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Optimal Clustering Technique for Handwritten Nandinagari Character Recognition

Prathima Guruprasad
Research Scholar, UOM,
Dept. of CSE, NMIT,
Gollahalli, Yelahanka,
Bangalore, India

Prof. Dr. Jharna Majumdar
Sc. G DRDO (Retd.), Dean,
R&D, Prof. and Head, Dept. of CSE and Center for Robotics Research, NMIT, Bangalore, India

Abstract: In this paper, an optimal clustering technique for handwritten Nandinagari character recognition is proposed. We compare two different corner detector mechanisms and compare and contrast various clustering approaches for handwritten Nandinagari characters. In this model, the key interest points on the images which are invariant to Scale, rotation, translation, illumination and occlusion are identified by choosing robust Scale Invariant Feature Transform method(SIFT) and Speeded Up Robust Feature (SURF) transform techniques. We then generate a dissimilarity matrix, which is in turn fed as an input for a set of clustering techniques like K Means, PAM (Partition Around Medoids) and Hierarchical Agglomerative clustering. Various cluster validity measures are used to assess the quality of clustering techniques with an intent to find a technique suitable for these rare characters. On a varied data set of over 1040 Handwritten Nandinagari characters, a careful analysis indicate this combinatorial approach used in a collaborative manner will aid in achieving good recognition accuracy. We find that Hierarchical clustering technique is most suitable for SIFT and SURF features as compared to K Means and PAM techniques.

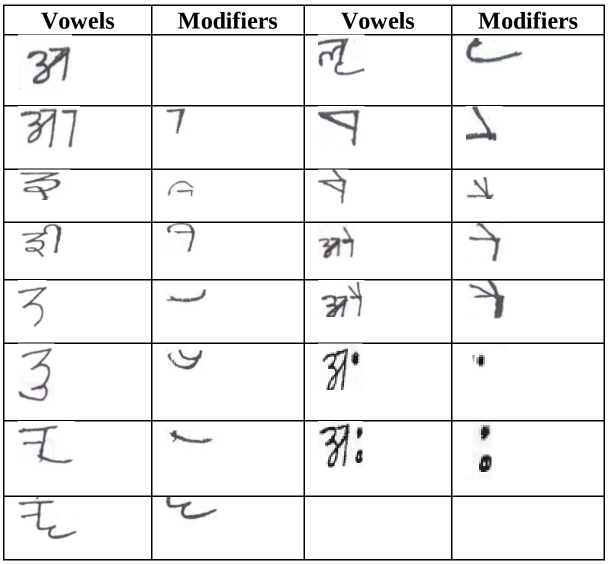
Keywords: Invariant Features, Scale Invariant Feature Transform, Speeded Up Robust Feature technique, Nandinagari Handwritten Character Recognition, Dissimilarity Matrix, Cluster measures, K Means, PAM, Hierarchical Agglomerative Clustering

1. INTRODUCTION

The awareness of very old scripts is valuable to historians, archaeologists and researchers of almost all branches of knowledge for enabling them to understand the treasure contained in ancient inscriptions and manuscripts [1]. Nandinagari is a Brahmi-based script that was existing in India between the 8th and 19th centuries. This is used as writing style in Sanskrit especially in southern part of India. Nandinagari script is older version of present day Devanagari script. But there are some similarities between Nandinagari and Devanagari in terms of their character set, glyphic representation and structure. However, Nandinagari differs from Devanagari in the shapes of character glyphs, absence of headline. There are several styles of Nandinagari, which are to be treated as variant forms of the script. Sri Acharya Madhwa of the 13th century, a spiritual Leader who founded the Dvaita school of Vedanta has hundreds of manuscripts written in Nandinagari on the Palm leaves.

Nandinagari script is available only in manuscript form hence it lacks the necessary sophistication and consistency. There are innumerable manuscripts covering vast areas of knowledge, such as Vedas, philosophy, religion, science and arts preserved in the manuscript libraries in digital form. Today though Nandinagari script is no longer in trend, the scholars of Sanskrit literature cannot be ignorant of this script. Nandinagari character set has 15 vowels and 37 consonants, 52 characters as shown in Table 1 and Table 2. We face many challenges to interpret handwritten Nandinagari characters such as handwriting variations by same or different people with wide variability of writing styles. Further, these documents are not available in Printed Format and only handwritten scripts are available. Absence of any other published research methods using these rare characters makes if more challenging. Nandinagari Optical Character Recognition (OCR) is not available to date. Therefore, we need to extract invariant features of these handwritten characters to get good recognition accuracy.

Table 1. Nandinagari Vowels and Modifiers



In this paper we extract features using Scale Invariant Feature Transform (SIFT) [2] and Speeded Up Robust Feature (SURF) transform techniques [7]. The SIFT and SURF features are local and based on the appearance of the object and are invariant to different sizes and orientations. They are also robust to changes in illumination, noise and highly distinctive with low probability of mismatch. From these features, a dissimilarity matrix is computed. Then this is given as an input to different clustering techniques to group similar characters. The set of clustering mechanisms identified for these characters are K Means, PAM and Hierarchical agglomerative clustering

technique. The performance of these techniques are compared and best method for SIFT and SURF features is identified.

Table 2. Nandinagari Consonants

2. RELATED WORK

The scale and variety of applications using SIFT [3][4][5][6] and SURF[9] is discussed in many papers on pattern recognition. The robustness of SIFT and its comparison with SURF algorithm is also discussed in some papers [8][9]. The recognition of multiple type of words including Devanagari using Visual bag of words is discussed using SIFT algorithm [11]. An attempt to classify human faces using SIFT and hierarchical clustering approach is also introduced [12].Clustering algorithms like K Means and K Medoids and their performance is also discussed [14].Different cluster measures to evaluate the performance of cluster methods are also discussed [15].

3. METHODOLOGY

Handwritten Nandinagari character database is created manually as standard dataset is not available. For a set of 52 vowels and consonants in Nandinagari, with an average of 5 different variations over the format of representation(jpg or png), size(256X256, 384X384, 512X512, 640X640), degree of rotation(0, 45, 90, 135 and 180 degree) and translation(positive or negative offset of 15 pixels), a database of 1040 characters is prepared. The proposed architecture shown in Fig. 1 consists of following steps:

1. In the first step, all the characters in the database are scanned.
2. In the pre-processing step, we convert these images into their grayscale form.
3. Interest points from the input image are extracted using the Scale invariant feature transform (SIFT) technique. From each point, 128 feature descriptors are extracted which are invariant to scale, rotation and illumination. Similarly, features are also extracted using Speeded Up Robust Feature (SURF) transform technique. 64 feature descriptors are generated from each candidate points.
4. For each image in the database, the number of match points are found with every other image and vice versa.
5. The maximum number of match points is computed by considering number of match points and N X N match matrix is generated.
6. The dissimilarity ratio is now computed using the following formula

Eij = Eji = {100 * (1 - nMax / nMin) }, where nMax = maximum number of match points in either directions and nMin = minimum number of key points in either direction

7. The SIFT and SURF features dissimilarity matrix is fed as input for different clustering techniques to group similar handwritten Nandinagari characters together.
8. The best-suited clustering technique for SIFT and SURF features is identified by analysing the performance using cluster measures.

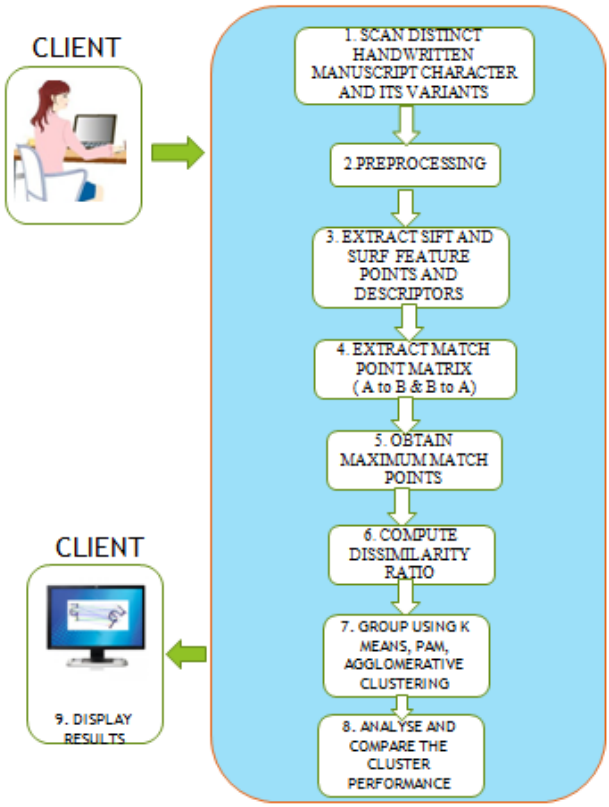


Figure 1. Proposed Model Architecture

3.1 Clustering

Clustering is the process of grouping a set of similar objects into same clusters and dissimilar objects in other clusters. Three prominent approaches are taken for analysis and comparison here. They are K Means, PAM and Agglomerative Hierarchical Clustering.

3.1.1 K Means Clustering

K-means clustering algorithm uses an iterative refinement approach. Here we partition of the characters into k clusters, such that the characters in a cluster are more similar to each other than to characters in different clusters [14].This is based on the Euclidean distance measure, we calculate the new mean

which is the centroid of the clusters and assign nearest points and this process is continued until the cluster centres remains unchanged.

3.1.2 PAM Clustering

This method chooses a character from all characters in the dataset as medoids of a cluster i.e., a cluster centre, in contrast to the K-Means method, which selects a random value as the centre of the cluster. The objective is to minimize the average dissimilarity of characters to their closest selected character. This method starts from an initial set of medoids and iteratively replaces one of the medoids by one of the non-medoids if it improves the total distance of the resulting clustering [15]. The PAM method is more robust to noise and outliers, compared to the K-means method.

3.1.3 Agglomerative Clustering

Agglomerative Hierarchical Clustering is a bottom up approach where each observation starts in its own cluster, and pairs of clusters are merged as one moves up in the hierarchy [13].The result of the hierarchical methods is a dendrogram, representing the nested grouping of objects. There are different methods for agglomeration such as single, complete, average methods. In this paper, we have used the average linkage method as an algorithm for this approach. This is better than the K Means and PAM approaches since it automatically detects the number of clusters.

3.2 Cluster Validation Measures

Choosing appropriate clustering method for a given dataset is a very challenging task. So different clustering measures are considered to validate the clustering results. It is helpful to choose best clustering technique for a specific application. Here we validate the results using two categories of measures such as internal and stability validation measures. Internal measure use the fundamental information in the data to evaluate the quality of the clustering. Stability measure evaluate the consistency of the clustering results [16].

3.2.1 Internal Measures

For internal measures, three measures are considered such as Connectivity, Silhouette width and Dunn Index. Connectivity is used to measure the connected component, which relates to what extent items are placed in the same cluster as their nearest neighbours in the data space. In the second measurement approach, the silhouette value measures the degree of confidence in the clustering assignment of a particular item. This value ranging between -1 to 1 need to be maximized. However, in the third measurement approach, the Dunn index indicates the ratio of the smallest distance between items not in the same cluster to the largest intra-cluster distance. The Dunn index has a value between zero and one, and need to be maximized.

3.2.2 Stability Measures

The stability measure compare the results from clustering based on the original data set to clustering based on deleting one column at a time. These measures work well if the data are highly correlated. The stability measures considered here are the average proportion of non-overlap (APN), the average distance (AD), the average distance between means (ADM), and the figure of merit (FOM). The APN measures the average proportion of observations not placed in the same cluster by clustering based on the original data and clustering based on the data with a single column removed. The AD measure computes the average distance between observations placed in the same cluster by clustering based on the original data and clustering based on the data with a single column removed. The ADM measure computes the average distance between cluster centres for observations placed in the same cluster by clustering based on the original data and clustering based on the data with a single column removed. The FOM measures the average intra-cluster variance of the observations in the removed column, where the clustering is based on the remaining samples. This estimates the mean error using predictions based on the cluster averages. The APN has the value between 0 and 1 and with values close to zero corresponds to highly consistent clustering results. Remaining measures have values between zero and ∞and smaller values are favoured for better clustering performance.

4. EXPERIMENTAL RESULTS

The results are obtained for various stages of character recognition. The samples of images of different size 256 X 256, 384 X 384, 512 X 512,640 X 640, different orientation angles 0o, 45o, 90o, 135o, 180o are taken. This forms a 1040 character in the database. All the 1040 characters are considered for computation and for the sake of depicting the results of cluster formation, we take a subset of 16 distinct characters from this set.

4.1 Cluster using SIFT Features

For K-means clustering approach, the parameter to be set prior to clustering is the number of clusters. The optimal number of clusters i.e. 14 for SIFT features is derived using Elbow method is as shown in Fig 2. The clusters obtained using this technique is indicated in Appendix1. As seen in this figure, the instances are misclassified and hence would yield a low accuracy rate. For PAM the optimal number of clusters need to be mentioned but the partition done around the medoids and this is better compared to K Means approach. The cluster results using SIFT features are as shown in Appendix 2.

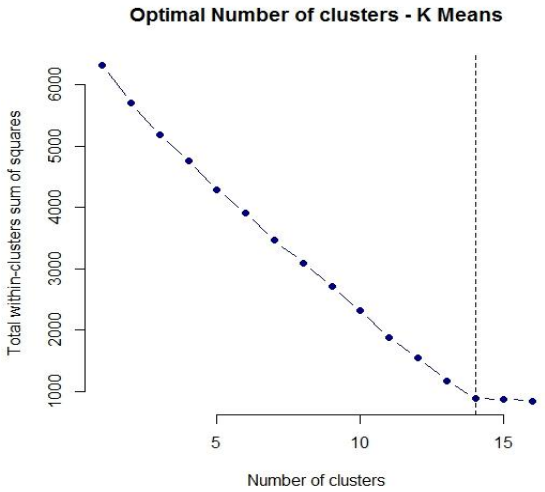


Figure 1. Optimal Number of Clusters (14) using K-means for SIFT features

The optimal number of clusters for PAM is same as K Means method as shown in Fig 3.The dendogram after hierarchical clustering using SIFT features for sample characters partitioned automatically into 16 clusters is as shown in Appendix 3.

