STCS in use, their design and benefits. In section IV, the limitations of each technique (STCS) are analyzed. Section V we briefly discuss our insights on reviewed work and give some suggestions and recommendation. Finally our concluding remarks are given in section VI.

2. METHODS

The works reviewed in this paper were selected and analysed based on the following criteria:

a) Approaches used to make traffic routing and light signal allocation decisions. For instance adaptive (learning) versus non-adaptive strategies; offline versus real time strategies; and hybrid strategies.
b) Number and types of parameters/variables (input and output) used. We review systems that use single variables (e.g. traffic quantity) and ones that use several variables (e.g. traffic quantity, waiting time, past and present traffic data knowledge) to make traffic routing decisions.
c) Traffic data collection methods used (such as sensor types) and communication methods applied (such as multi-hop or single-hop) to transmit collected data.
d) STCS that control traffic at an isolated junction or multiple intersection junction or both.

e) Ways to improve overall performance of already existing intelligent/smart systems (STCS) in use.

3. SMART TRAFFIC CONTROL TECHNIQUES USED BASED ON THEIR SYSTEM ARCHITECTURE

Smart traffic light controls are dynamic. This means that they use real time data to make priority based decisions. They use advanced communication systems based on sensors and/or RFID tags to collect data and provide the system with information on the current situation on the roads (such as number of vehicles on individual roads or how long vehicles have been waiting for green light). The smart system then processes this information and makes decisions; that is, it automatically determines the duration of each traffic light signal based on prevailing traffic situation on the roads. Commonly used systems include fuzzy expert systems (FES), artificial neural networks (ANN) and wireless sensor networks (WSN).

3.1 Fuzzy expert systems (FES)

FES is a suitable approach to dynamic traffic signal control because of the nature of uncertainties on road traffic where the traffic distributions fluctuate non-uniformly. Fuzzy logic is a field started by Zadeh [9]. It is a superset of Boolean logic that has been extended to handle partial truths between completely false (0) and completely true (1). This is in an attempt to mimic or reflect how humans think, to model our sense of words when describing certain phenomena as well as our common sense in decision making. The sensors collect data from the environment which in turn is fed into the fuzzy logic controller (FLC) for processing. The inference process in a FLC is similar to the way traffic officers handle the traffic flow at a typical roundabout [10; 11]. The FLC's objective is to control operations in systems by making decisions that utilize rules expressed with the uncertainty of human terms such as cool (slightly cold) or warm (slightly hot). Therefore FLCs are a suitable approach to traffic signal control because it assigns green or red light signal based on urgency or as traffic fluctuates; and selects the best decision that will minimize congestion at a particular interval. For instance, a lane could also have low or medium traffic as opposed to just no traffic (0) or high traffic (1).

Khiang et al [11] present a fuzzy logic traffic light controller. Their system uses two input variables; quantity of traffic on the arrival side (arrival) and quantity of traffic on the queuing side (queue) collected from the sensors on the lanes. Their system controls traffic on multiple lanes simultaneously i.e. North and south lanes move together while east and west lanes move together. When North and South have green light, East and West stop (queue). The fuzzy controller observes the density of north and south as one side and east and west as another side. Their system then determines green light allocation and extension based on the side that has the highest traffic quantity. From their experiments, they are able to demonstrate that their fuzzy logic traffic light controller performs better than the fixed-time (static) controller.

From a comparison made between the performance of the fuzzy logic controller and that of a fixed-time (static) controller; [11] observed from the results that the fuzzy logic controller had a lower average waiting time – a difference of 6 minutes.

Fahmy [10] later presents another system FLATSC that uses fuzzy logic controller to manage traffic at a four intersection roundabout. However, unlike Khiang et al system, his system employs another input variable, waiting time, to determine green light allocation and extension. FLATSC therefore uses traffic quantity and waiting time to determine the priority degree (output variable) for each lane on the roundabout. The output value is the green light time/extension for each lane. The lane with the highest output value gets allocated the green light. When cars in one lane move the other lanes stop. The green light extension was not a fixed value; it was dependent on real time data collected from the sensors. The value changed as the traffic variables fluctuated from cycle to cycle and/or lane to lane. This ensured that traffic was controlled based on prevailing traffic conditions on the roads.

From a comparison with the fixed controller and vehicle actuated systems, FLATSC proved to be more effective in managing the changing traffic patterns. In addition FLATSC attempted to resolve starvation. Starvation describes a situation whereby some lanes end up always getting last priority because they usually get the least traffic consequently ending up always queuing for the longest time during a cycle. FLATSC addressed this issue by incorporating waiting time as a factor in determining green light allocation. For instance a lane that has low traffic but very high waiting time still has a chance of getting a high priority degree just as a lane with high traffic but low waiting time; depending on the fuzzy inference.

3.2 Artificial neural networks (ANN)

The major difference between ANN (learning systems) and FES is that; while an FES uses present knowledge to make decisions, in a learning system, the decisions are computed using the accumulated experience or knowledge from successfully solved examples. Since ANNs try to mimic the human brain they possess an adaptive feature that allows each node within the network to modify its state in response to past and present knowledge. [12; 3]

Patel et al. present an ANN system used to control traffic. The input given to the ANN models are the list of data collected by the sensors which are placed around the traffic lights. The sensors give the traffic light ANN model all the data which are related to the past and present traffic parameters. The model then processes this input and selects the most suitable output that suits current traffic situation. These results are then used by the traffic lights to set the timing for the red and green lights. In their ANN approach they evaluate that for the ANN to produce accurate decisions it required 83 neural nodes, their system produced 73% accuracy level for the derived solutions.

Michael et al. [28] also present a neural networks based traffic light controller called Environment Observation Method based on Artificial Neural Networks Controller (EOM-ANN) to control urban traffic. Their approach is different from [3;13] because they also incorporate mathematical strategies (EOM) to make signal allocation decisions. EOM is a mathematical methodology for obtaining timing plans for isolated intersections. It achieves this by calculating the minimal green time for each phase then to prevent congestion an additional green time is allocated to each lane that still has cars even after getting green light. However the downside of EOM is that it sets traffic light timing based on averages of the basic parameters. Due to the fact that these figures are constants, the EOM doesn't incorporate the real time nature of

traffic which means that the traffic parameter values (data) keep changing every time, this is further backed by [13] that traditional mathematical methods have limitations when they are applied in traffic control. The EOM-ANN is an attempt to resolve this issue of real time data, [28] propose use of ANN to obtain this traffic data patterns. That way, the green light timing and allocation is based on actual/prevailing traffic conditions rather than analytical calculations. [28]

EOM-ANN uses the feed-forward method with 8 neural nodes in total for input, hidden and output layers. It is further divided into two modules; reviser and the neural. The former defines correct traffic light timing and the latter provides the most appropriate value for the current traffic behaviour. The inputs of the ANN are the number of light, medium and heavy vehicles. [28]

From a comparison between static time controller and EOM, EOM-ANN reported better traffic flow and congestion management. The average traffic flow of the individual controllers was as follows: static controller - 82.55, EOM - 68.70 and EOM-ANN registered an average of 53.75. [28]

3.3 Wireless Sensor Networks (WSN)

In the event WSN is used to not only collect traffic data but also actively control road traffic, additional functionalities are incorporated into the network's controller. An algorithm is embedded to control the traffic lights – it generates routing decisions based on sensor data aggregated. Unlike some A.I systems, WSN does not require vehicles to have additional systems such as RFID tags to control and manage traffic. As a result WSN are cost inexpensive and make it a more practical than ANN and FES approaches especially in emerging economies.

