Proceedings of the International Conference on Computer Applications 2016

# ICCA 2016

**Meenakshi College of Engineering,**
Chennai, India

9 April, 2016

Editor-in-Chief

Gunasekaran Gurusamy

ISBN 978-81-929866-5-4

Price : 200 USD

*International Conference on Computer Applications 2016*

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# Volume 1

**By**
**Meenakshi College of Engineering, KK Nagar, Chennai, India**

**Financially Sponsored By**
**Association of Scientists, Developers and Faculties, India**

Multiple Areas

## 9 April 2016
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## *Editors:*

**Kokula Krishna Hari Kunasekaran, Daniel James & Saikishore Elangovan**

*Published by*

**Association of Scientists, Developers and Faculties**
Address: RMZ Millennia Business Park, Campus 4B, Phase II, 6th Floor, No. 143, Dr. MGR Salai, Kandanchavady, Perungudi, Chennai – 600 096, India.
Email: admin@asdf.org.in || www.asdf.org.in

## International Conference on Computer Applications (ICCA 2016)

## VOLUME 1

Editor-in-Chief: **Dr. G. Gunasekaran**
Editors: **Kokula Krishna Hari Kunasekaran, Daniel James & Saikishore Elangovan**



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ISBN-13: 978-81-929866-5-4
ISBN-10: 81-929866-5-9

## PREFACE

The Fifth International Conference on Computer Applications will be held on 9th April 2016, in collaboration with Association of Scientists, Developers and Faculties (ASDF), an International body, at Meenakshi College of Engineering, Chennai, Tamilnadu, India, Asia.

ICCA 2016 provides a chance for academic and Industry professionals to discuss the recent progress in the area of Science, Engineering & Technology. The outcome of the conference will trigger for the further related research and future technological improvement. This conference highlights the novel concepts and improvements related to the research and technology.

The technical committee consists of experts in the various course subfields helped to scrutinize the technical papers in various fields, support to maintain the quality level of the proceedings of conference which consist of the information of various advancements in the field of research and development globally and would act as a primary resource of researchers to gain knowledge in their relevant fields.

The constant support and encouragement from Dr. S. Prithiv Rajan, ASDF Global President, Dr. P. Anbuoli, ASDF International President and Dr. K. Kokula Krishna Hari, ASDF International General Secretary helped a lot to conduct the conference and to publish the proceedings within a short span. I would like to express my deep appreciation and heartfelt thanks to the ASDF team members. Without them, the proceedings could not have been completed in a successful manner. I would like to express my sincere thanks to our management, student friends and colleagues for their involvement, interest, enthusiasm to bring this proceeding of the conference in a successful way.

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| Volume | 05 | ISBN | 978-81-929866-5-4 |
|---|---|---|---|
| Month | April | Year | 2016 |


**International Conference on Computer Applications 2016**

International Conference on Computer Applications 2016 [ICCA 2016]

| | |
|---|---|
| **ISBN** | 978-81-929866-5-4 |
| **Website** | icca.co.in |
| **Received** | 14 – March– 2016 |
| **Article ID** | ICCA001 |

| | |
|---|---|
| **VOL** | 05 |
| **eMail** | icca@asdf.res.in |
| **Accepted** | 02 - April – 2016 |
| **eAID** | ICCA.2016.001 |

# Recognition of Isolated Handwritten Arabic and Urdu Numerals along with their Variants

**Md Sohail Siddique[1], Ayatullah Faruk Mollah[2]**
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**Abstract-** *Arabic script is one of the most widely used scripts in the world. Besides 340 millions native speakers, more than 200 million nonnative speakers are there in the world. Many languages such as Urdu, Persian, etc. adopted this script. Therefore, recognition of optical handwritten Arabic characters has received significant attention from the past decade. Unlike numerals of any other scripts, some Arabic numerals have more than one representation. For instance, Arabic '4', '5' and '7' have two variations each. Considering these variants as the same class may deviate the recognition performance. The present work proposed a mechanism to deal with such variations for improved classification. At the first phase, the recognition problem is considered as a 13 class classification problem instead of 10. Then, in the second phase, the classes are reorganized and post-processed for improved classification. A comparative study has also been included with the conventional approach that considers the variants as the same class. Experimental results reflect the efficiency of the proposed technique.*

## I. INTDRODUCTION

Optical character recognition (OCR) of handwritten text is an active area of research. Unlike printed text, handwritten text recognition involves a number of additional challenges mainly due to varying handwriting styles and slanted as well as cursive nature of such texts. Although, significant works have been carried out for handwritten Roman numerals, recognition of handwritten Arabic numerals is yet an unsolved problem 1. Arabic script is one of the most widely used scripts in the world. Besides 340 millions native speakers, more than 200 million nonnative speakers are there in the world. About fifty languages such as Urdu, Persian, etc. have adopted this script 2.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Classical Arabic | ٠ | ١ | ٢ | ٣ | ٤ | ٥ | ٦ | ٧ | ٨ | ٩ |
| Modern Standard Arabic | ٠ | ١ | ٢ | ٣ | ٤ | ٥ | ٦ | ٧ | ٨ | ٩ |
| Urdu | ٠ | ١ | ٢ | ٣ | ۴ | ۵ | ۶ | ۷ | ۸ | ۹ |