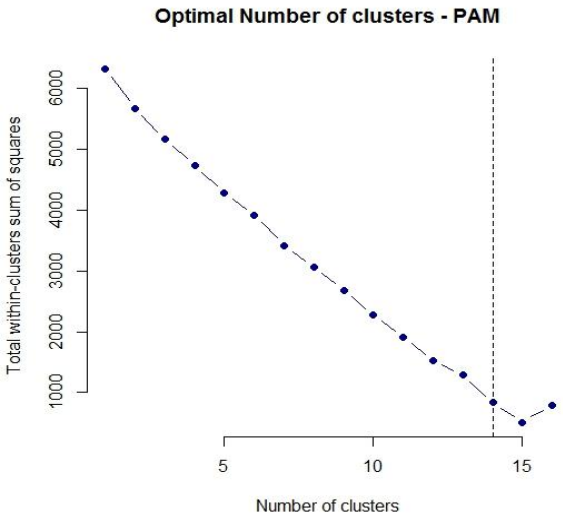


Figure 3. Optimal Number of Clusters (14) using PAM for SIFT features

4.1.1 Cluster Validation Measures for SIFT Features

The internal validation measures are the Connectivity, Silhouette width, Dunn Index derived for three different clustering techniques, K Means, PAM, and agglomerative hierarchical clustering techniques using SIFT features. The clustering validation results are analysed and the optimal score for these three measures as shown in Table 3. For internal measures using SIFT features, hierarchical clustering with two clusters performs better for connectivity measures. For Dunn Index and Silhouette Width, hierarchical clustering with fourteen clusters performs better. For good clustering, the connectivity is minimized, while both the Dunn index and the silhouette width is maximized. So from table 3 it appears that hierarchical clustering performs better compared to the other clustering techniques for each internal validation measure.

Table 3. Internal and Stability cluster validation measures for SIFT Features

Internal Measures			
Measures	**Value**	**Cluster Method**	**No. of Clusters**
Connectivity	8.5079	Hierarchical	2
Dunn Index	0.9191	Hierarchical	14
Silhouette Width	0.7140	Hierarchical	14
Stability Measures			
Measures	**Value**	**Cluster Method**	**No. of Clusters**
APN	0.0195	Hierarchical	14
AD	61.1687	Hierarchical	14
ADM	7.6345	Hierarchical	14
FOM	8.8808	Hierarchical	14

The graphical representation of the connectivity, Dunn index, and Silhouette Width measures are as shown in Fig.4 to 6.

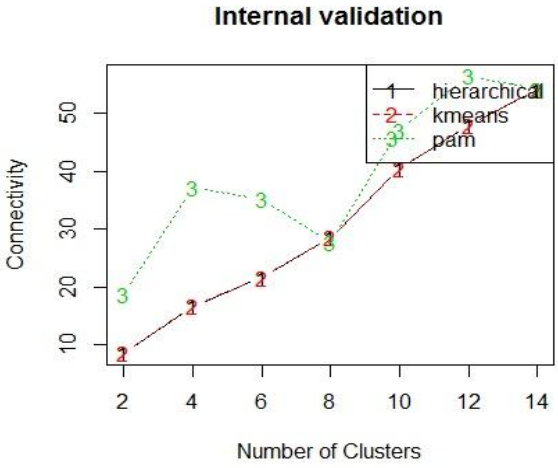


Figure 4. Graphical representation of the connectivity internal measure using SIFT Features

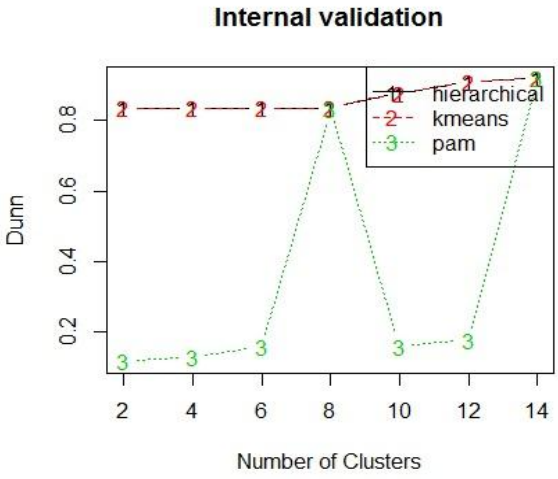


Figure 5. Graphical representation of the Dunn index internal measure using SIFT Features

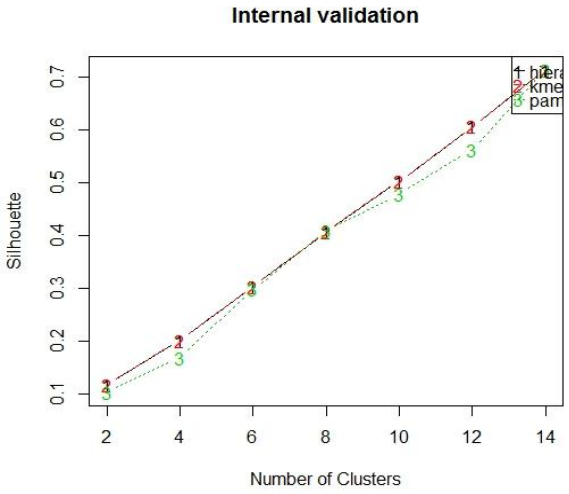


Figure 6. Graphical representation of the Silhouette Width internal measure using SIFT Features

The stability measures for K Means, PAM and agglomerative hierarchical clustering techniques using SIFT features are computed. The optimal scores of the measures such as APN, AD, ADM, and FOM are as shown in Table 3. For better clustering results the measures are minimized. From the table 3, for these measures, hierarchical clustering with fourteen clusters gives the best score. The graphical representation of the stability measures for SIFT features such as APN, AD, ADM and FOM as shown in Fig.7 to Fig. 10.

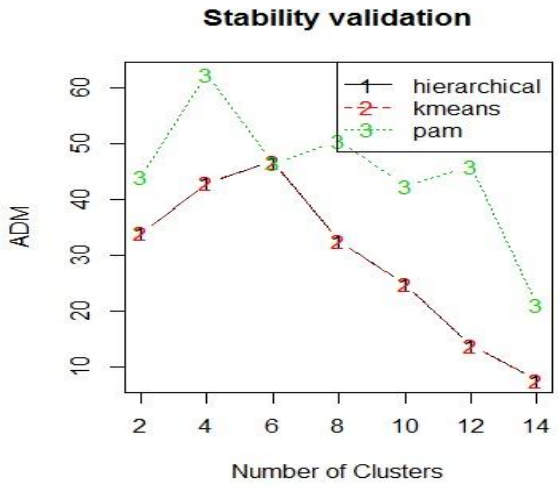


Figure 7. Graphical representation of the ADM stability measure using SIFT Features

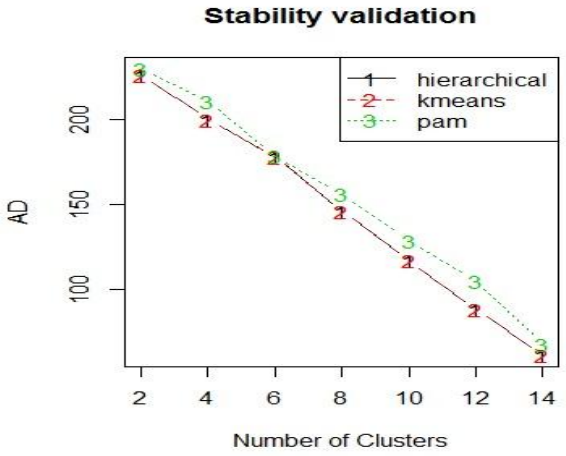


Figure 8. Graphical representation of the AD stability measure using SIFT Features

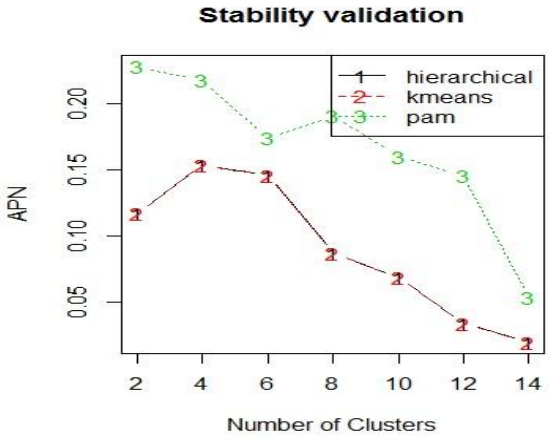


Figure 9. Graphical representation of the APN stability measure using SIFT Features

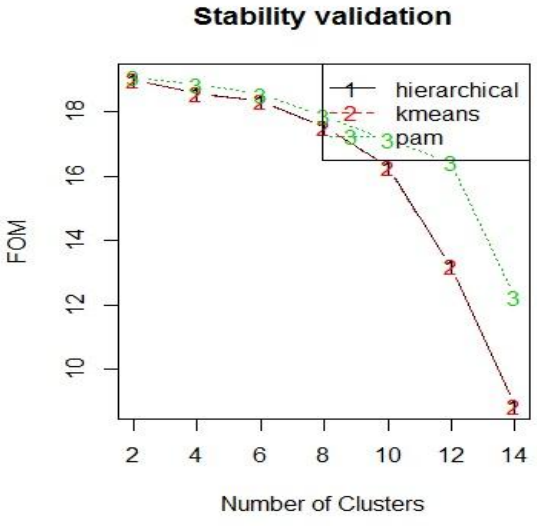


Figure 10. Graphical representation of the FOM stability measure using SIFT Features

4.2 Clustering using SURF Features

For K-means clustering technique, the number of clusters are decided by Elbow method for SURF features. The k value is found as 16 as shown in Fig 11. The SURF features grouped together using this approach is as shown in Appendix 4. The misclassification rate is more in K Means method. For PAM the optimal number of clusters is generated using Elbow method and as shown in Fig 12.

PAM is better compared to K Means approach because partition is done around the medoids which leads to low error rate. The cluster results using SURF features is as shown in Appendix 5.

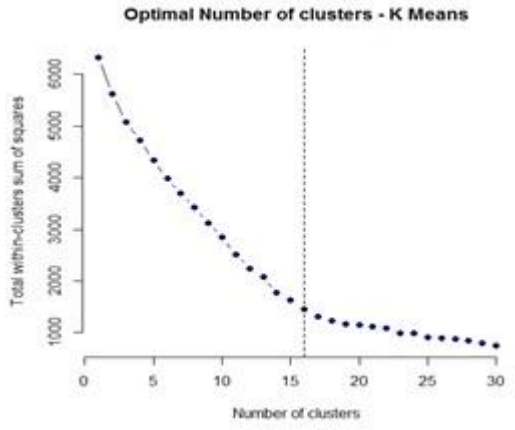


Figure 11. Optimal Number of Clusters (16) using K-Means for SURF features

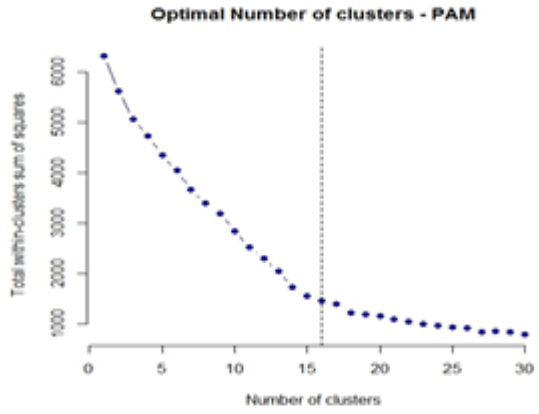


Fig. 12. Optimal Number of Clusters (16) using PAM for SURF features

The dendogram of hierarchical clustering using SURF features for sample characters partitioned automatically into 16 clusters is as shown in Appendix 6.

4.2.1 Cluster Validation Measures for SURF Features

The internal and stability cluster validation measures for SURF features is used to evaluate the results of K Means, PAM and agglomerative Hierarchical clustering methods.

The analysis is as shown in table 4 for different cluster measures. Internal clustering validation, which use the internal information of the clustering process to evaluate the efficiency of a clustering method. It can be seen that for SURF features among three clustering methods, hierarchical clustering with 2 clusters performs better for Connectivity and with 16 clusters for Dunn Index and Silhouette Width.

Clustering stability validation evaluates the consistency of a clustering result by comparing it with the clusters obtained after each column is removed, one at a time. It is analysed that for SURF features, Hierarchical clustering with 16 clusters proved to be better for APN, AD, ADM, FOM stability measures.

Table 4. Internal and Stability cluster validation measures for SIFT Features

Internal Measures			
Measures	**Value**	**Cluster Method**	**No. of Clusters**
Connectivity	8.5079	Hierarchical	2
Dunn Index	3.0797	Hierarchical	16
Silhouette Width	0.8153	Hierarchical	16
Stability Measures			
Measures	**Value**	**Cluster Method**	**No. of Clusters**
APN	0.0000	Hierarchical	16
AD	34.2118	Hierarchical	16
ADM	0.0000	Hierarchical	16
FOM	3.4201	Hierarchical	16

The corresponding graphical representation of these measures as shown in Fig.13 to 19.