Yousef et al. [15] present an adaptive traffic light control system for single and multiple intersections using WSN. Their system uses the WSN to route traffic based on traffic density and waiting times. It is composed of: sensors that detect the presence of vehicles and have a memory that stores their waiting times on each road. It also has an intelligent traffic controller that processes the sensor data then employs two algorithms traffic system communication algorithm (TSCA), traffic signal time manipulation algorithm (TSTMA) to route traffic based on the traffic variations of all lanes of the intersections at a particular time and traffic control algorithm on multiple intersections (TCAMI).

TSCA main objective is to enable exchange of information between the sensors' base station (BS) and the controller using a direct routing scheme approach. This means all sensors are within range of the BS and directly communicate with it. On the other hand, TSTMA main responsibility is to set the traffic signal duration in an efficient and dynamic manner such that traffic flow is maximized while at the same time ensuring minimal average queue length (AQL) and average waiting time (AWT). TSTMA makes use of the traffic information gathered at the traffic BS from the sensors to calculate in intelligent manner, the expected queue length, for the next traffic cycle, and then schedule efficient time setting for the various traffic signals. TSTMA achieves this objective through three main techniques: (a) Dynamic selection and ordering of the traffic phases based on the number of lanes allowed in the intersection; (b) Dynamic adaptation to the changes in the arrival and departure rates and thus dynamic decisions about queues' lengths and their importance; (c) Dynamic control of the traffic cycle timing of the green and red periods. TCAMI main objective is coordination and setting of traffic parameters and conditions on the multiple intersections in general and on the successive intersections in specific, with the objective of minimizing delays, caused by stopping, waiting and then speeding up during road trips (also known as green wave – where drivers need not stop on multiple intersections thus achieving, if implemented correctly, an open route for the vehicles). When TCAMI is executed on each intersection it will generate traffic information, which in turn represents an input to the subsequent intersection, and so on. As such, the traffic flow will be controlled in a flexible manner. [15]

To show efficiency of proposed scheme, [15] compared the system to the traditional traffic light control approach which uses static plans i.e. fixed time control. The results indicate that the proposed system had a better performance rate in managing traffic; its AWT was much lower at 2.98 minutes compared to 7.87 minutes of the fixed time controller. A low AWT means that the flow of traffic is increased hence lower AQT of 9 cars as opposed to 36 cars per queue in the fixed time controller. The dynamic approach was able to handle queues quickly with less cars accumulating on a lane during the observed time. [15]

Bhuvaneswari et al. [16] further support [15] by developing a traffic congestion control system ATSWSN that is adaptive in nature. However it differentiates from Yousef et al [15]. in that the time slots allocated for each route is not only based on traffic density, but also on emergency conditions and speed patterns of incoming traffic. Their system collects real time data using IR sensors and the microcontroller's scheduled algorithm processes this data and determines which direction gets green light priority. The duration of the green light is dynamically calculated based on the weighted speeds of all the vehicles in the waiting queue factoring in any emergencies.

When compared to the conventional fixed time approach, ATSWSN registers a higher traffic flow rate and as a result lower average waiting time. This is because the clearance time is inversely proportional to delay factor, slow moving vehicles are allotted more clearance time than fast moving vehicles. Further, by scaling the delay factor by the emergency factor, the clear route parameter is kept high when an emergency vehicle enters the lane. Thus, both the direction and time to be cleared are chosen optimally. They observed that in the fixed time approach, the waiting time increased as the number of vehicles increased irrespective of their speeds and speed factors [16].

3.4 Hybrids

To overcome the limitations of the individual implementations of ANN and FES approaches, such as; lack of learning ability of fuzzy systems and lack of inference process of ANNs (mentioned in section IV of this paper); Patel et al. [3] developed a hybrid intelligent decision making system (IDUTC) for urban traffic control applications.

The sensors (closed loop detectors) placed on the roads collect traffic data; volume (traffic quantity) and occupancy (wait time) of each lane. However IDUTC only computes its decisions based on one parameter, the traffic quantity. Using the volume data, five traffic parameters are computed that describe in more detail the traffic flow of the intersection lanes. They are: 1) highest saturation, 2) the cross saturation, 3) the saturation difference of the traffic, 4) the volume difference and 5) the required green time extension. The four parameters from the previous time frame which were stored in a memory device (the saturation difference was not included) and the five parameters for the current time frame become inputs to the ANN. This is fed into the IDUTC as crisp values. The ANN then processes all the system data, past (collected and stored from previous cycles) and present. The ANN output provides the input for the FES. The FES performs inference and assigns a fuzzy label/values to the input received. Then FES fires the rules based on these fuzzy values. The defuzzification unit converts the computed decisions into crisp values that are used to determine green light allocation and extension for each traffic light. The cycle goes on repeating and tries to change the traffic light timings condition so as to ensure that IDUTC self-adjusts according to the situation. IDUTC integrates the learning abilities of an ANN and the knowledge-based decision-making ability of the FES. The back propagation-based ANN allowed the system to learn and adapt to the dynamically changing environment and the FES was employed for decision making using the IF-THEN rules. [3]

A summary of the simulations for the IDUTC system, the ANN, and the FES approaches indicate that: the IDUTC system provided 95% correct decision rate and an average waiting time of 2.186 minutes. It relieved intersection congestion better than the ANN approach which provided 73% correct decision rate and an average waiting time of 2.958 minutes. While the FES approach correct decision rate was equal to that of IDUTC, it was observed that the computed decision did not lead to a better reduction in the wait times. The FES had an average wait time of 2.975 minutes which is lower than the other two approaches. [3]

4. STCS DESIGN CONSTRAINTS

Singh. et al [14] aver that most automated traffic control systems not excluding STCS; have the following general limitations:

a) If the position of vehicle does not come in alignment of infrared rays then IR sensor would not give response.
b) If the vehicle is under faulty condition in the range of IR rays then the response given by IR sensor would not be accurate.
c) If a single camera is used as a vision sensor for acquiring the image of traffic then it is difficult to detect the space between two vehicles means projection of camera would be crucial factor for measuring the traffic density.