Figure 1. Numerals and their variants of Arabic script

There are two variants of Arabic language viz. Classical Arabic and Modern Standard Arabic. Variations in numerals among these



**Cite this article as:** Md. Sohail Siddique, Ayatullah Faruk Mollah. "Recognition of Isolated Handwritten Arabic and Urdu Numerals along with their Variants". *International Conference on Computer Applications 2016*: 01-05. Print.

language-variants are shown in Figure 1. It may be noted that some numerals have more than one variants that must be taken care of during recognition. Although, Arabic is written from right to left, Arabic numerals are written from left to right. It is also evident that Urdu numerals are identical to Classical Arabic numerals.

Figure 1 shows that numerals '4', '5' and '7' have significant variations. Some handwritten samples of these letters are also shown in Figure 2.

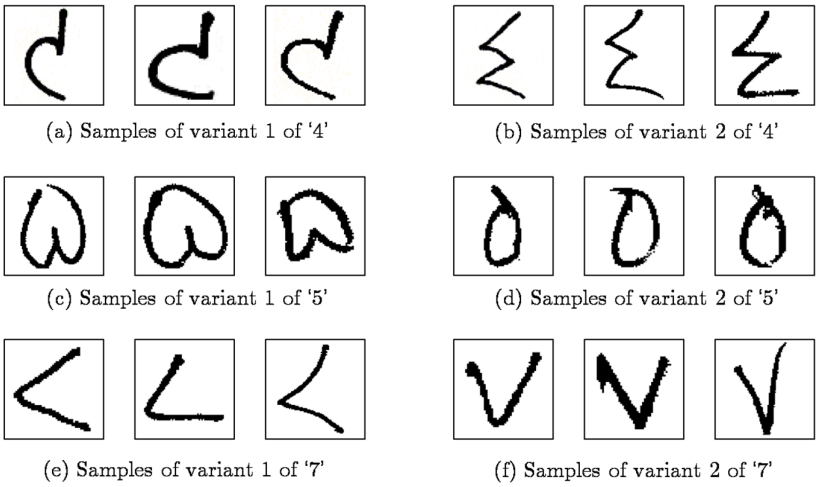


Figure 2. Variants of same handwritten numerals

So, a complete OCR system for Arabic numerals needs to consider these variants for recognition. Existing works on Arabic numerals recognition focuses on Modern Standard Arabic Numerals 345678. In this paper, an OCR system for Arabic numerals along with their variants is presented.

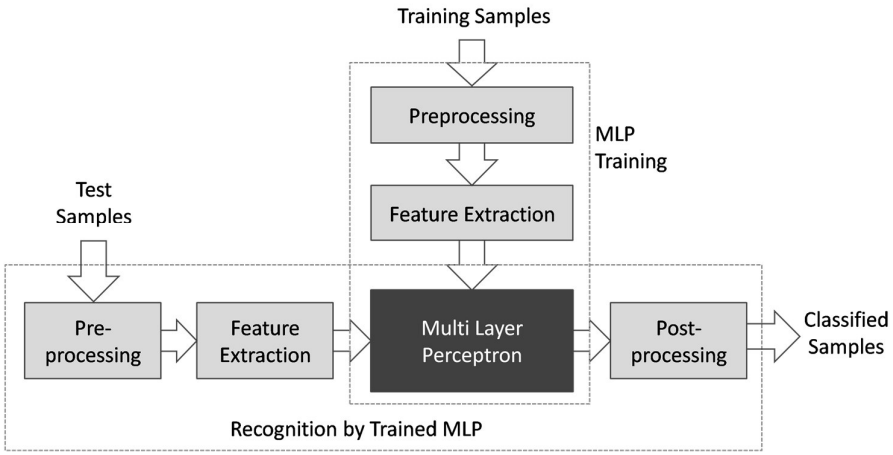


Figure 3. Block diagram of the MLP based OCR system

## II. Present Work

The block diagram of the present system is shown in Figure 3. At first, training samples are preprocessed and the features extracted from them are used to train a multi-layer perceptron (MLP). Then, the preprocessed recall samples are tested using the trained MLP by feeding the same features used during training.

### A. Preprocessing

At the preprocessing phase, the segmented training samples are binarized using Otsu's 9 global thresholding technique. Then, boundary box is detected and the sample is normalized to a standard size. In this work, 48x48 pixels have been taken as the normalized size. In Figure 4, sample views at different stages for a sample pattern are shown.