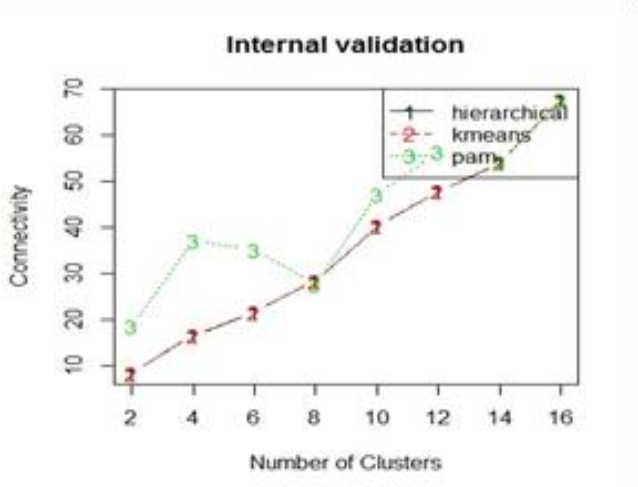


Figure 13. Connectivity internal measure for SURF Features

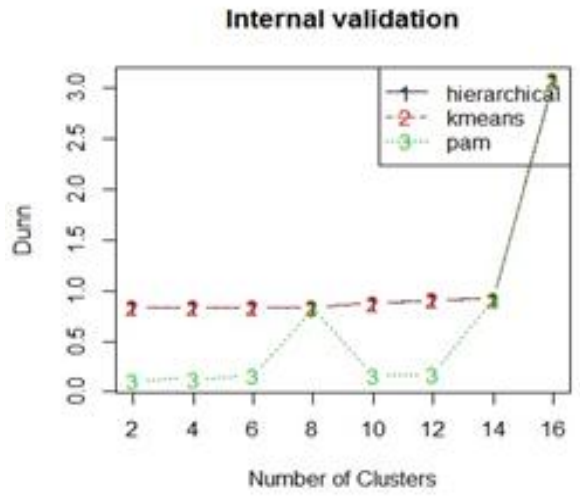


Figure 14. Dunn Index internal measure for SURF Features

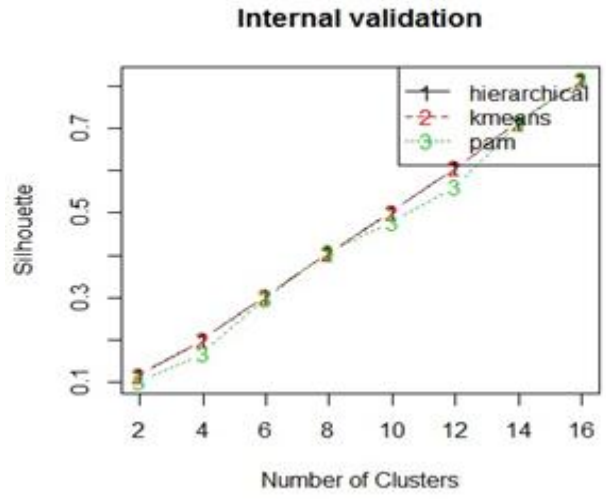


Figure 15. Silhouette Width internal measure for SURF Features

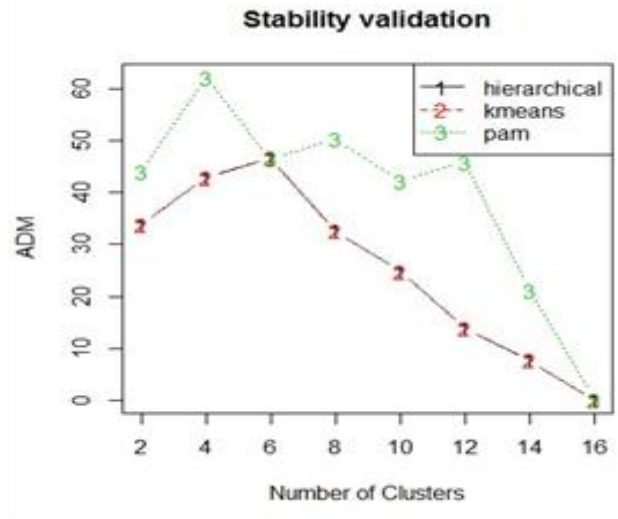


Fig. 16: ADM stability measure for SURF Features

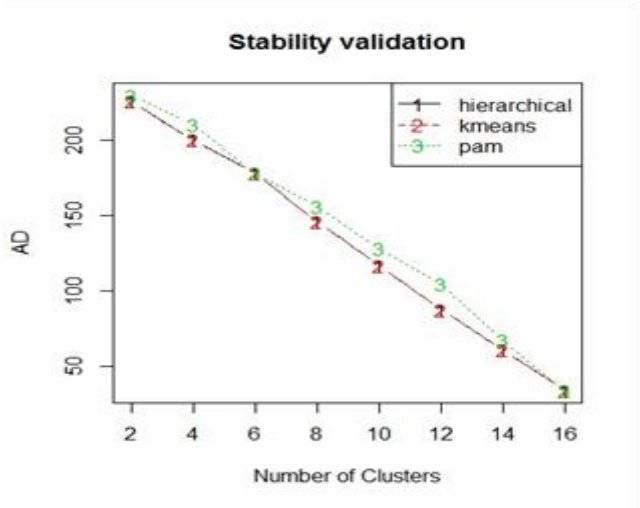


Fig. 17: AD stability measure for SURF Features

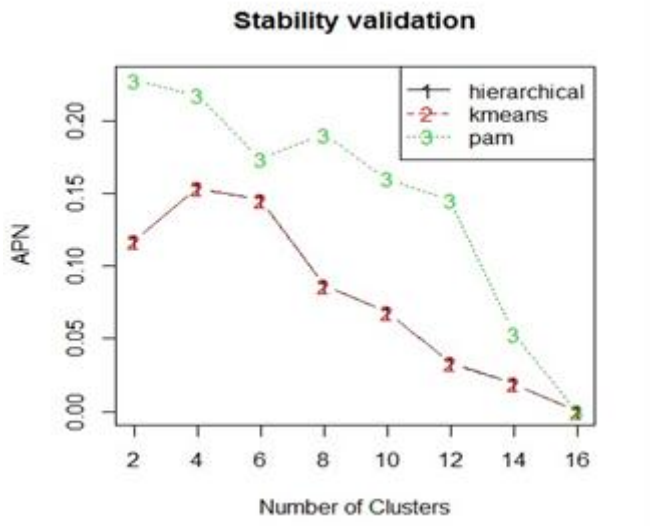


Fig. 18: APN stability measure for SURF Features

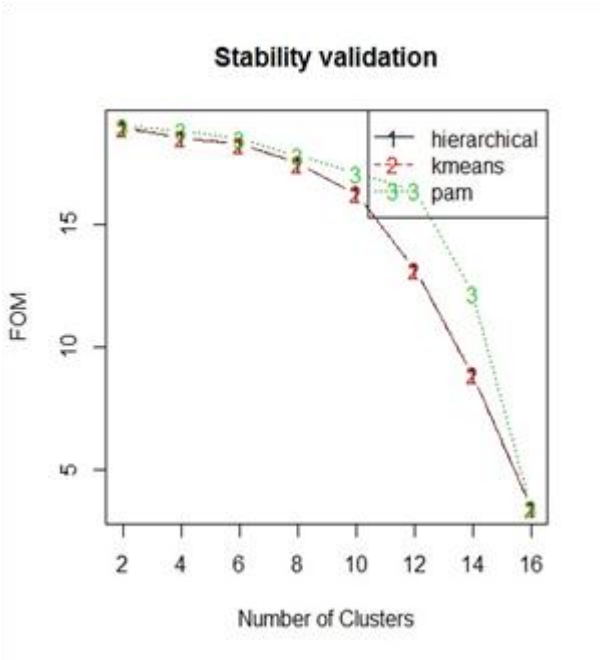


Fig. 19: FOM stability measure for SURF Features

5. CONCLUSION

The proposed Nandinagari character retrieval system based on data visualization method and is highly scalable. The SIFT and SURF methods detect the interest points and derives feature descriptors. This approach requires no or minimal pre-processing of images and still can identify images in varying states of occlusion. Our main aim is to provide efficient and robust descriptors which are then used to compute dissimilarity matrix. SIFT descriptors are more robust compared to SURF descriptors. But computation time for SURF is less compared to SIFT method. Then dissimilarity matrix of these descriptors are subjected to different clustering approaches to group similar handwritten Nandinagari characters together. Prerequisite for K-Means and PAM is to specify the number of clusters. Performance of PAM is better compared to K Means. Agglomerative clustering method is more suitable for both SIFT and SURF descriptors. Further we can explore the performance of these descriptors using wide variety of clustering techniques.

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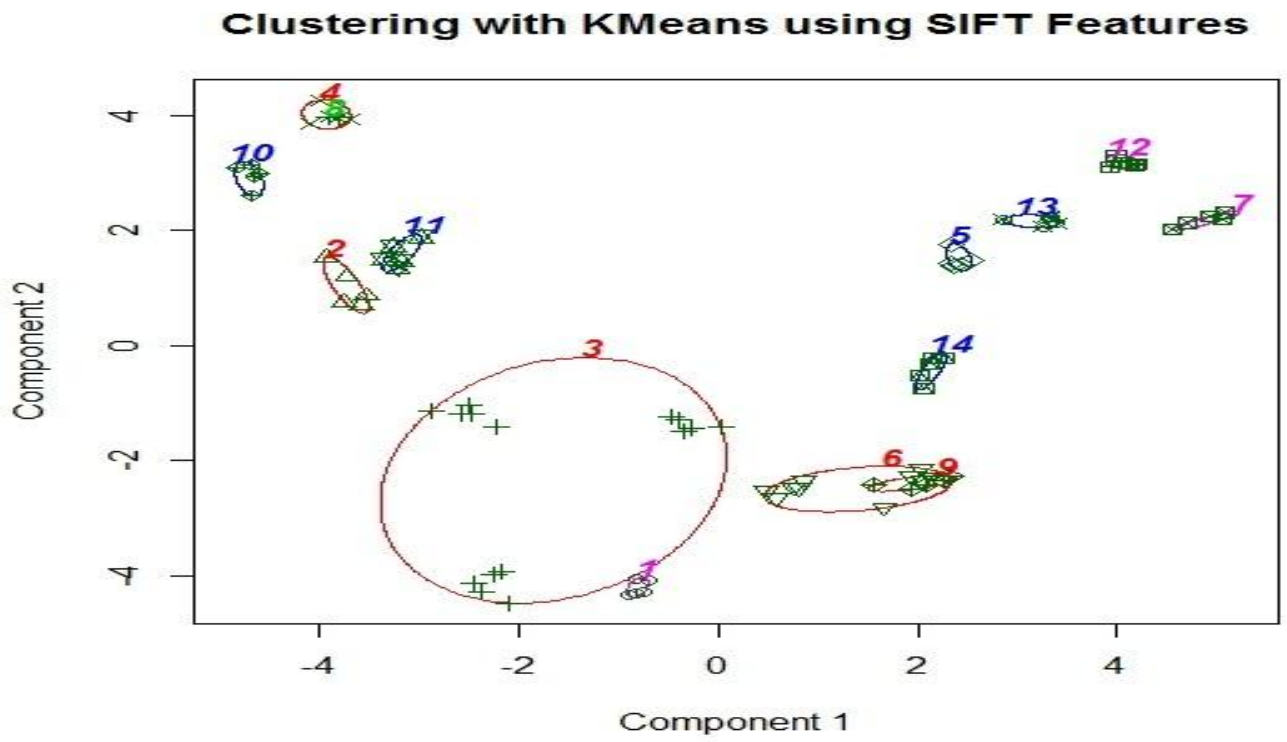
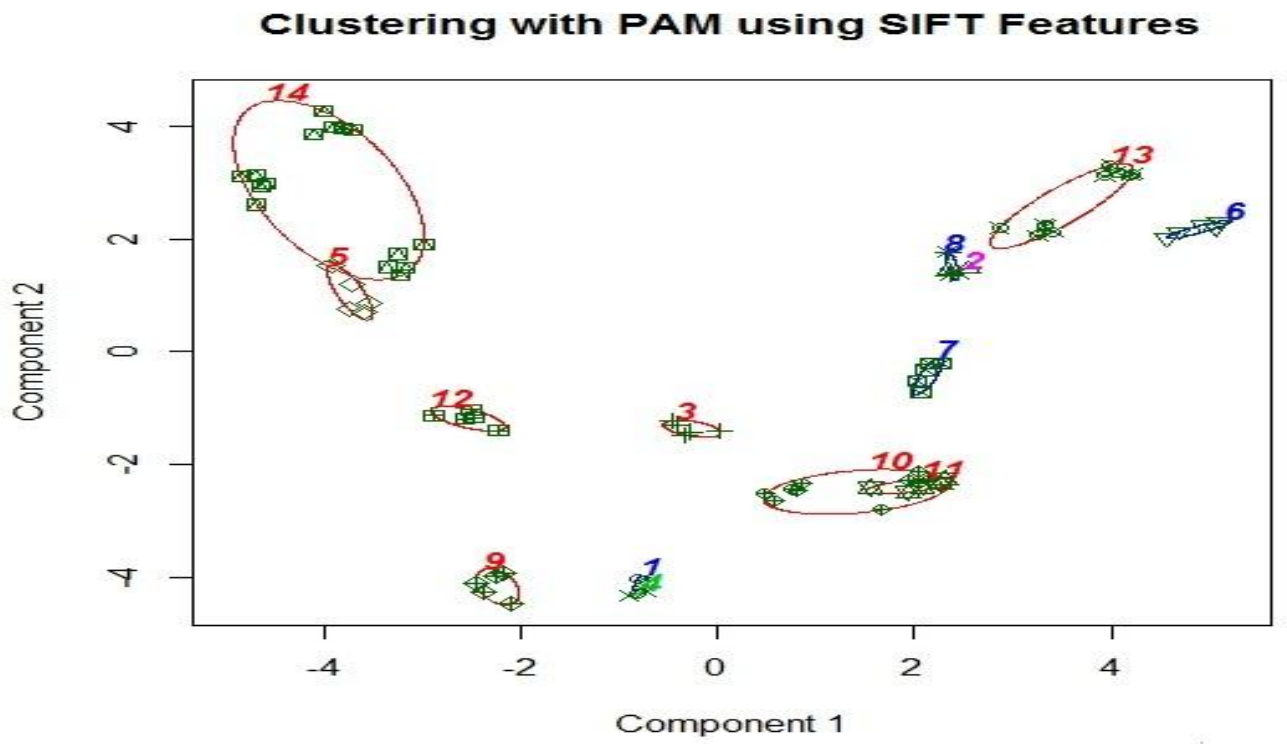
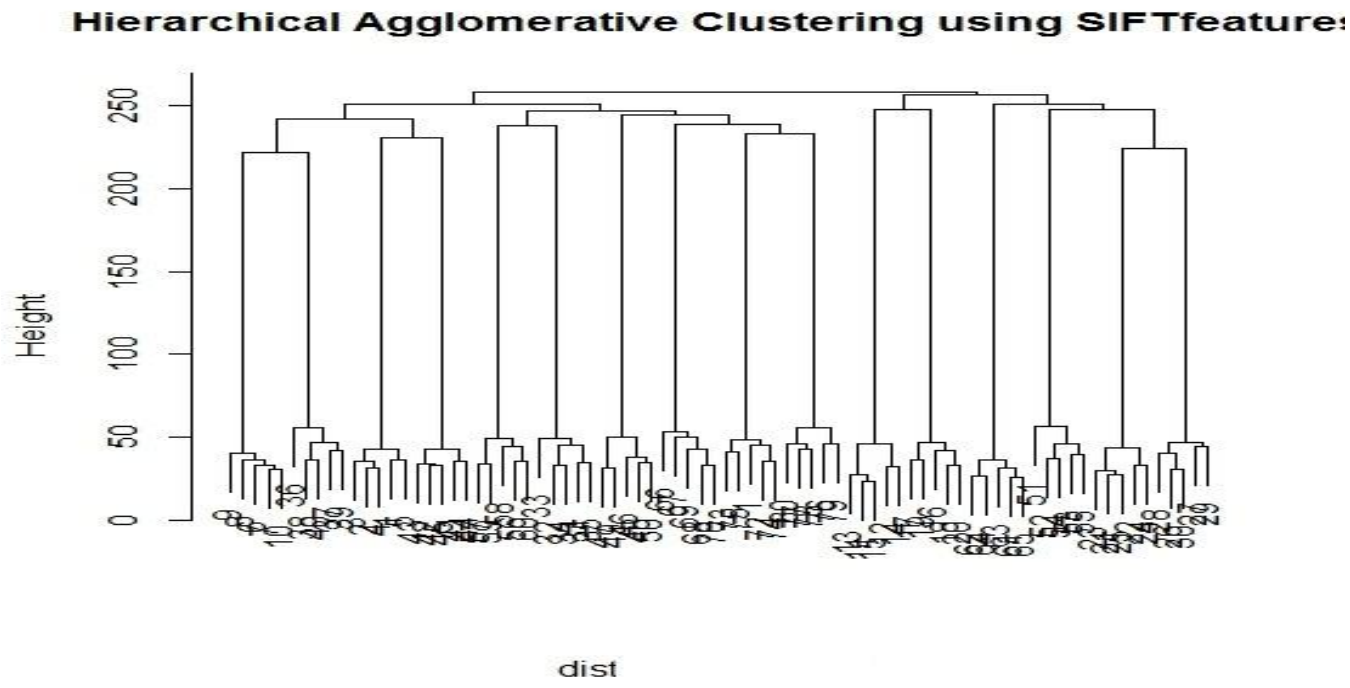