Below are the specific limitations with respect to the design of each of the mentioned STCS:

4.1 FES

Although use of fuzzy expert systems in traffic light control systems enhances the efficiency of traffic movement in roads, the downside of such systems is that, they do not have the ability to learn, they are not adaptive. Meaning, they do not incorporate past knowledge or experiences to make current decisions; rather they only make decisions based on the current knowledge they have of the situation. For this reason, it becomes quite challenging to modify the system's parameters whenever necessary. For instance; changing the green light duration time for a single lane only; based on the discovery that it usually gets more cars on average would be very tasking.

4.2 ANN

While [28;13;3] demonstrated that using ANN to manage traffic was effective; ANNs training process in most cases is a time-consuming task requiring the application of input training patterns in an iterative manner. This was experimentally proven by Barbosa and Pinto [17]; they successfully managed to show that by increasing the amount of data the performance of the ANN system improved. The error margin was lower when training was extended to 15 minutes of collecting data as opposed to 5 minutes.

Also another drawback of ANNs is the lack of rules or guides to support the decisions to be made; resulting in development of solutions that are mostly specific or case base problems. This means no explanation or guarantee that the solution chosen is the optimum one [17]. This is proven by Patel et al. where they demonstrate that the ANN had a correct decision rate of 73% as opposed to the IDUTC (hybrid system) and FES which both had a 95% rating. They further realized in their experiments that the ANN approach had difficulty in generalizing on the various numbers and the combinations of traffic parameters and required cycle-time adjustments (desired outputs) .[3]

4.3 WSN

Owing to the fact that sensors are micro-electric devices, they operate on a limited energy budget. For this reason WSNs are faced with the problem of having to regulate their energy consumption. This can be a daunting task especially when dealing with large complex traffic networks with multiple intersections. The interdependency of each intersection on its neighbors makes it extremely important to ensure that the different sensors in each intersection are in constant communication to ensure real time data processing. This consequently takes a toll on the energy consumption rate of the sensors especially if the distance between them is wide. The wider the distance between nodes and BS the higher the attenuation rate; consequently leading to increased power needed during data transmission/communication. Failure of a node could lead to massive traffic congestion; also, a downside of this is that motorists will avoid this lane and move to the lanes with lower AWT. This could lead to an increase in congestion levels on the lanes that usually get first priority.

4.4 Hybrid

The initial implementation cost can be quite costly, considering that A.I is still considerably a new research area in traffic control. Also the fact that a hybrid is a combination of two or more STCS, the development time can take a long time in an attempt to ensure successful integration of the different systems.

5. DISCUSION

From the review of the different STCS used, some open issues arise for each technique. Firstly we discuss the general open issues that need to be addressed in all the STCS techniques reviewed:

We start with *starvation.* This is one of the general open issues that come up in any STCS in an attempt to ensure that no lane at any particular time is neglected for as long as there are cars queuing. How to solve starvation is still an open issue particularly because traffic quantity (TQ) and waiting time (WT) are usually isolated from each other. That is, most STCS systems use only one of them to determine traffic light

signal allocation. Also another reason is that naturally, overtime as traffic quantity increases (assuming there is a continuous flow of traffic in and out of all lanes at a junction) the average waiting time of vehicles also increases.

Some scholars like [10] and [15] try to resolve starvation by presenting a system that uses both parameters (TQ and WT) to determine green light allocation and extension. However, overtime our assumption is that the lanes that usually have low traffic volumes will end up experiencing some level of starvation especially during peak hours.

The other general open issue is *controlling traffic signals in a large scale traffic network* (i.e. simultaneously controlling traffic for multiple intersections). Srinivasan et al. [19] state that it is crucial for traffic signal control systems to have the capability to examine both the microscopic level of the situation (the traffic state of each intersection) as well as the macroscopic level of the situation (the overall traffic state of the traffic network)

Yousef et al [15] implement an adaptive traffic light control system that controls traffic across multiple intersections using WSN. However, for a large-scale traffic management system, it may be quite difficult to ensure and or even to determine whether the traffic network is flowing smoothly and assess its current state. Also due to the non-uniform nature of traffic in traffic networks, predicting the effects of modifying any of the traffic control parameters is a difficult task [19]. For instance; consider the following network arrangement. There are three networked intersections that are coordinated linearly; A, B and C respectively. Such that, whenever lane 1 in intersection A is green, lane 1 in B and C also get green light. In the event that the STCS needs to control traffic based on the following scenario: the traffic on lane 1 in A is high but that of B requires green light for lane 2 instead with lane 1 having no cars (least priority) and intersection C requires green light on lane 3 and its lane 1 requires second priority (next in line); then it becomes very difficult to determine how to synchronize the lights across the intersections to ensure minimal traffic congestion while at the same time ensuring that all lanes get green light priority when needed.

The specific open issues pertaining to the individual STCS techniques are described below:

5.1 FES

Defining rules. Where do these rules come from? [23]. There are no specific universal criteria used to derive rules and membership functions (degree to which a variable is associated with a term) of this system. Each developer has their own criteria. This is because the linguistic variables (set of terms expressed in natural language that can represent possible values that a system variable can take [22]) and their membership functions vary in type and number from one system to the next. While some applications like fuzzylite [22] derive the rules for you, it is still quite difficult to determine how the application arrived at those rules. Further, the more variables (input/output) a system has, the more complex it becomes to define rules. As for their accuracy levels (i.e. how correct the decisions are), this can only be determined during an iterative testing phase; which in our opinion is not ideal especially if one is dealing with a large knowledge base of rules. In the event the FES fails to meet standards, developer is left with the difficult task of modularizing the rules and possibly the inference process (which if changed affects everything else).

Adaptability. Owing to the fact that FES are not learning systems, it becomes very difficult to ensure that they are adaptable. They work for specific data values that have already been assigned probability factors [24]. This means, for out of the box scenario, an FES cannot provide decision as the rules for the exception are not coded [24]. More importantly, because the membership functions and the rules are dependent on each other, a change in one will necessitate a change in the other [23]. A change in any of the parameters (input/output variables) will require reorganization of part or entire knowledge base depending on the number of parameters being changed. This can be a daunting task especially if you have many membership functions. For instance an FES with 3 membership functions will yield 9 rules while one with 6 membership functions will yield 36 rules four times more than the latter. Consequently a system with many rules can be quite complex to make adaptable or flexible to changes, yet [22] and [23] suggest that the more rules a system has the more accurate the decisions will be because more case scenarios will be factored in the rules.

5.2 ANN

Optimality of solution. ANN derives solutions based on past and present knowledge that is fed into it. Therefore, in the event the data training of the system is improper, it could lead to incorrect decisions. Further, because ANN does not give explanations for its decisions [3; 17; 24]; determining beforehand whether the new knowledge extracted is the best solution can be quite difficult. ANN follows the theory of 'garbage in garbage out' [24]. This remains an open issue because an important aspect in intelligent system design is decision explanation, which involves supplying a coherent explanation of its decisions [25]. This is required for acceptability of the solution and correctness of the reasoning [3].