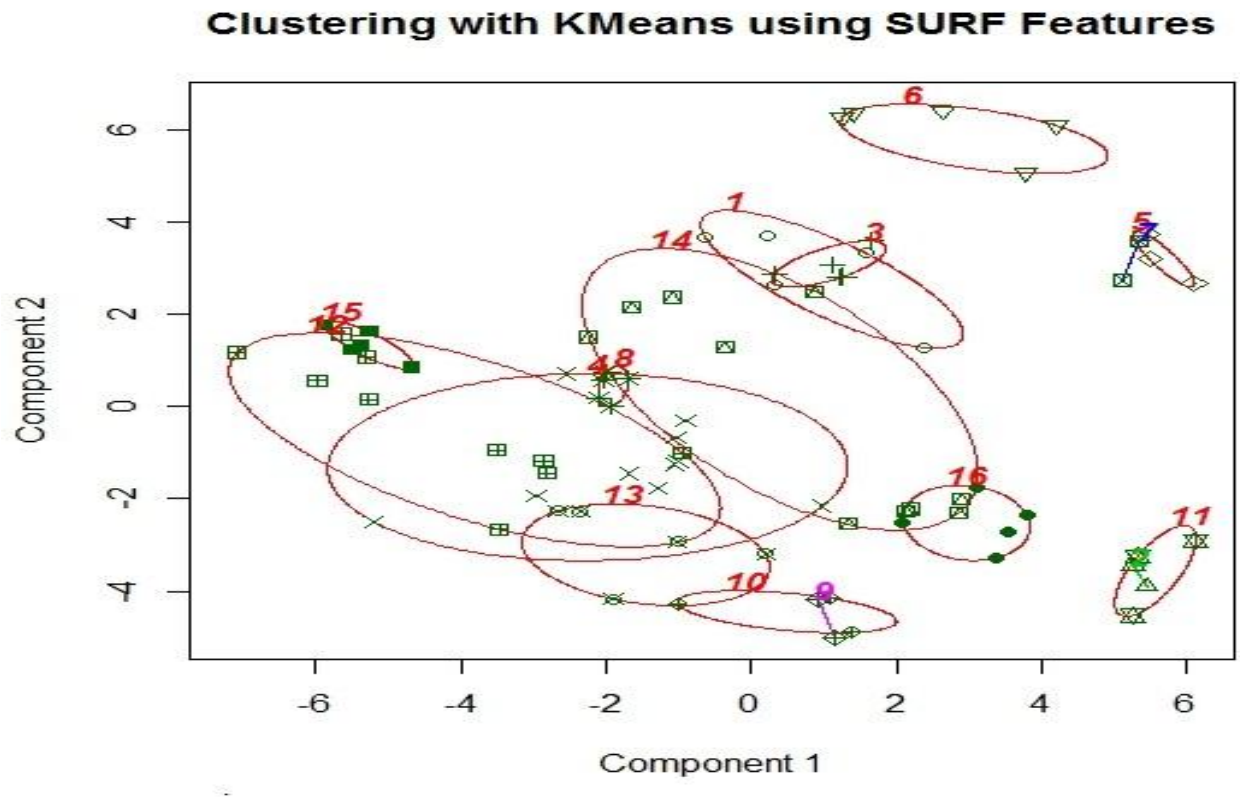
Appendix1: Clustering SIFT features with K Means method for sample characters (14 clusters)



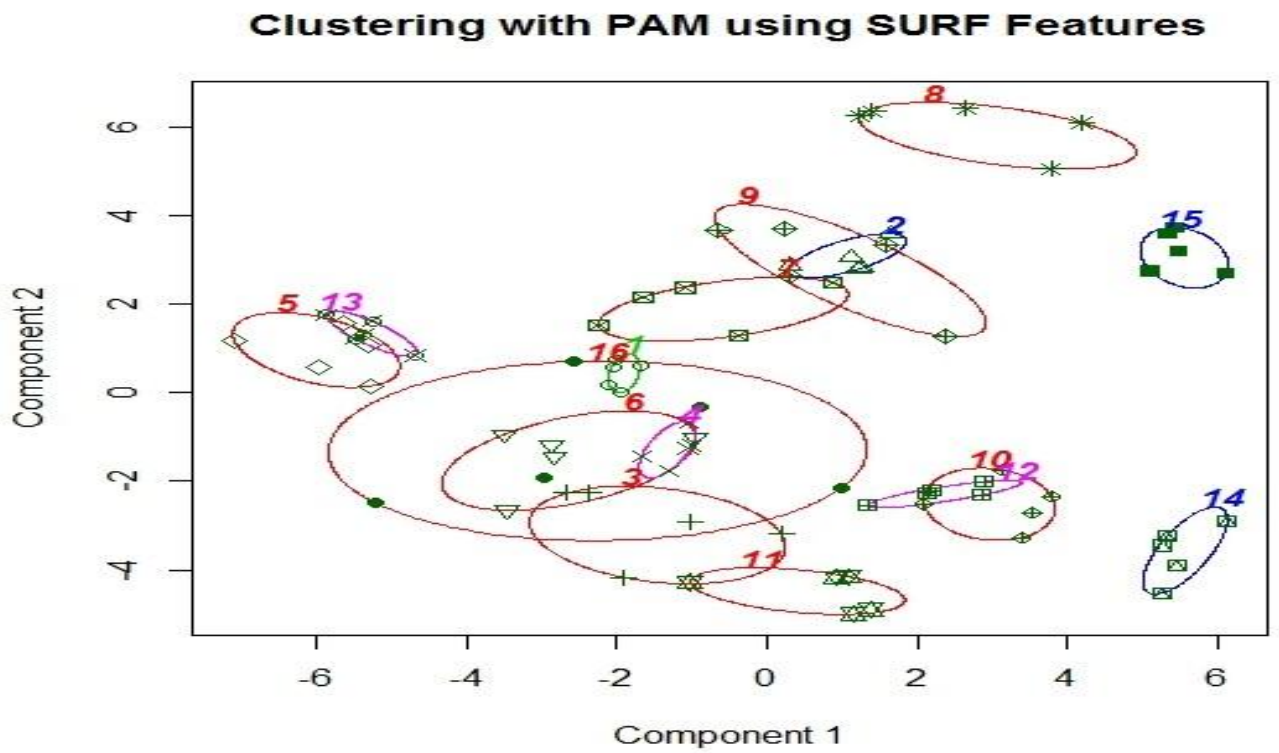
Appendix2: Clustering SIFT features with PAM (Partition around Medoids) for sample characters (14 clusters)



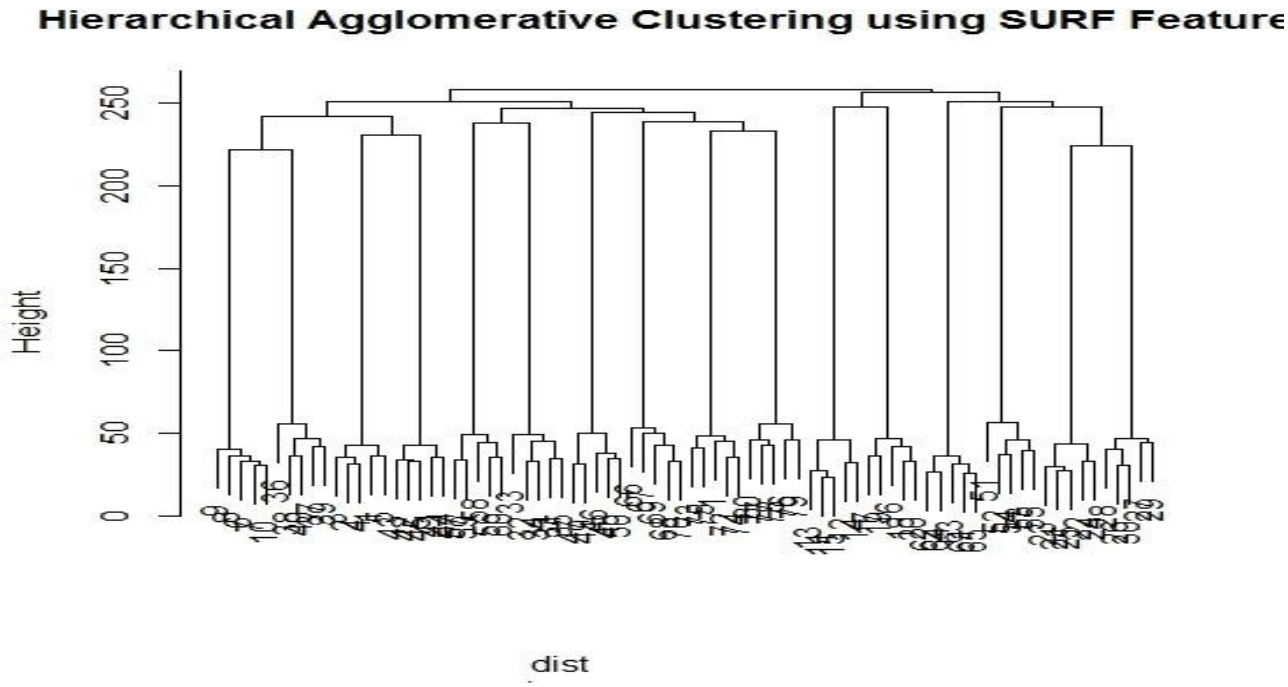
Appendix 3: Clustering SIFT features with Agglomerative Hierarchical clusters for sample characters (16 clusters)



Appendix4: Clustering SURF features with K Means method for sample characters (16 clusters)



Appendix 5: Clustering SURF features with PAM (Partition around Medoids) for sample characters (16 clusters)



Appendix 6:. Clustering SURF features with Agglomerative Hierarchical clusters for sample characters (16 clusters)

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Optimised Proactive Link State Routing For DOS Attack Prevention

Vishnu S Kumar
Department of Computer Science and Engg.
Mangalam College of Engineering
Ettumanoor, Kerala, India

Divya. S. B
Department of Computer Science and Engg.
Mangalam College of Engineering
Ettumanoor, Kerala, India

Abstract: A Mobile Ad hoc Network is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes that are in radio range of each other can directly communicate, whereas others need the aid of intermediate nodes to route their packets. Each node has a wireless interface to communicate with each other. These networks are fully distributed, and can work at any place without the help of any fixed infrastructure as access points or base stations. Routing protocols are divided into two broad classes – Reactive and Proactive. In Reactive or on demand routing protocols the routes are created only when they are needed. The application of this protocol can be seen in the Dynamic Source Routing Protocol (DSR) and the Ad-hoc On-demand Distance Vector Routing Protocol (AODV). Wherein Proactive or Table-driven routing protocols the nodes keep updating their routing tables by periodical messages. OPSR proposes a proactive mechanism in source routing.
Keywords: MANET, OPSR, DOS attack

1. INTRODUCTION

A Mobile Ad Hoc Network (MANET) is a group of mobile devices capable of communicating wirelessly with each other without using a predefined infrastructure or centralized authority [1]. Sending packets from one node to another is done through a chain of intermediate nodes. A number of routing algorithms exist for packet transmission in networks. These algorithms can be broadly classified into two main categories: reactive routing and proactive routing protocols. In the case of proactive (table-driven) protocol, for example, DSDV[2] and OLSR [3], [4], every node constantly maintains a list of all possible destinations in the network and the optimal paths routing to it. Reactive protocols, such as DSR [5] and AODV [6], find a route only on demand.

The essential requirement of MANET's is its ability to have all its nodes recognized by other node in the network, even in motion. A route between two nodes can be broken due to intermediate nodes that dynamically change their position. Mobile nodes can join or leave the network at any time.

The Optimized Link State Routing (OLSR) protocol [3], [4], has become one of the algorithms widely used today [7]. Although OLSR is quite efficient in bandwidth utilization and in path calculation, it is vulnerable to various attacks [8], [9]. As OLSR relies on the cooperation between network nodes, it is susceptible to a few malicious nodes which can cause routing havoc. These attacks include link withholding attacks [6], link spoofing attacks [6], flooding attacks [6], wormhole attacks, replay attacks, black-hole attacks, colluding mis-relay attacks, and DOS attacks.

Denial-of-service attack (DoS attack) is a cyber-attack where the perpetrator seeks to make a machine or network resource unavailable to its intended users by temporarily or indefinitely disrupting services of a host connected to the Internet. Denial of service is typically accomplished by flooding the targeted machine or resource with superfluous requests in an attempt to overload systems and prevent some or all legitimate requests from being fulfilled. Denial-of-service attacks are characterized by an explicit attempt by attackers to prevent legitimate users of a service from using that service. The nodes causing denial of service attacks are mostly selfish nodes .

There can be two types of selfish attacks –selfish node attack (saving own resources) and sleep deprivation (exhaust other's resources). Routing protocol plays a crucial role for effective communication between mobile nodes and operates on the basic assumption that nodes are fully cooperative. A selfish node does not supposed to directly attack the other nodes, but is unwilling to spend battery life, CPU cycles, or available network bandwidth to forward packets not of direct interest to it. It expects other nodes to forward packets on its behalf. To save own resources there is a strong motivation for a node to deny packet forwarding to others, while at the same time using the services of other nodes to deliver own data.

At first in Route Update, each node in the network constructed a star graph centered at that node itself. i.e., at the beginning, a node is only aware of the existence of itself. In our proposed model we create selfish node who drops the the packet to next intermediate hop to reach its destination. Normal routing protocols does not detect this threat. But here we form an adjacency matrix of each node based on the network constructed for each node after that we form a spanning tree for each node to find the number of intermediate nodes, as the selfish nodes coursing DOS attack will not be having next intermediate hops their calculated values will be zero and the non attacker nodes will be having values greater than zero based upon their intermediate next hops count. This phase is done at the routing level, so before forming the routing paths the identified selfish nodes are eliminated from routing table and form proactive routes based on this.

The reminder of this paper is organized as follows. In Section 3 the protocols such s ADOV, AOMDV, OLSR, DSR, protocols are presented. A method for protecting OLSR MANET from DOS attack is described in depth in Section 4. Section 5 and describes the simulation model and presents the

results achieved along with a discussion of the results. Finally, conclusions and future works are presented in Section**.**

2. BACKGROUND

Network Simulator (Version 2), widely known as NS2, is simply an event-driven simulation tool that has proved useful in studying the dynamic nature of communication networks. Simulation of wired as well as wireless network functions and protocols can be done using NS2. In general, NS2 provides users with a way of specifying network protocols and simulating their corresponding behaviors.

Due to its flexibility and modular nature, NS2 has gained constant popularity in the networking research community. NS2 consists of two key languages: C++ and Object-oriented Tool Command Language (OTcl). While the C++ defines the internal mechanism of the simulation objects, the OTcl sets up simulation by assembling and configuring the objects as well as scheduling discrete events.

3. ROUTING PROTOCOLS IN NS2

3.1 Destination-Sequenced Distance-Vector

The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements[2]. Every mobile station maintains a routing table that lists all available destinations, the number of hops to reach the destination and the sequence number assigned by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. The stations periodically transmit their routing tables to their immediate neighbors. A station also transmits its routing table if a significant change has occurred in its table from the last update sent. So, the update is both time-driven and event-driven.

3.2 Ad Hoc On-Demand Distance Vector Routing

AODV discovers routes on an as needed basis via a similar route discovery process[5]. However, AODV adopts a very different mechanism to maintain routing information. It uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple

route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers. An important feature of AODV is the maintenance of timer-based states in each node, regarding utilization of individual routing table entries. A routing table entry is expired if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets.

3.3 Dynamic Source Routing (DSR)

The key distinguishing feature of DSR is the use of source routing. That is, the sender knows the complete hop-by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the network.

3.4 AOMDV Protocol

AOMDV stands for Ad-hoc On-demand Multipath Distance Vector Routing protocol. AOMDV is a multipath extension to the AODV protocol[10]. In AOMDV protocols multiple routes are founded between the source and destination.It uses alternate routes on a route failure. In AOMDV protocols new route discovery is needed when all the routes fail. In AOMDV protocols multipath routing is the enhancement of unipath routing in which advantage is to handle the load in network and avoid the possibility of congestion and increases reliability.

3.5 OLSR PROTOCOL

OLSR is a proactive routing protocol, that is, it is based on periodic exchange of topology information. The key concept of OLSR is the use of multipoint relay (MPR) to provide an efficient flooding mechanism by reducing the number of transmissions required. In OLSR, each node selects its own MPR from its neighbors. Each MPR node maintains the list of nodes that were selected as an MPR; this list is called an MPR selector list. Only nodes selected as MPR nodes are responsible for advertising, as well as forwarding an MPR selector list advertised by other MPRs.

4. OPTIMISED PROACTIVE LINK STATE ROUTING

OPSR proposes a proactive mechanism in source routing. Our proposed method, provides every node with a Breadth First Spanning Tree (BFST) of the entire network rooted at itself. To do that, nodes periodically broadcast the tree structure to its best knowledge in each iteration. Based on the information collected from neighbors during the most recent iteration, a node can expand and refresh its knowledge about the network topology by constructing a deeper and more recent BFST. This knowledge will be distributed to its neighbors in the next round of operation. On the other hand, when a neighbor is deemed lost, a procedure is triggered to remove its relevant information from the topology repository maintained by the detecting node.

With the adjacency matrix calculation and spanning tree we find out the nodes with zero adjacency that is nodes with no forwarding node or intermediate hopes. Attacker nodes will be off no intermediate nodes as they drop the received packets or increases the path length by wasting the bandwidth. After identifying these nodes it will not be considered for routing in our proposed method thus by ensuring a much better safer and less overhead communication.

5. SIMULATION PLATFORM CREATION

For the simulation of nodes in mobile adhoc network (MANET), we have created the platform on Ubuntu. The MANET network simulations are implemented using NS-2 simulator. For this purpose, in NS2 we need to create a topology for the project with which can be used for proactive source routing. The coding will be done using TCL (Tool Command Language). But none of current NS2 versions does not have any proactive source routing mechanism. Source routing included in NS2 is DSR.

For analysis of existing source routing we need to integrate OLSR routing protocol in NS2 which is not part of standard NS2. And it is available as patch file externally. But to integrate this OLSR into NS2 will include some work as it will now compile with the current NS versions. This is done to generate olsr object file with the GCC compiler. NS2 version here we used is NS ALL in one 2.35.

The topology creation will be done using TCL coding. But to edit AODV or DSR or to create a new protocol we cannot code with TCL. Protocol codes are core coded files which is done using C++. So in coding, first thing needs to do the topology and node creations using TCL which uses existing protocol coding within NS all in one version 2.35.

For analyzing the delay, throughput and overhead caused in the existing method we need to capture the packet drop and through put, for this we generate the trace output files of out TCL execution. From this trace output we calculate the drop and throughput using Perl and AWK scripts.

For next purpose we need to find the core code files(written in C++) related to our project in NS. We need to create a new proactive source routing cpp code along with its associate routing and header files, as there is no other proactive source routing code to modify in current NS versions we need create it a whole new one for this. Gcc Complier will be called to compile the new coding and and then will be futher bind with the TCL . This will enable TCL to call the newly created protocol code into topology. And further we can compare delay, throughput and overhead caused of the new PSR with the exixting Protocols including the newly added OLSR.

6. PERFORMANCE EVALUATION AND RESULTS

Here we present the measurement of various parameters by implementing the simulation environment. Throughput is defined as the ratio of the data delivered to the destination of the data sent out by the sources[7]. Average end-to-end delay is the avg. time a packet takes to reach its destination.

End-to-End Delay (EED): It is the time taken for an entire message to completely arrive at the destination from the source. Evaluation of end-to-end delay mostly depends on the following components i.e. propagation time (PT), transmission time (TT), queuing time (QT) and processing delay (PD). Therefore, EED is evaluated as:

EED = PT + TT + QT + PD.

Throughput: It is the measure of how fast a node can actually sent the data through a network. So throughput is the average rate of successful message delivery over a communication channel.

Packet Sent and Received: It is the total number of packets sent and received during the complete simulation timeframe.

Packet Delivery Ratio (PDR): It is the ratio of the total data bits received to total data bits sent from source to destination.

Control Overhead: It is ratio of the control information sent to the actual data received at each node.

6.1 RESULTS AND ANALYSIS

During the implementation of this project, an attempt was made to compare the performances of various protocols such as AODV, AOMDV, OLSR and PSR under the same simulation environment.

For all the simulations, the same movement models were used, the packet size is fixed to 512 bytes. For the experimental significance, here we only discuss the experimental results of simulation of 6 nodes only. The simulations environment is the same for other nodes of 10,15,20 number of nodes. The diversity of the experiments is more as we increase the number of nodes in a simulation environment.