Offline vs online methods of learning. Backpropagation being the most popular approach used to train ANN [2; 26]; an open issue that usually comes up with this approach is, when to use offline methods (batch leaning) or online methods (single step learning) during the learning process. Offline/batch learning requires that all training data is available because learning is only performed after a full set of training data is presented. On-line/single-step learning is suitable for when training data is produced by an on-going process meaning training data is not available prior to the process. This means that learning for a single step is performed after presentation of a single training pattern. However both methods have their share of limitations; batch learning can take a bit longer because weights are only updated after a full set of training data is presented. Single-step learning can reduce the adaptability performance of the system because weights are updated based on the last training pattern presented; this means the solution derived for the next predicted pattern is specific to one single previous pattern. On the other hand, the two methods also have their strengths when compared to each other; single-step training is faster while batch method yields lower residual error due to more data information as proved by [17] that increasing the training data of an ANN results in more correct solutions. [27]

Despite the benefits of each method, considering that the nature of traffic is uncertain and keeps fluctuating, the question of when to use these methods when it comes to smart transport systems is still debatable. Scholars like [27] suggest use of on-line methods is a better approach to transport traffic management. However, Pinto et al [17] insist that for an ANN to provide more accurate solutions the training time has to be extended to incorporate more data and that includes more past data not just single training pattern. With that in mind, then perhaps the best solution is to incorporate both methods in one system. Start with single-step learning to fasten the learning process and then batch learning to reduce error rate and improve accuracy of final result [27].

5.3 WSN

Techniques for regulating energy consumption in large traffic WSN networks (multiple intersections). It is evident that an increase in the distance between a node and a base station will trigger the need to use more transmission power. Thus, in the design of WSN, short range transmission (multi-hop) should be considered, in order to reduce attenuation as well as minimize power consumption during transmission. In multi-hop communication the sensor nodes serve as relays for other sensor nodes, and must co-operate with each other to find the most efficient route to transmit sensor data towards the BS. However, in an attempt to make the network more energy efficient by splitting up large distances between nodes into several shorter distances, WSN designers are faced by yet another challenge, routing [20].

This *routing* problem, that is, the task of finding a multi-hop path from a sensor node to the base station, is one of the most important challenges and has received immense attention from the research community [20]. This challenge is especially experienced in networks that use switching techniques. To conserve power, transceivers are designed to have switching states: active, idle and sleep states. Where active is when the nodes are receiving and transmitting, idle is when the sensor is on but not transmitting or receiving any data and sleep state is when the sensor is off. Designers thus have the task of deciding how and when it is appropriate to implement each state in order to conserve energy and still maintain network efficiency

In such networks, the sensor nodes are switched off when not in operation. In [21] it is observed that most transceivers operating in idle mode have power consumption almost equal to the power consumed in receive mode. Thus, it is better to completely shut down the transceiver rather than leave it in the idle mode when it is not transmitting or receiving. As a consequence, during these down-times, the sensor node cannot receive messages from its neighbors nor can it serve as a relay for other sensors [20]. Consequently if node 1 wants to send data to node 2, but node 2 is in sleep state this might cause some communication/network.

Scholars have suggested some strategies to resolve this routing problem, they include: 1) *wake-up on demand* where a node switches to active state only when needed and 2) *adaptive duty cycling strategy*, when not all nodes are allowed to sleep at the same time; instead, a subset of the nodes in a network remains active to form a network backbone. However, a significant amount of power is consumed when switching from sleep mode to transmit mode in order to transmit a packet. [21]

Perhaps then the most sustainable approach to energy consumption currently is regenerative power sources for the nodes such as solar charged batteries. However rechargeable batteries are more expensive than disposable ones. Therefore designers are forced to make the difficult decision of a trade-off between cost and energy consumption.

5.4 Hybrid

While this area of research is still fairly new, there still exist few studies done. However one major issue with these systems is *cost*. This is in the context of both design and their implementation particularly the implementation cost considering that A.I is still a new open ground research area. Patel et al [3] come up with a hybrid IDUTC that actually strives to reduce the design components of a hybrid system while still at the same time improving the system's performance. In the IDUTC we see that they successfully manage to reduce the design of the system with regards to the individual approaches. Their system has 55 nodes that produces an overall correct decision rate of 95% as opposed to ANN individual approach which requires 83 nodes in order to produce a correct decision rate of 73% overall. The ANN approach required more neural nodes than the ANN in IDUTC, which led to slower training and a higher implementation cost [3].

6. CONCLUSION

A review on the use of technology to control and manage traffic was presented in this paper. It is observed that the implementation of smart technology in transportation systems has a substantial impact on traffic levels. While the static systems provide a simpler method of automatically controlling traffic; they do not have the flexibility needed on most urban junctions which serve non uniform traffic from the various approaches/roads. Advancement in AI has further led to the development of intelligent traffic control systems. The main objective of these smart systems is to have the traffic lights mimic the human intelligence thus eliminating the need of having traffic officers control traffic on the roads. These intelligent systems provide a way for the lights to change from red to green based on current traffic conditions. Though these systems provide substantial benefits to management of traffic, FES and ANN are a branch of A.I. that is still an emerging field in IT; hence the implementation of such systems as stand alone is still quite costly, especially in the developing countries. Another STCS alternative to using the A.I systems is sensor networks. These networks have gained popularity especially due to the low cost of implementation compared to the A.I based systems. The network is comprised of many sensors that cooperate to monitor and collect data about traffic conditions on the roads. This information is then forwarded to a controller that processes the data into meaningful information. Using an algorithm the controller is able to make routing decisions based on current traffic conditions.

Although smart traffic control systems still have some limitations to what they can achieve intelligently, the future still holds a lot of promise for these systems. Researchers especially in the field of A.I are working hard to find ways to overcome these limitations in order to make them completely efficient. From this paper it is evident that smart systems are the way forward for road traffic control.

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Neuro-Fuzzy Model for Strategic Intellectual Property Cost Management

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Abstract : Strategic Intellectual property (IP) management requires strategic IP creation cost management. It is ideal to be able to proactively estimate the cost of creating IP. This would facilitate the alignment of IP creation activities in order to meet strategic management objectives. This paper proposes the use of Neuro-fuzzy model for strategic management of IP cost management. The extraction of the variables for the model is based on the Activity Based Costing techniques.

Keywords: Neuro-fuzzy; Intellectual Property; Cost Management.