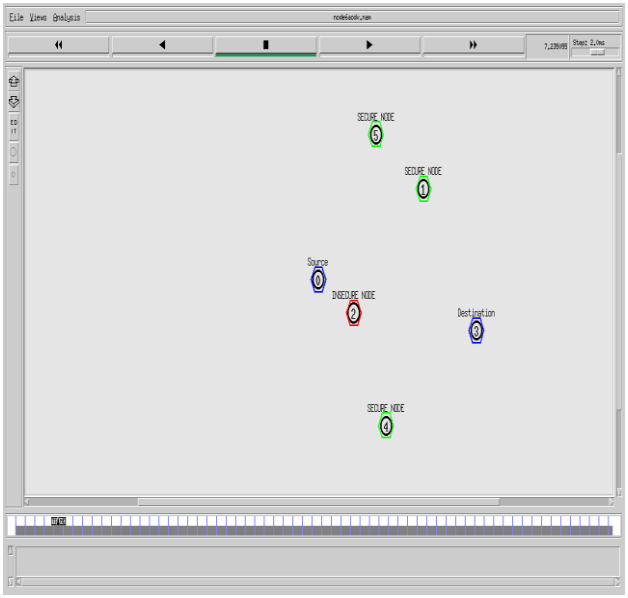

Figure 1: Simulation with 5 nodes

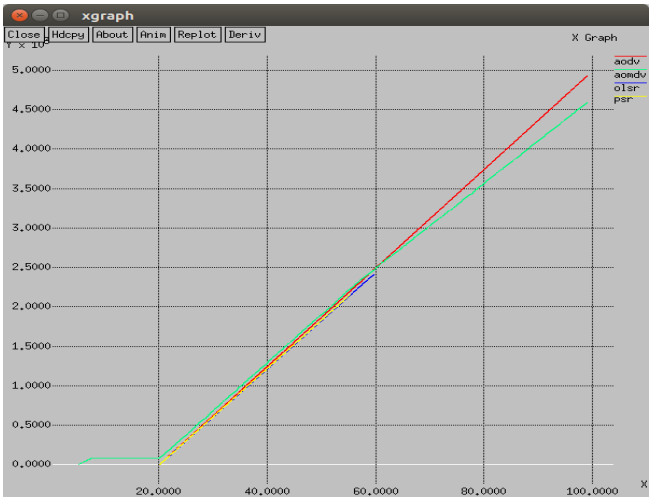

Figure 2: Number of dropped packets

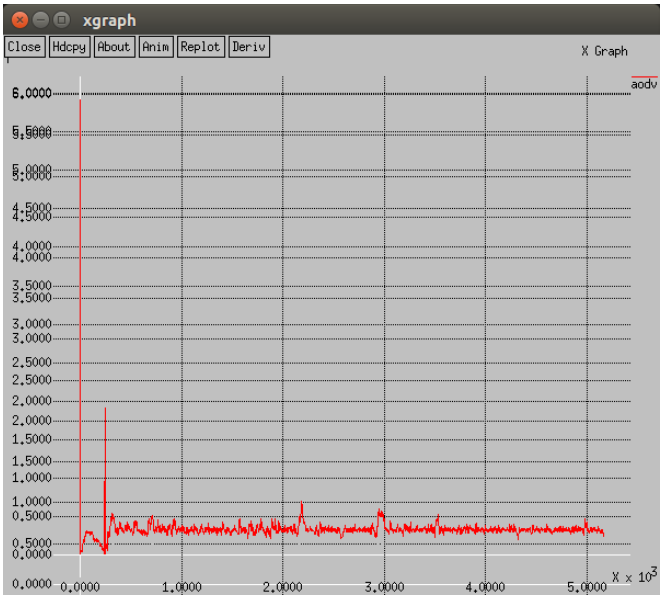

Figure 3: End-to-End Delay in AODV

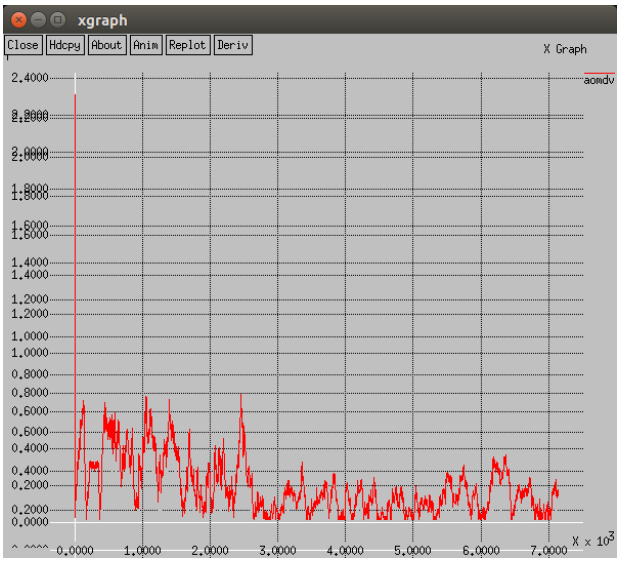

Figure 4: End-to-End Delay in AOMDV

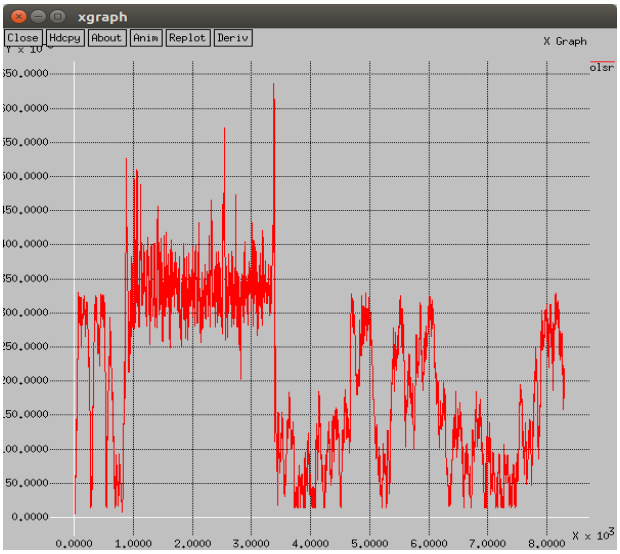

Figure 5: End-to-End Delay in OLSR

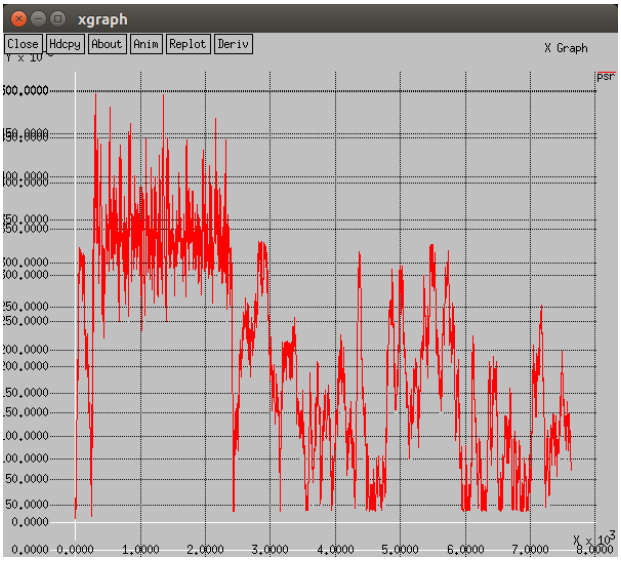

Figure 6: End-to-End Delay in OPSR

7. CONCLUSION

In this project, we evaluated the five performance measurements of various routing protocols such as AODV, AOMDV, OLSR and PSR. Routing protocols were simulated with 6,10, and 15 nodes moving randomly. In this project proposed a new routing protocol called OPSR, a secure extension for source routing protocol in Mobile Ad hoc Networks. Reviewed different routing protocols: Reactive and Proactive. Reactive protocols are on demand protocols. These Protocols do not initiate route discovery by themselves, until or unless a source node request to find a route. The major drawback of this protocol is that its initial delay in path establishment is high.

Proactive protocols are table driven which maintain up-to-date information of routes from each node to every other node in the network. These protocols continuously learn the topology of the network by exchanging topological information among the network nodes. Thus, when there is a need for a route to a destination, such route information is available immediately. Drawback of this protocol is that overhead because every node keep all possible path to every other node in the network. OPSR is introduced to overcome the drawback of reactive and proactive protocols. OPSR design includes three phases: Route Update, Neighbourhood Trimming, and node Update. In the simulation part compared the performance of OPSR with existing protocols such as AODV, DSDV, DSR and OLSR and results are analysed. Proposed model of OPSR reduces overhead and initial delay in route finding and to detect and prevent blackhole attacks in MANETs.

In Future works and development we can add cross layer security to futher improve the security under an attack. And further more parameters like range , bandwidth , assigning trustworthy values by neighboring(which has routing overhead delays and pother drawbacks) in improved ways to enhance our proposed method OPSR .

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Black Box for Accident Analysis Using MATLAB-Image Processing

Roshan Koshy
Department of Computer Science and Engg.
Mangalam College of Engineering
Ettumanoor, Kerala, India

Vineetha V Nair
Department of Computer Science and Engg.
Mangalam College of Engineering
Ettumanoor, Kerala, India

Abstract: The main purpose of this paper is to develop a prototype device that can be installed in automobile for accident analysis .in this paper I proposed a method to analysis the face of driver that weather he was felling doziness while driving. This is done by taking the image from the raspberry pi device and put it in an image processing method using MATLAB. Also, I used the method to store the data into the cloud as well as device which can be further used for analysis the cause of accident.

Keywords: *raspberry pi, MATLAB, Controller*

1. INTRODUCTION

According to [1]WHO report says that there are millions of people die every year because of vehicle accident. In order to solve the causes of accident this black box plays a crucial role to know the purpose of accident and this black box records data and images which is later used for forensics in case of car accident it stores clips that is used for investigating automobile related accidents. This system approaches in three ways first is that how to detect and record the data in vehicle. [1][2][4]Second is how to store the data recorded in the black box. Third is how to analyses the images stored in black box using MATLAB. As implementing first method some important electronic components and different types of sensors were used and second method we used cloud to store the data so that we can later fetch the data from cloud even if the device completely damaged and the third method we take the image from black box manually and load into the MATLAB program and analyses the image weather the driver was active or inactive during driving So, the proposed system show the consciousness of the driver in nonreal-time processing using MATLAB simulation of the image fetched from the black box device.

2. OVERVIEW OF THE SYSTEM

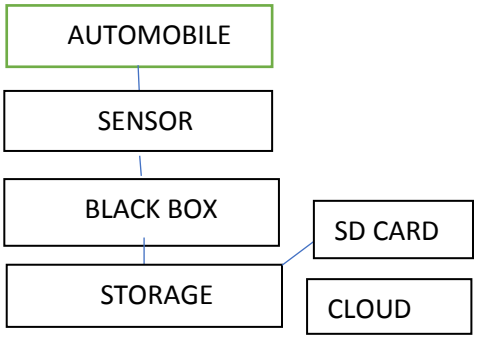

Figure 1 system flow chart

3. OVERVIEW OF THE PROPOSED SYSTEM

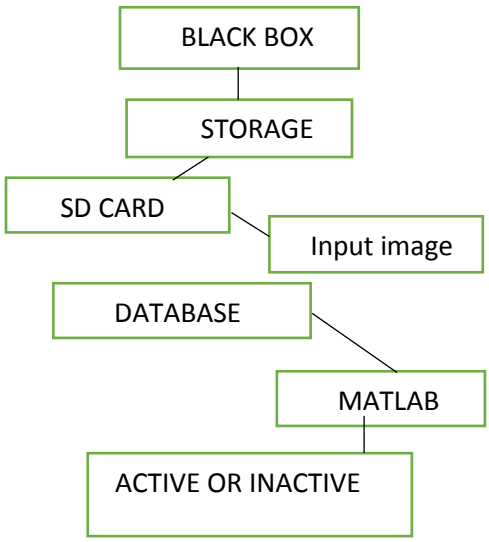

Figure 2 Proposed system flow chart

Sensors: -

Ultrasonic: - An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Since it is known that sound travels through air at about 344 m/s (1129 ft/s), you can take the time for the sound wave to return and multiply it by 344 meters (or 1129 feet) to find the total round-trip distance of the sound wave. Round-trip means that the sound wave traveled 2 times the distance to the object

before it was detected by the sensor; it includes the 'trip' from the sonar sensor to the object AND the 'trip' from the object to the Ultrasonic sensor.

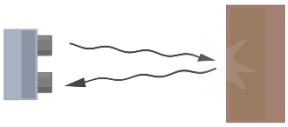

Figure 3 Ultrasonic waves

Fire sensor: -
fire sensor circuit exploits the temperature sensing property of an ordinary signal diode IN 34 to detect heat from fire. At the moment, it senses heat, a loud alarm simulating that of Fire brigade will be produced. The circuit is too sensitive and can detect a rise in temperature of 10 degree or more in its vicinity. Ordinary signal diodes like IN 34 and OA 71 exhibits this property and the internal resistance of these devices will decrease when temperature rises.

IR Sensor: -
IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.

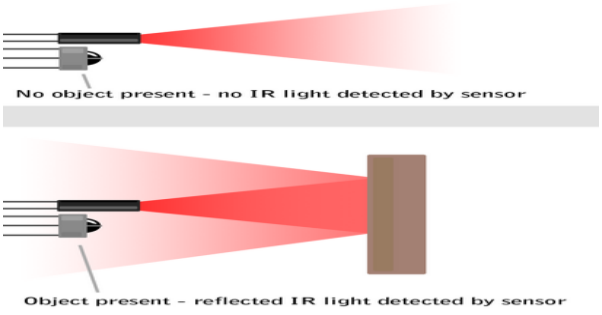

Figure 4 Detecting object through infrared

Detecting Brightness

Since the sensor works by looking for reflected light, it is possible to have a sensor that can return the value of the reflected light. This type of sensor can then be used to measure how "bright" the object is. This is useful for tasks like line tracking.

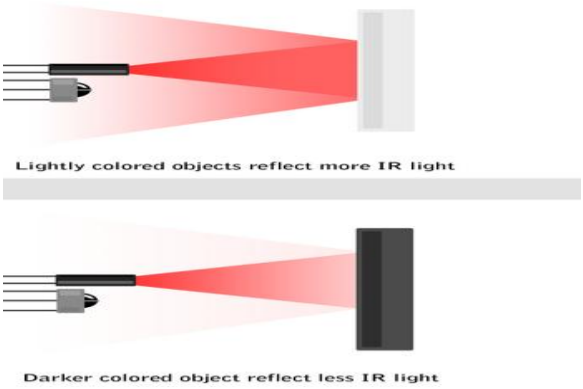

Figure 5 Different object identified by IR Sensor

Alcohol Gas Sensor: -
Gas Sensor(MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

LDR Sensor: -
A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a **LDR**.

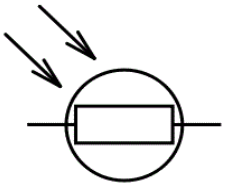

Figure 6 LDR

IMAGE PROCESSING USING MATLAB: -
Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development. You can perform image segmentation, image enhancement, noise reduction, geometric transformations, image registration, and 3D image processing.

Image Processing Toolbox apps let you automate common image processing workflows. You can interactively segment image data, compare image registration techniques, and batch-process large data sets. Visualization functions and apps let you explore images, 3D volumes, and videos; adjust contrast; create histograms; and manipulate regions of interest (ROIs).

In this prototype image is being fetched from the black box manually, then it is being analyzed in the MATLAB using fuzzy logic method. From this process, we get a result weather the driver was drowsy or not while driving the car.

4. METHODOLOGY ADOPTED

[5]A Raspberry pi is a credit card-sized computer originally designed for education, inspired by the 1981 BBC Micro. It is a low-cost device that would improve programming skills and hardware understanding at the pre-university level. But thanks to its small size and accessible price, it was quickly adopted university level. But thanks to its small size and accessible price, it was quickly adopted by tinkerers, makers, and electronics enthusiasts for projects that require more than a basic microcontroller. The Raspberry Pi is slower than a modern laptop or desktop but is still a complete Linux computer and can provide all the expected abilities that implies, at a low-power consumption level.

Python language is used for programming the Raspberry Pi. Threading is being used in python programming to run image and Data Recording.

5. EXPERIMENTAL RESULTS

The different sensors interface to the system is shown in Figure

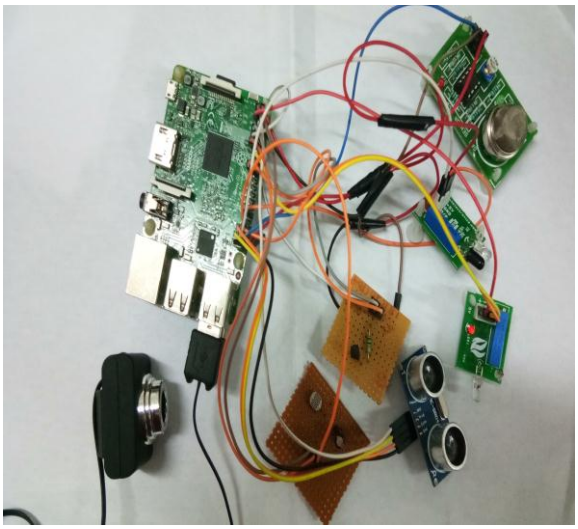

Figure7Model of Different Sensors attached to raspberry pi.

Image processing is shown in figure 8

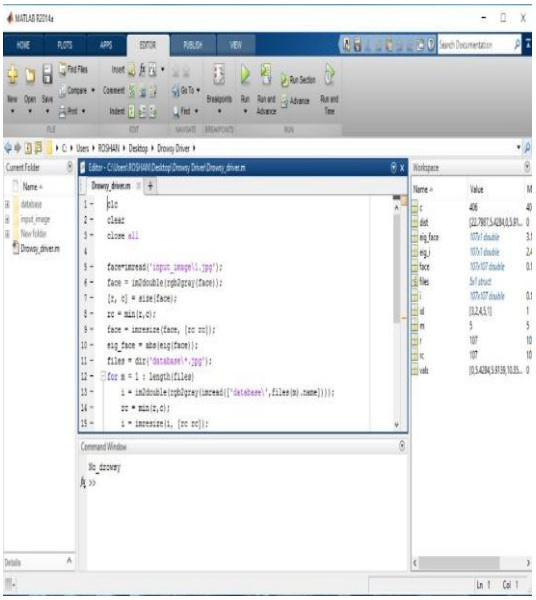

Figure8 Fuzzy Algorithm used to detect Drowsy

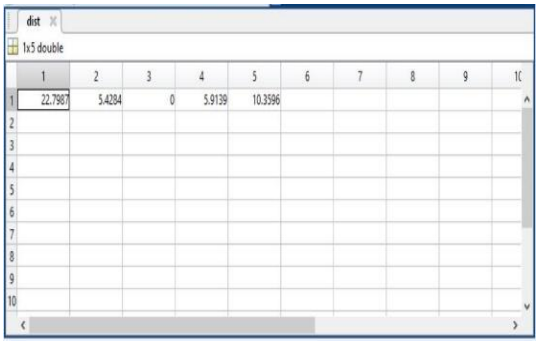

Figure 9 Distinct Value of no drowsy in MATLAB

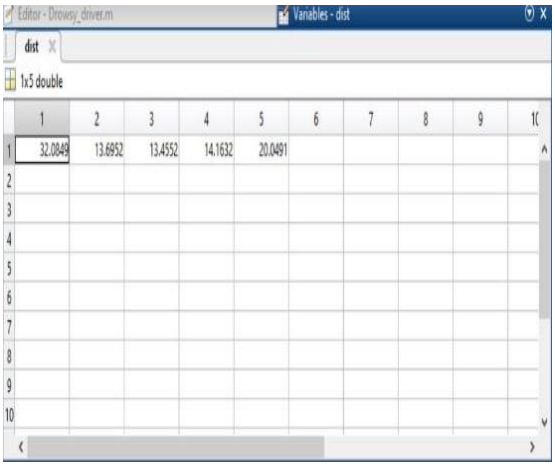

Figure 10 Distinct value of drowsy in MATLAB

The values from Raspberry Pi are transferred over to the cloud over Wi-Fi. The Raspberry Pi output is shown in Figure11

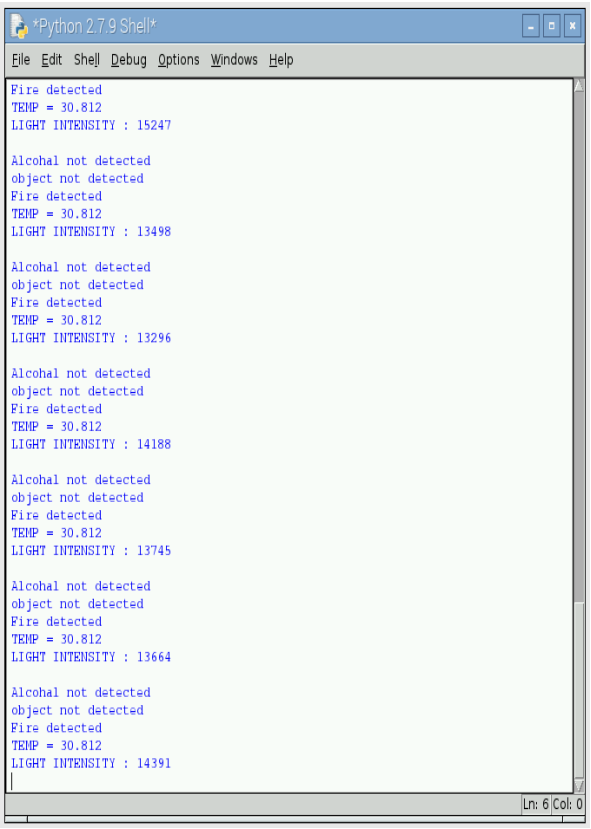

Figure 11 Values of different sensors

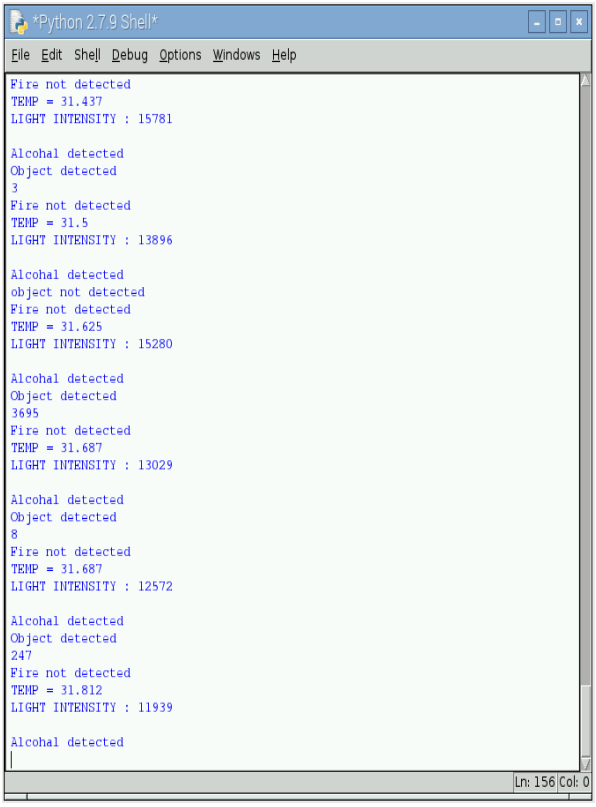

Figure 12 Values of different sensors

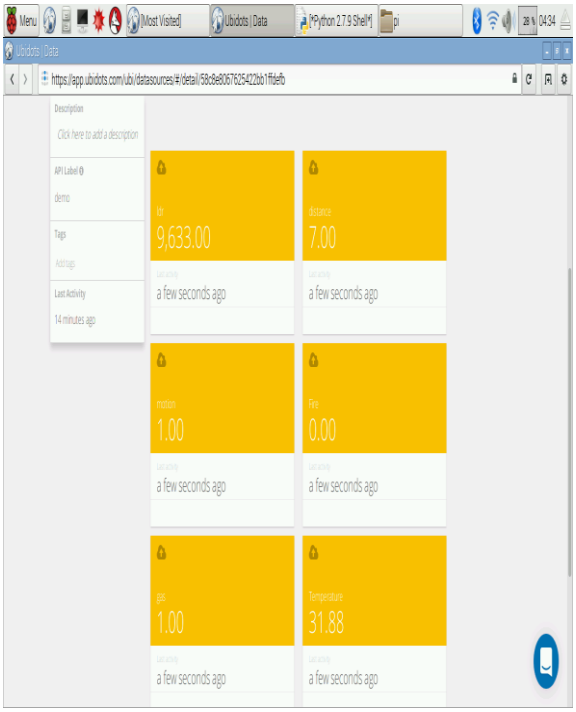

Figure 13 Values being stored over the cloud

6. CONCLUSION

This paper has presented a vision for the vehicles, which is the Black Box system used for automobiles. A description was made for every part of this system. This paper has also offered a user-friendly MATLAB program to analyze the image of the accident. The Black Box system built can be implemented in any vehicle. As soon as the driver runs the motor, this system will start recording the events of the vehicle. The data saved can be, retrieved before and after the accident for analyses purposes. Data can also be retrieved in the form of .txt format from the board in case of data uploading failure over cloud.

7. FUTURE SCOPE

System can further improve by connectivity of connection between black box over to the cloud even when vehicle is not on mechanically and electrically. Also, to improve the accuracy of driver drowsiness while analyzing the image. The system can be made more rigid device in case of crash.

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Church Choir Online Communication and Music Recording and Streaming System

Egbono F.
Department of Computer Science
University of Port Harcourt
Port Harcourt, Nigeria

Ndigwe C. F.
Department of Computer Science
Chukwuemeka Odumegwu Ojukwu University
Uli, Nigeria

Abstract: Communication among choristers has left some choristers in the dark because of the present method used which has led to poor performance in ministration. In the light of this situation, a user friendly system with data storage abilities to facilitate an integrated and centralized system in the storage, management and presentation of data, recording and streaming music as well as in sending notification in the form of text messages and email messages is proposed in this paper. The methodology adopted in this work is Object Oriented Analysis and Design methodology (OOADM). The system was implemented using Microsoft C# programming language which runs on Microsoft Visual Studio 2012 IDE and Microsoft SQL Management Server Studio 2012. This result show that the system handles the messaging and recording of the church choir music well as a solution for the communication problem.

Keywords: Music streaming; Choir Online communication; messaging system

1. INTRODUCTION

Technology have been growing continuously in many aspects of human life, one of them is in the religious practice. For the last few years, the adoption of information technology for communication in church is also growing. More and more people all around the world are turning to the internet and social media to find personal, social, and also religious information. Many churches are also having church websites and media departments that manage the activities going on in the internet. The Ecclesiastical institution is devoting more and more resources to improve their presence on the web (Bolu, 2012)

There are several studies how information and technology influence the church nowadays. Gunton (2011) in his research presented the important of information by developing an understanding how the church uses information in learning and the result showed that the exploration may help church organization, church leaders and lay people to consider how information can be used to grow faith, develop relationship, manage the church and respond the religious knowledge

More research came from (Bolu, 2012); he discussed the adoption of information and communication technology in church communication for growth in Nigeria. He analyze the perception of church leaders on internet usage for church growth, communication, as well as the deployment of church ICT infrastructure for church administration and human capital management. The result showed that most churches have email address and website but there is little communication between members and church leaders. In addition, not many churches upload bible studies, music, and other information on their website for people to download. Finally although while most churches do not have ICT personnel and infrastructure well, they totally agree that they need to have one.

On the other hand, Seller said that information technology is very important for church. In his Journal entitled Technology and Ministry, Seller said that "Technology is a major issue for every church, because it is a major issue in society" (Seller, 2007). Seller also describe that website technology is meant to function as a form of community for congregation, it have a way for people to interact online, to connect with the church and with others in the congregation, and to stay connected when they are away, and also update users on what's happening within the church.

Grinter, (2011) presented the results of their research in four sections focused on different aspects of ministry served by ICTs: Corporate work; Sunday Worship Service; Coordinating the Church Community; and Outreach to People outside the Congregation. Further, Grinter also describe that technologies play an important role in the management of the church to support financial data, payroll for any employees, service for community and so forth. Further study come from (ZECH, 2013) in his research, he tried to find out the effective design of church website. Technology is a mainstay in most people lives especially for religious purpose, using website the church can provide information and keep members engaged with the church community.

2. ELECTRONIC COMMUNICATION SYSTEM

An electronic communication system for use in church and other collaborative environments would ideally include a suite of capabilities that facilitate decision making and communication by two or more individuals. Such capabilities could include:

1. enabling users to view the history of multiple conversations with multiple parties (referred to hereinafter as "conversation history");
2. enabling users to view messages as soon as they are available without requiring the users to log onto a public bulletin board system (BBS) (referred to hereinafter as "instant access");
3. enabling users to view the content of messages without requiring that the messages first be selected (referred to hereinafter as "open display");
4. enabling users to conduct their conversations in privacy so that each user is the only person who can view the history and content of their respective multiple conversations (referred to hereinafter as "private conversations");
5. enabling users to undeniably agree to proposals made in the course of a conversation in such a way that the conversation is concluded (referred to hereinafter as "agreement"); and
6. Enabling users to participate in moderated conferences or informal chats, as well as in conversations (referred to hereinafter as "integrated modes").

2.1 Church and Web Communication

In 2007 the center for congregations offered grants to provide churches with computers, and their financial officer, and they noted that emerging web based systems would allow congregations to think in new ways about how they connect with and use information about people (Armstrong 2007). According to Capterra in its article on buyers guide for Church Management Software it is said that most Church Management Software has the ability to; keep track of contributions, memberships, and attendance. Manage schedules for events, classes, and worship services. Handle accounting needs, fund management, and ability to track income and expenses. Manage donations and online giving and offering collection. It can also be used in managing groups, ministries, and volunteers in church activities.

In its blog report on "top 7 free open source church management software solutions by Leah Readings", it can be said that most church management software were solely built with the aim of developing a database system that has the ability to help the church manage and track its members, visitors and sending of bulk emails and text messages to its members and visitors. (LEAH 2014).

Mithras, (2002) Prior art electronic systems, which include electronic mail (e-mail), bulletin board systems (BBS), instant messaging and chat rooms, offer some but not all of these capabilities and, as a result, are less than ideally suited to enterprise communications. The capabilities of these various communication systems can be modified for even more general use in other church related system.

The capabilities of the various communication systems are listed in table 1 below. The table also show the various features that can be easily seen on the various columns of the system and the various responses illustrating the availability of certain features in the system.

Table1: Capabilities of various communication systems

System	Conv History	Instant Access	Open Display	Private Conv	Agreement	Integrated Modes
E-mail	No	Yes	No	Yes	No	No
BBS	Yes	No	No	No	No	No
Instant Messaging	No	Yes	Yes	Yes	No	No
Chat	No	Yes	Yes	No	No	No

3. ANALYSIS AND DESIGN

System analysis is the decomposition of the system requirements into units that can form building blocks for the new system. In the review of the church electronic communication system it is clear that the Choir have no place in the system that is already existing. The paper presents a web communication system that captures the choir in the provision of communication within the church.

3.1 Design

Design is the synthesis of the system component parts that are required in the building of the new system. The system main users are the registered choir members the other registered church members and guests in the site. In figure 1, the actors are capable of carrying out certain activities such as communicating with the church site via bulletin boards or email systems and databases that are in the site. Church music and hymn are also prepared and stored in the databases for easy download by members and other users as well as by choir members themselves.

Users can then :

1. View Related Choir Activities
2. Download Music Files

Fig 1. Choir Record and Messaging Use Case Model Diagram

3.2 Information and Product Flow Diagram

The diagram in figure 1 shows a use case diagram that describes the functionalities of the different factors in relation to the different use cases.

The **USE CASE MODEL** is made up of three actors;

1. Registered Choir User
2. Registered Choir Member
3. Web User

These actors serve as the clients that will use the proposed system.