1. INTRODUCTION

Intellectual property (IP) describes ideas, inventions, technologies, artworks, music and literature, all of which are intangible when created, but become valuable in the intangible form as product or service [1]. IP is a crucial contributor for the knowledge economy and generates monopoly position in return for providing payoffs to innovation. Identifying managing, protecting and exploiting valuable IP are the core elements of success of any organization [2]

Good IP management is important not only because of the financial return that it can help generate for a firm, but because it can also contribute to their corporate aims and objectives [3][4]. Strategic IP management requires effective IP cost management [5].

This requires appropriate models for estimating, validating and predicting IP creation cost. Cost prediction would help IP managers and organizations to identify aspect of IP creation that has to be adjusted to align IP R & D budget to IP strategy.

This paper proposes a Neuro-fuzzy for strategic IP creation cost management.

2. NEURO-FIZZY MODELS

Neural network (NN) consist of an Interconnected group of neurons [6]. Artificial Neural Networks (ANN) is made up of interconnecting artificial neurons (programming constructs that mimic the properties of biological neurons). A Neural network is an analog and parallel computing system. A neural network is made up of a number of very simple processing elements that communicate through a rich set of interconnection with variable weights or strength. ANN (or NN) is used in solving artificial intelligence problems without creating a model of a real biological system.

NN processes information using connectionist approach to computation [7]. It changes its structures based on internal or external information that flows through the network during the learning phase.

NN can be used to model complex relationship between input and output or find patterns in data.

The term network in the term "Artificial Neural Network" arises because the function f(x) is defined as a composition of other function g1(x) which can

further be defined as a composition of the other function.

Figure 1 presents a simple NN which comprises of the three layers (input, Hidden and output layers).

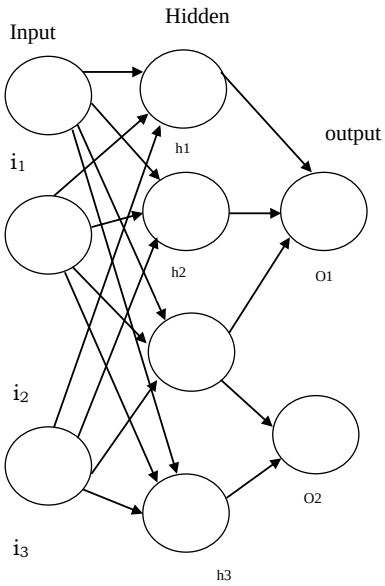

Figure 1: A Simple Neural [illegible]

The NN presented in figure 1, comprises of a layer of "input" connected to a layer of "hidden" units which is in turn connected to a layer of "output" units. The activity of the input unit represent the raw information that is fed into the network: the activity of the hidden units is determined by the activity of the input unit and the weights between the hidden and output

units. The hidden units are free to construct their own representation of the input: the weight between the input and hidden units determine when each hidden unit is active, and so by modifying these weights, a hidden unit can choose what it represents [8].

NN employs learning paradigm that includes supervised, unsupervised and reinforced learning [9]. NN has been applied in stock market prediction, credit assignment, monitoring the condition of machinery and medical diagnosis [7][10[11].

NN learn by example, hence details of how to recognize cost variation patterns in intellectual property creation is not needed. What is needed is some example that are representatives of all the variation of cost patterns.

However, NN cannot handle linguistic information and also cannot manage imprecise or vague information [12].

Fuzzy Logic (FL) is a branch of machine intelligence (Artificial intelligence) that helps computers paint vivid pictures of the uncertain world. Fuzzy sets were introduced as a means of representing and manipulating data that are not precise, but rather fuzzy. Fuzzy logic provides an inference morphology that helps appropriate human reasoning capabilities to be applied to knowledge-based systems. The theory of fuzzy logic provides a mathematical strength to capture the uncertainties associated with human cognitive processes, such as thinking and reasoning. A fuzzy set is called fuzzy number (figure 2) with peak (center) a, left width [>O and right width β > O if its membership function has the form:

$$A(t) = \begin{cases} 1 - a - t/\square & \square \le + \\ (t-a)/\beta \quad \text{if} & \le + \le \alpha + \beta \\ 0 \text{ otherwise} & \end{cases}$$

and the notati , β_. It can be easily shown that

[A]y = [a- (1-y) □, ; -y) β], VgE{0,1}

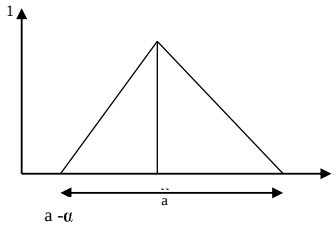

Figure 2: Triangular fuzzy membership number

Fuzzy systems often learn their rules from experts when no expert gives the rules, adaptive fuzzy systems learn by observing how people regulate real systems [13]. The difference between classical and fuzzy logic is something called "the law of excluded" [14][15]. In standard set theory, an object cannot belong to both its set and its compliment set or to neither of them. This principle presents the structure of the logic and avoids the contradiction of object that both is and is not a thing at the same time [16]. However, fuzzy logic is highly abstract and employs heuristic (experiment) requiring human expert to discover rules about data relationship. Fuzzy Neural network or Neuro-fuzzy system is a learning machine that finds the parameters of a fuzzy system (i.e., Fuzzy sets, fuzzy rules) by exploiting approximate techniques from neural networks [17]. Neuro-fuzzy refers to the combination of artificial neural network and fuzzy logic. It eliminates the individual weaknesses of neural network and fuzzy logic while making most of their best advantages. Fusion of neural network and fuzzy logic (Neuro-fuzzy) is therefore beneficial [18][19][20][21].

3 MODEL DEVELOPMENT

In order to generate variables for the Neuro-fuzzy systems, the Activity Based Costing (ABC) model is used to allocate cost for the IP creation activities. The ABC framework is depicted in figure 3.

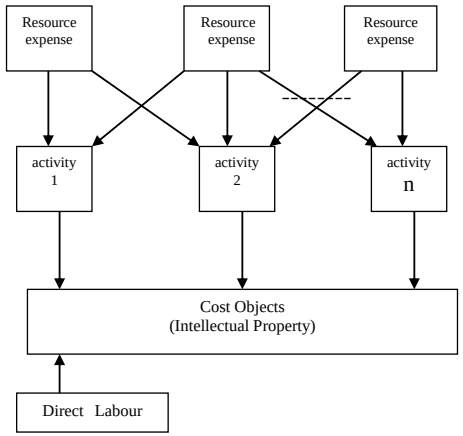

Figure 3: Activity based costing applied to IP Creation.

The activities that goes into IP creation is used as the basis of cost estimation and management.

The consideration is the focus on activities that result from events or decisions, and consume resources in order to produce output. That is cost allocation for IP creation is moved from central cost centers to discrete units of activity. A database whose schema is designed to manage data based on the ABC model would be suitable.

The proposed neuro-fuzzy model is developed in three main stages – the first using statistical method to pre-process the data on the cost of IP creation, the second using neural networks to develop relative final cost weighing of predictors and lastly using fuzzy sets to predict final cost. These stages are detailed below:

3.1 Stage one: Data and Data pre-processing

Historic data of IP creation cost is required here. It is

assumed that the data base logical storage structure corresponds to the Activity Based Costing structure, where the cost of IP creation is not seen as a single value but broken into activities, in which cost or resource is allocated to each activity.

The data required for the model is collected from such a database. The collected data is processed so as to structure and present the data to the model in the most suitable way. For the model, extreme values and others are either removed or deleted from the sample set and missing values replaced with the mean or mode. The activities that make up the creation of the IP constitutes the variables in this model, for instance if n activities is required to create an intellectual property, they n variables are used in the model.

3.2 Stage two: Neural network stage of the modeling is developed to determine a consistent numerical weighting for all the predictors depending on their relative contribution to determining the final cost of the intellectual property creation activities. A given number (possibly 10) of initial predictors is used in a 3-layered feed-forward back-propagation in neural network architecture with final Target cost as output of the model. The samples from the IP cost database is split into three portions probably in ratio of 75:15:102) for training, testing and validation respectively. The best model is developed through an iterative procedure of continually tweaking the neural network parameters i.e hidden nodes and activations, function to produce improved model performance.

Model performance is measured using the correlation coefficient between presented IP cost estimate and output values as well as the sum of squares (S0S) of errors:

SOS = Σ(Ti – Oi)2----------(1)

were Oi is the prediction (network output) Ti is the target (actual value) of the ith data case.

3.3. Stage three: Fuzzy sets modeling.

fuzzy set theory is applied at this stage of the modeling to evaluate the subjective measures of each of the cost predictors in order to predict the final cost. Using,

$$\Sigma \text{ Normalized ranking} = \frac{wi}{\Sigma w} = 1 \text{ ------(2)}$$

the average weighted ranking for each of the variables from the IP cost database sample is normalized to unity in order to generate a standardized index for the subsequent fuzzy set computations (see table 1)

In equation (2), Wi is the average relative weighting of the ith predictor, Σw is the sum of relative weighting of all predictors.

Table 1: Normalized weighted values of the IP cost predictors from the neural network model.

IP creation activity	Activity 1	Acti-v-ity 2	Activi-ty 3	… … … … …	Act-ivity n
Norm-alized ranking	r1	r2	r3	… … … … ….	r n

With mean target cost to predictor plots, all predictors are fuzzified using a set range. The next stage of the fuzzy modeling involves developing membership functions. In developing these, the tolerance index is particularly relevant and constraining the range of possibilities subject to a complex set of influencing variables, quantitatively or qualitatively defined. The tolerance index is vital in order to model the uncertainly in the cost values within a realistic continuum as opposed to a single figure-of-merit.

The IP creation cost prediction from the neuro-fuzzy model would be vital to strategic IP cost management. This would help by providing important information for strategy formulation, evaluation of strategy implementation and highlighting the practical limitation or problems with the adopted IP management strategy.

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4. CONCLUSION

Intellectual property is a vital asset of a company. Strategic IP management require strategic IP cost management. This paper proposes a neuro-fuzzy model for predicting IP creating cost. This is to enable Strategic alignment of IP creation activities, IP creation cost with the organization IP management strategy. In the specification of this model, the Activity Based costing model is used as input the model building. This work laid out the framework of the system. This included the extraction, pre processing of the IP cost variables from database, the fuzzification procedure of the variable and through the neural network training procedure. This is in order for the inference engine to output a final cost prediction. This prediction is vital to strategic IP cost management.

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Survey on Indian CLIR and MT systems in Marathi Language

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Abstract: Cross Language Information Retrieval (CLIR) deals with retrieving relevant information stored in a language different from the language of user's query. This helps users to express the information need in their native languages. Machine translation based (MT-based) approach of CLIR uses existing machine translation techniques to provide automatic translation of queries. This paper covers the research work done in CLIR and MT systems for Marathi language in India.

Keywords: Cross Language Information Retrieval, NLP, Machine Translation, Marathi.

1. INTRODUCTION

Monolingual Information Retrieval System refers to the Information Retrieval system that can identify the relevant documents in the same language as the query was expressed whereas Cross Language Information Retrieval System (CLIR) retrieves information written in a different language from the query language. However, with the rapid growing amount of information available to us, the situations that a user needs to use a retrieval system to perform querying a multilingual document collection are becoming increasingly emerging and common. As a result CLIR has received more research attention and is increasingly being used to retrieve information on the Internet [1].

Most of the information on the internet is available in English. However, users who don't use English as first language are also significantly high. Non-English users find it difficult in querying information in English. Proficiency in English language is becoming a kind of barrier in finding rich source of information available on World Wide Web. CLIR helps in bridging this gap. A unique feature of CLIR allows users to query in their native language and provide search result in English. It translates given query into target language then search and provides the most relevant information to the user. This feature of CLIR separates it from any other translating system.

1.1 Translation Types

CLIR system uses two types of translations: Query and Document translation [2]. In Query Translation, the given query will be converted from Native language to Target language and then search operation is performed to get the relevant documents. In Document Translation, all the documents are translated into Native language. It allows the user to ask query in Native language and then the searching will take place to obtain the resultant documents in Native language. Among the two, the query translation is easier [3] compared with document translation, because of the size of translation. But, the drawback with query translation is that the given query normally will be short and hence ambiguity problem may arise. As, document Translation is not feasible, most research is based on query translation.

1.2 CLIR Phases

CLIR system involves phases: query pre-processing, translation and disambiguation followed by information retrieval. The pre-processing includes stop words removal and morphological analysis to get the root words. The whole query or some words of the query are transliterated into the target language and sent to the search engine. The process of transliteration refers to expressing a word in one language using the orthography of another language. Document retrieval system involves the use of algorithms for information retrieval and the final stage is to display the results.

2. TERMS IN CLIR SYSTEM

2.1 Machine Translation (MT)

Machine Translation is one of the parts of language processing within Computational Linguistic. Machine Translation (MT) refers to the use of computers to automate some of the tasks or the entire task of translating between human languages. However, the MT system is good tool for CLIR, and actually, if good MT software is available, the CLIR task becomes easier [3]. However, in the case of query translation, the MT approach has not always shown better performance than that of dictionary-based translation. One of the reasons can be short queries are insufficient to provide contextual information for translation.

2.2 Bilingual Dictionary

Bilingual dictionaries are specialized in translating text and words from one language to another. Using a bilingual Machine Readable Dictionary (MRD) is the general approach for CLIR when no commercial MT system with an established reputation is available [3]. In general, most retrieval systems are still based on so called bag-of-words architectures, in which both query statements and document texts are decomposed into a set of words (or phrases) through a process of indexing. Thus translation of a query can be easily done by replacing each query term with its translation equivalents appearing in a bilingual dictionary or a bilingual term list.