The various Cases in the Model include;

3. Manage Choir Members
4. Manage Choir Users
5. Manage Choir Patrons/Matrons
6. Manage Choir Events
7. Send Email(s)
8. Send SMS Messages(s)
9. View Related Choir Activities
10. Download Music Files

Based on the implementation of a web based software application for the new system, the following are the limitations associated with the new system;

1. Lack of internet enabled platform will deprive users from operating the system.
2. Outdated web browsers will restrict the functionalities attached to the new system
3. Slow operation of the internet will affect the flow of operation of the new system.
4. Lack of power supply affects the operation of the new system.

3.3 High level Model of the Proposed System

The proposed system is built with a high level model class library called **SignalR** which is a technology developed by Microsoft technology in the year 2014.

SignalR is a new library for ASP.Net developers that make developing real-time web functionality easy. **SignalR** allows bi-directional communication between server and client. Servers can now push content to connected clients instantly as it becomes available, rather than having the server wait for a client to request new data.

SignalR can be used to add any sort of "real-time" web functionality to your ASP.Net application. While chat is often used as an example, you can do a whole lot more. Any time a user refreshes a web page to see new data, or the page implements a long polling to retrieve new data, it is a candidate for using **SignalR.** Examples include dashboards and monitoring applications, collaborative applications (such as simultaneous editing of documents), job progress updates, and real time forms. **SignalR** provides a simple API for creating server to client remote procedure calls (RPC) that call JavaScript functions in client browsers (and other client platforms) from server-side .Net Code.

In figure 2 the server invocation of client methods is clearly illustrated using the MyClientFunc( ), a function executing on the client . The client application execute and call for action on the server using its Javascripts and the server application on the .NET responses by processing the action required.

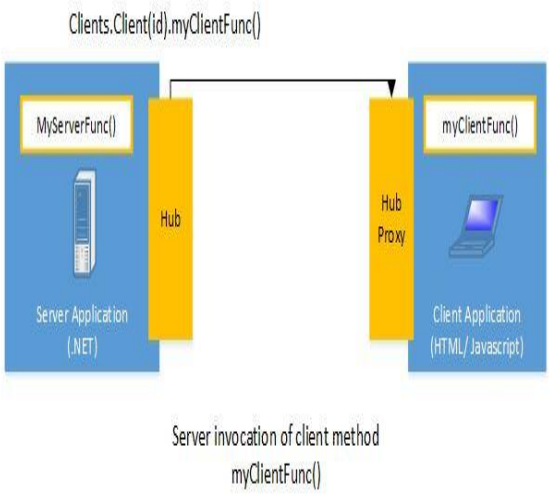

Fig 2: Server to Client Method

In the corresponding figure 3 instead of using a client function a server function is used in offering the response. When MyServerFunc() is called the request made by the client function is been processed in the server machine and response gets back to the requesting

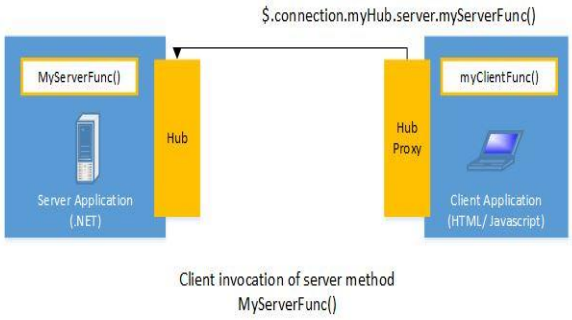

Fig 3: Client to Server Method

SignalR handles connection management automatically, and lets broadcast messages to all connected clients simultaneously, like a chat room. You can also send messages to specific clients. The connection between the client and server is persistent, unlike a classic HTTP connection, which is re-established for each communication. (Fletcher2014)

4. IMPLEMENTATION

Using the design presented for the church choir system, the implementation of the design was also carried out and presented. The user interface of the implemented system is discussed in the documentation carried out during the testing of the system. The explanation of the implemented system functionality was also clearly illustrated in the development process. The system interface was developed using HTML and the client internal functionality facilitated using Java script. The server side runs a windows server that have .NET fully installed and functional.

4.1 Software Testing

The following a test scenarios to be implemented in the application of the new system

4.1.1 Login

The Login Page is made up of two Login Modes which are USER and MEMBER Mode.

USER MODE:

Enter Username: UserTest (CAPS or No CAPS)

Enter Password: UserTest (CAPS or No CAPS)

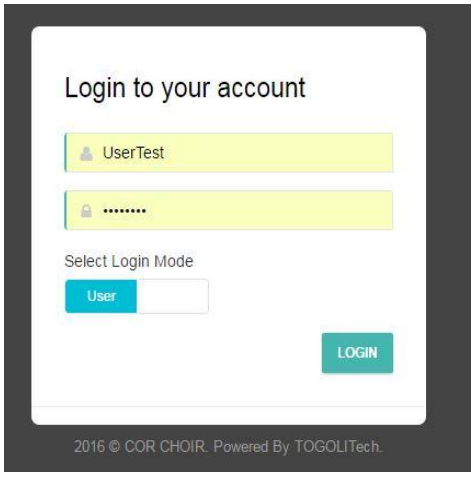

Fig 4: Login Mode

4.1.2 Member Page

The member page is used by the users to create new member registration where a new member can provide data that will be captured and automatically be added to the database provided by the system.

Once Add new member button is activated the corresponding page shows up in the system awaiting response from the users who are expected to fill in the data for the system to use in processing various operations. The new member window is shown in figure 5.

Add New Member: To add a new Member, click the Add new button located on the Loaded Datatable , a Pop-Up Modal Form shows, there fill in Data into all fields in the form and then submit the form for the server to process.

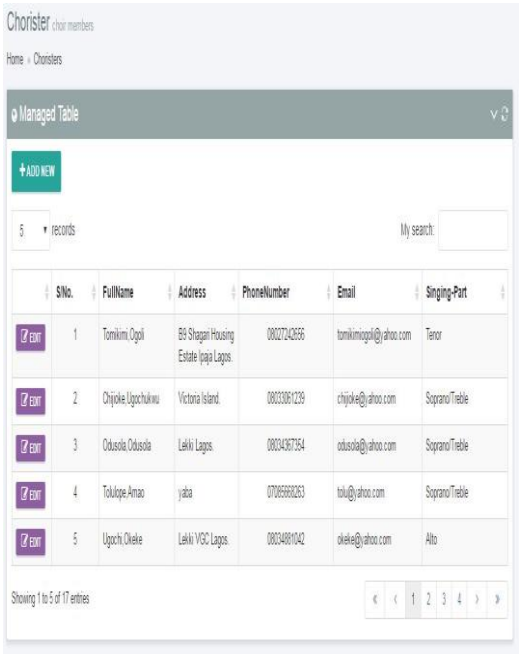

Fig 5: Member Output Form

If a user information are incomplete or improperly presented, the user can be allowed to update the content of the information provided. This action is provided for in the setup and configuration window provided in the system. This is illustrated in figure 6. The critical information are displayed for the user to make some adjustment on the information already provided. Based on the information provided the users information can be easily updated using the window.

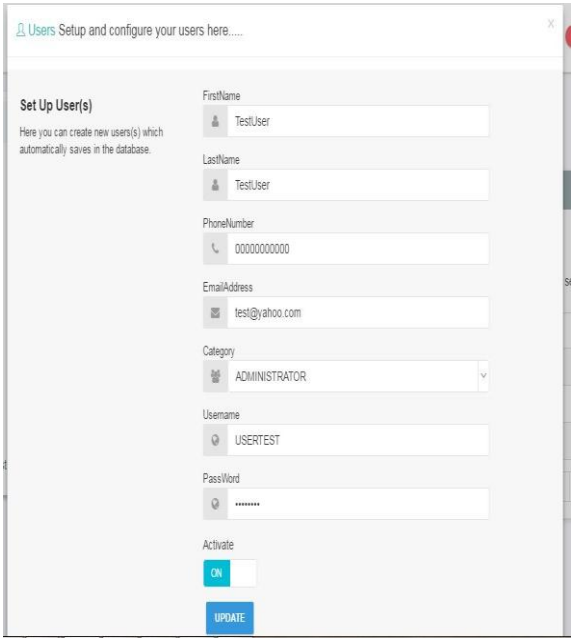

Fig 6: User Setup and Configure Form

4.2 Compose Email Page

An internal mailing system is used by the choir members in sharing information concerning their activities in the church.

The mailing system contain email setup window used to compose the message before it can be sent. Sending of the email message is done after composing it as shown in figure 7.

Send Email Message : To send a new Email, fill in the fields in the Compose TAB section of the form and click send.

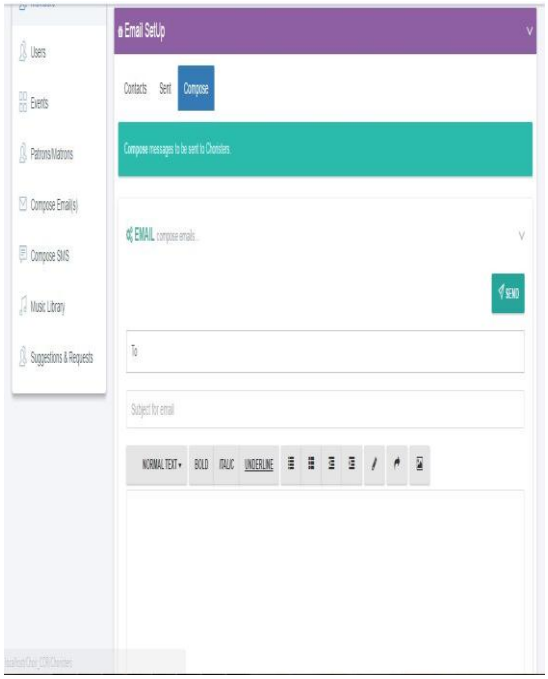

Fig 7: Send Email Message Form

4.3 Music Library Page

The system provides for music available as database that can be played by members by downloading them from the site. But before the music will be downloaded it has to be uploaded into the site by the system admin after it must have being made available by the choir. The buttons are provided for the user to add new music files once they are ready for upload and the page for streaming the music directly from the site is also provided to make sure that users can enjoy church music directly from the site.

Add New Music file: To add a new Music File, click the Add new button located on the Loaded Data table , a Pop-Up Modal Form shows, then fill in Data into all fields in the form and ensure that you upload a music file before saving unless the operation is unsuccessful. Once a music is uploaded the copy of the music is saved on the system for download.

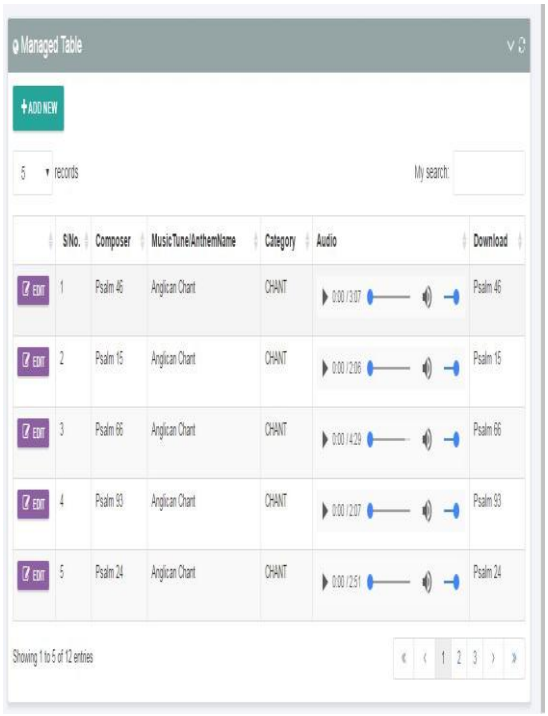

Fig 8: Music Library Output Form

In figure 8 the music library output form show the audio play back button from where a church member or other users can stream the music and play it directly from the site. The button that can be used to download the music is also provided in the system so that the file can be directly downloaded into users systems and then played back from the users machine.

5. RESULTS AND FINDINGS

When the site was tested using real life data from a selected church the web application functioned the way it was expected to perform. Operations such as getting of values from the users, setting of values for the users and fetching of values for the users and other operations are executed based on the functionality required by the page or form.

The music library menu provides a platform where different hymns, chants and anthems are uploaded into the database, also a table that shows a list of uploaded music files are presented to the user along with the option to listen to what has been uploaded from the page. The system was developed with the main purpose of providing a messaging platform and making music available to members of the church through the download platform of the software application, this project has been able to meet the goals of this project by providing a user friendly system that enables communication through text and email messaging easy. Through its music library, Hymns, Chants and Anthems from great composers are also made available to the listening pleasure of the church.

The new technology SignalR used in developing the system provides in establishing a real-time web functioning system which reduces the time it takes for the system to retrieve new data.

6. CONCLUSIONS

Within the timeframe of the project discoveries found out has shown that the file structure system of keeping records in church is still in use and transmission to electronic system need to be carried out gradually. The file structure may not be eliminated immediately but should serve as an area to fall back to in case of unforeseen instances that can occur to the software application developed during transition.

In this paper a system for the choir to use in communication within their group and with the church have been developed and proposed for the use of the church. Looking at the need of todays church it is clear that, a Web base software application along with a well-defined database system is needed to help provide a process that will bridge the break in communication between members and this paper have proposed a solution.

7. RECOMMENDATION

In the light of the research we recommend the system for the Church to be used by the Choir as it will enhance the performance and ministration of the choir. The system will assist them in carrying out their duties with greater efficiency.

It will also expand their kill in electronic communication and make their music available for a larger audience to listen to by using the music download facility provided on the system.

Developers of similar church system can also leverage on the system and expand on the features provided in the system.

8. ACKNOWLEDGMENTS

We acknowledge the students who collected the church data used in test running the system and the Church that provided the environment for direct test using the real life circumstances.

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10. ABOUT THE AUTHORS

Dr. Fubara Egbono is a database researcher and computer hardware engineering expert. His research interest is in Information System Development and application of software in solving local problems and data management in the Niger Delta communities in Nigeria.

Chinwe Ndigwe is a Lecturer at Department of Computer Science, Chukwuemeka Odumegwu Ojukwu University, Uli, Anambra State. Her research interest is ICT application and Data Mining..