2.3 POS Tagger

A Part-Of-Speech Tagger (POS Tagger) reads text and assigns parts of speech to each word (and other token), such as noun, verb, adjective, etc.

Singh J. et al. [4] developed a Marathi POS tagger. The general approach used for development of tagger is statistical method using Unigram, Bigram, Trigram and HMM. It presents a clear idea about all the algorithms with suitable examples. It also introduces a tag set for Marathi language which can be used for tagging Marathi text.

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Patil H. B. et al. [5] demonstrated a rule-based POS tagger for Marathi Language. The hand–constructed rules that are learned from corpus and some manual addition after studying the grammar of Marathi language are added and that are used for developing the tagger. Disambiguation is done by analysing the linguistic feature of the word, its preceding word, its following word, etc.

2.4 Morphological Analyser

Morphological Analyser is a software component which analyses morphology of given text. It senses or finds out the morphemes of an input word.

A. Muley et al. [6] proposed the morphological analysis for Marathi Language using Ruled Bases Approach. This system has been developed to find a root word of a given word and can be used in Gender Recognition as well.

P. Gawade et al. [7] developed the morphological analyser for Marathi, an inflectional language and also a parsed tree i.e. a grammatical structure. The morphological analyser is combined with statistical POS tagger and Chunker to see its impact on their performance so as to confirm its usability as a foundation for NLP applications.

2.5 Transliteration

It is a process of converting text from one script to another. For example English transliteration of Marathi script "गुजरात" is "Gujarat". There are many standard formats possible for Devanagari-English transliteration viz. ITRANS, IAST, ISO 15919, etc. Transliteration is very useful for converting the named entities (NEs) written in one script to another script in NLP applications like CLIR, Multilingual Voice Chat Applications and Real Time MT.

S. Karimi et al. [8] surveyed key methodologies introduced in the transliteration literature. The approaches are categorized based on the resources and algorithms used and the effectiveness is compared.

P. H. Rathod et al. [9] proposed the named entity transliteration for Hindi to English and Marathi to English language pairs using Support Vector Machine (SVM). The source named entity is segmented into transliteration units and classification of phonetic units is done by using the polynomial kernel function of SVM. The system uses phonetic of the source language and n-gram as two features for transliteration.

2.6 Word sense disambiguation

Word Sense Disambiguation is a process of identifying the most appropriate sense of a word that is used in a given sentence. M. Khapra et al. [10] proposed Domain Specific Iterative Word Sense Disambiguation (WSD) for nouns, adjectives and adverbs in the trilingual setting of English, Hindi and Marathi. The methodology proposed relies on dominant senses of words in specified domains. Starting from monosemous words it iteratively disambiguates bi, tri and polysemous words. Corpus biases for senses are combined with information in Wordnet graph structure to arrive at the sense decisions.

M. Khapra et al. [11] proposed a WSD method that can be applied to a language even when no sense tagged corpora for that language is available. This is achieved by projecting wordnet and corpus parameters from another language to the language in question. The approach is centered on a novel synset based multilingual dictionary and the empirical observation that within a domain the distribution of senses remains more or less invariant across languages.

There are some terms in CLIR such as corpus, stop words, precision, recall, etc. which have same meaning as in traditional information retrieval.

3. LITERATURE SURVEY ON CLIR

3.1 Hindi and Marathi to English Cross Language Information Retrieval

Chinnakotla M. K. et al. [12] proposed a Hindi and Marathi to English CLIR systems as part of CLEF 2007 Ad-Hoc Bilingual task. The system uses query translation approach using bi-lingual dictionaries. First, the input query is pre-processed to identify the root words. Then the words are translated using dictionary. If the words are not found in the dictionary then they are transliterated using a simple rule based approach which uses the corpus to return the 'k' closest English transliteration. Then translated/transliterated words are disambiguated using an iterative page-rank style algorithm. Finally, the disambiguated words are given to the monolingual search engine to get the relevant results. For Hindi, a Mean Average Precision (MAP) achieved is higher than that for Marathi.

3.2 Using Morphology to Improve Marathi Monolingual Information Retrieval

Ashish A. et al. [13] studied the effects of lexical analysis on Marathi monolingual search over the news domain corpus of FIRE-2008. The work also observed the effect of processes such as lemmatization, inclusion of suffixes in indexing and stop words elimination on the retrieval performance. The results show that lemmatization significantly improves the retrieval performance of language like Marathi which is agglutinative in nature. Also, it was observed that indexing of suffix terms, which show spacio-temporal properties, further improved the precision. The effects of elimination of stop words were also observed.

3.3 Sandhan

Sandhan is a project developed under Technology Development for Indian Languages (TDIL) programme [14] with an objective to develop a monolingual search system which will cater tourism domain in five Indian languages viz. Bengali, Marathi, Hindi, Tamil and Telugu. In this project, user has facility to submit query by typing using the INSCRIPT or phonetic layout. On-screen keyboard is also provided to submit query. *Sandhan* has the capability to process the query based on its language and retrieve results from the respective language. Snippets generated for each of the retrieved documents, help the user to understand the context of query terms in that document. Summary is generated for each retrieved document and this feature helps the user in knowing the basic information about the overall content of the document without opening it. An additional UNL based semantic search facility has been provided for Tamil language.

3.4 CLIA

The CLIA (Cross Lingual Information Access) [15] Project is a mission mode project executed by a consortium of academic and research institutions and industry partners. CLIA enables users to enter queries in languages they are fluent in, and uses language translation methods to retrieve documents originally written in other languages. CLIA is an extension of the CLIR paradigm, the objective of which is to introduce additional post retrieval processing to enable users make sense of these retrieved documents. This additional processing takes the form of machine translation of snippets, summarization and subsequent translation of summaries and/or information extraction.

3.5 Marathi-English CLIR

We have presented Marathi-English CLIR in paper [16] for improving the performance of Marathi-English CLIR system. The system first finds possible translations of input query in target language, disambiguates them and then gives English queries to search engine for relevant document retrieval. The disambiguation is based on unsupervised corpus-based method which uses English dictionary as additional resource. The experiment is performed on FIRE 2011 (Forum of Information Retrieval Evaluation) dataset using "Title" and "Description" fields as inputs. The experimental results show that proposed approach gives better performance of Marathi-English CLIR system with good precision level.

4. MT APPROACHES

MT approaches are classified into three categories: rule-based, knowledge-based and corpus-based.

4.1 Rule-based MT

The Rule Based Machine Translation System takes into account semantic, morphological and syntactic information from a bilingual dictionary and grammar. Based on these rules, it generates the output target language from the input source language by producing an intermediate representation. Rule based system is further classified as Direct MT, Interlingua-based and Transfer –based [17].

In Direct Machine Translation, a direct word by word translation of the input source is carried out with the help of a bilingual dictionary and after which some syntactical rearrangement are made [18].

The Interlingua Approach converts words into an intermediate language IL, which is typically a universal language created for the system to use it as an intermediate for translation into more than one target language [18].

The Transfer based approach uses translation rules to translate the input language to the output language. a dictionary to directly convert source into target whenever a sentence matches one of the transfer rules.

4.2 Knowledge-based MT

It uses the knowledge base that converts the source representation into an appropriate target representation before synthesizing into the target sentence [19]. The basic translation strategy is to extract meaning from the input text in source language, represent this meaning in a language independent semantic representation and then render this meaning in a target language [20].

4.3 Corpus-based MT

In this approach, a bilingual text corpus is trained to get the desired output. The corpus based approach is mainly used in Statistical MT and the Example-Based MT System.

Statistical machine translation is a data-oriented statistical framework for translating text from one natural language to another based on the knowledge and statistical models extracted from bilingual corpora. It requires bilingual or multilingual textual corpora of the source and target language or languages [21].

Example Based Machine Translation System uses previous translation examples to translate from source to target language. EBMT System retrieves examples of existing translation in its example-base and provides the new translation based on that example [17].

5. LITERATURE SURVEY ON MT SYSTEMS FOR MARATHI

This section describes the MT system developments in India for Marathi language.

5.1 Literature Survey of Existing Surveys

The authors in [21] and [22] surveyed various MT systems such as Anglabharti, Anubharti, Shiva and Shakti.

Anglabharti uses pseudo-interlingua approach for translating English to Indian languages. The analysis of English as a source language is done only once and it creates intermediate structure – PLIL (Pseudo Lingua for Indian Languages). The domain of this machine translation system has been public health.

Anglabharti-II uses a generalized example-based (GEB) approach for hybridization with Raw Example-Base (REB). It has provisions for automated pre-editing and paraphrasing, generalized and conditional multi-word expressions as well as recognition of named-entities. The system also contains a 'failure analysis' module. The failure analysis module consists of heuristics on speculating the reasons for wrong translation.

Anubharti uses a hybridized example-based machine translation approach. It is a combination of example-based, corpus-based approaches and some elementary grammatical analysis. In Anubharti, the traditional EBMT approach has been modified to reduce the requirement of a large example-base.

Anubharti-II uses Generalized Example-Base (GEB) along with Raw Example-Base (REB) MT approach for hybridization. The combination of example-based approach and traditional rule-based approach is used in this system. The example based approach emulates human-learning process for storing knowledge from past experiences and to be used in future. A shallow chunker is used to fragment the input sentence into small units and then they are matched with a hierarchical example-base.

'Shiva' and 'Shakti' MT systems are developed jointly by Indian Institute of Science, Bangalore, India, Carnegie Mellon University USA, and International Institute of Information Technology, Hyderabad. Shiva is designed using an Example-based and the system Shakti is designed using combination of rule based and statistical approaches. The rules used for target language generation are mostly linguistic in nature and the statistical approach tries to infer or use linguistic information. Semantic information is also used by some modules in the system. Currently the system is working for three languages (Hindi, Marathi and Telugu).

5.2 Anusaaraka

Anusaaraka project [23] started at IIT Kanpur by Rajeev Sangal is now being continued at IIIT Hyderabad. The purpose of the project was the MT of one Indian language to another Indian language. It is not domain specific but the system has been tested mainly for translating children's stories. The focus of Anusaaraka was not mainly on MT, but it was on language access between Indian languages. It is currently attempting an English-Hindi machine translation. It uses a Paninian Grammar (PG) and exploits the close similarity of Indian languages.

5.3 UNL Based

Dave S et al. [24] developed a translation system using Universal Networking Language (UNL) as the Interlingua structure. The Universal Networking Language is an international project aimed to create an Interlingua for major human languages. Hindi- UNL, English-Hindi, English-Marathi, English-Bengali and UNL-Hindi, were also developed using UNL formalism. It is easy to add new language in the system for translation.

5.4 Sampark

A consortium of 11 institutions in India has developed 'Sampark' [25], a multipart machine translation system to India Language Machine Translation (ILMT) from Indian Language, funded by TDIL program of Department of Electronics and Information Technology (DeitY), Govt. of India. This program uses Computational Paninian Grammar (CPG) for analyzing language and combines it with machine learning. It is developed using both traditional rules-based and dictionary-based algorithms with statistical machine learning. This consortium has developed language technology for 9 Indian languages resulting in Machine Translation for 18 Indian language pairs.

5.5 Anuvaadaksh

Anuvaadaksh [26] was developed by English to Indian Language MT (EILMT) consortium. Anuvadaksh being a consortium based project has a hybrid approach that is designed to work with platform and technology independent modules. This system has been developed to facilitate the multi-lingual community, initially in the domain-specific expressions of tourism. It integrates four MT Technologies: Tree Adjoining Grammar (TAG) based MT, SMT, Analyze and Generate rules (Anlagen) based MT, Example-based MT (EBMT).

5.6 Google Translator

Google Translate [27] is a free translation service that provides instant translations between 57 different languages. Google Translate generates a translation by looking for patterns in hundreds of millions of documents to help decide on the best translation. By detecting patterns in documents that have already been translated by human translators, Google Translate makes guesses as to what an appropriate translation should be. This process of seeking patterns in large amounts of text is called "SMT".

The TABLE I describe the comparison of different Machine Translation (MT) systems for Marathi language with supported languages, developers of the system and MT approach.

TABLE 1 Comparison of MT Systems for Marathi

MT System	Language	Developer	Approach
Anglabharti (1991)	English to IL	IIT, Kanpur	Interlingua based
Anglabharti II (2004)	English to IL	IIT, Kanpur	Example based
Anubharti (1995) Anubharti II (2004)	Hindi to IL	IIT, Kanpur	Hybrid MT
Anusaaraka (1995)	Punjabi, Bengali, Telugu, Kannada, & Marathi to Hindi.	IIT, Kanpur and University of Hyderabad	Direct MT
UNL based (2003)	Between English, Hindi, and Marathi	IIT, Mumbai	Interlingua based
Shiva and Shakti (2003)	English to {Hindi, Telugu, Marathi}	IISc- Bang, IIIT Hyd, and Carnegie Mellon University	Example based
Sampark (2009)	Among Indian Languages	Consortium of institutions	Rule based + SMT
Anuvadaksh	English to {Hindi, Urdu, Oriya, Bangla, Marathi, Tamil}	EILMT consortium	Hybrid
Google Translate	57 different languages	Google	SMT

6. CONCLUSION

Cross-language IR is a technique for searching documents in many languages across the world and it can be the baseline for searching not only among two languages but also in multiple languages. Machine Translation (MT) is one of the approaches for CLIR system which refers to the use of computers to automate some of the tasks or the entire task of translating between human languages. This paper surveys various developments in CLIR and MT systems, specifically for Marathi language. The work done for both CLIR and MT system for Marathi is in its preliminary stage.

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