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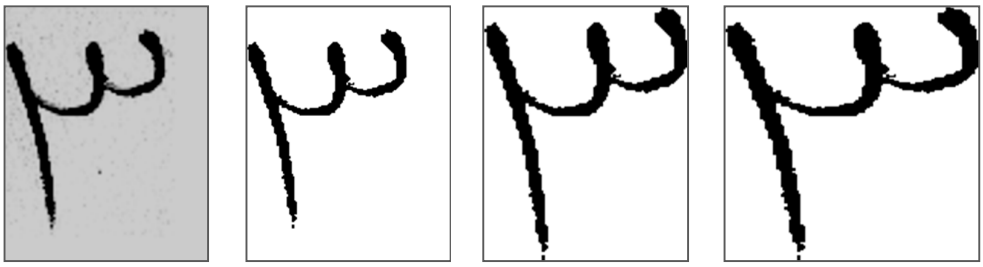

(a) (b) (c) (d)

Figure 4. Samples at different preprocessing stages, (a) segmented input sample (Arabic '3'), (b) binarized view, (c) bounded sample, (d) normalized view (48x48 pixels)

### B. Feature Extraction

Features are extracted from all samples for the purpose of training and testing. In this work, we have implemented octant centroid (16), longest run (20) and shadow features (24) reported by Basu et. al.10. Octant feature set is prepared by taking the position of centroid of all octants. Longest run feature set computes the longest run length at various direction and shadow features calculate the lengths of shadowed projection from beams of light sent from various directions.

### C. Architecture of MLP

In the present work, a feed forward back propagation multi-layer perceptron is used having a three layer architecture. The first layer is the input layer in which the number of neuron is equal to the number of input features. The second layer is the hidden layer in which the number of neuron is heuristically determined and the last layer is the output layer where the number of classes is taken as the number of neuron. The architecture is shown in Figure 5.

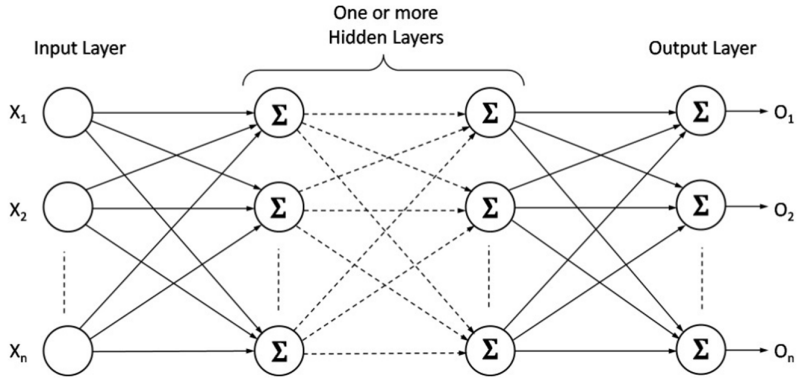


Figure 5. Architecture of the MLP based classifier

### D. Classification of Numerals

As discussed in Section I that the variants of some numerals would be considered, we have designed the classification problem in two ways. At first, we have considered all variants of the same class together and in this way we have got 10 classes (i.e. 0-9) as shown in Figure 6. Then, each variant is considered as a separate class and in this way 13 classes are found as shown in Figure 7.

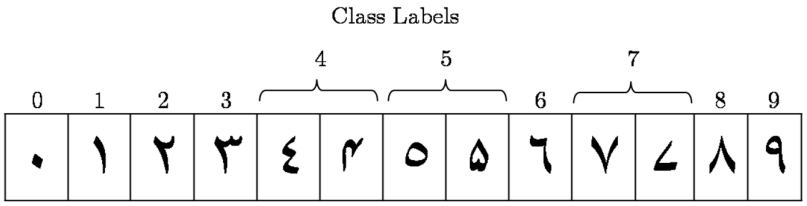


Figure 6. Classification problem with conventional 10 classes

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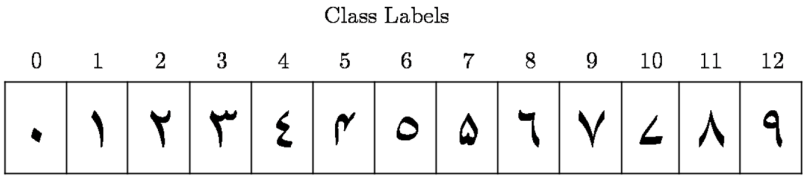


Figure 7. Classification problem with proposed 13 classes

## III. Experimental Results

To validate the performance of the present system, handwritten numerals data have been collected at first. People of different ages, backgrounds and literacy who are familiar with Arabic and Urdu numerals have given their isolated handwritten numerals in a given format shown in Figure 8. Then, these sheets are segmented and individual numerals' images are stored into the database. This database contains a total of 3900 samples (300 samples for each of the 13 classes). For the present experiment, training and test samples are taken in the ratio of 2:1. So, 2600 random samples are chosen for training and the remaining 1300 samples are taken for testing.

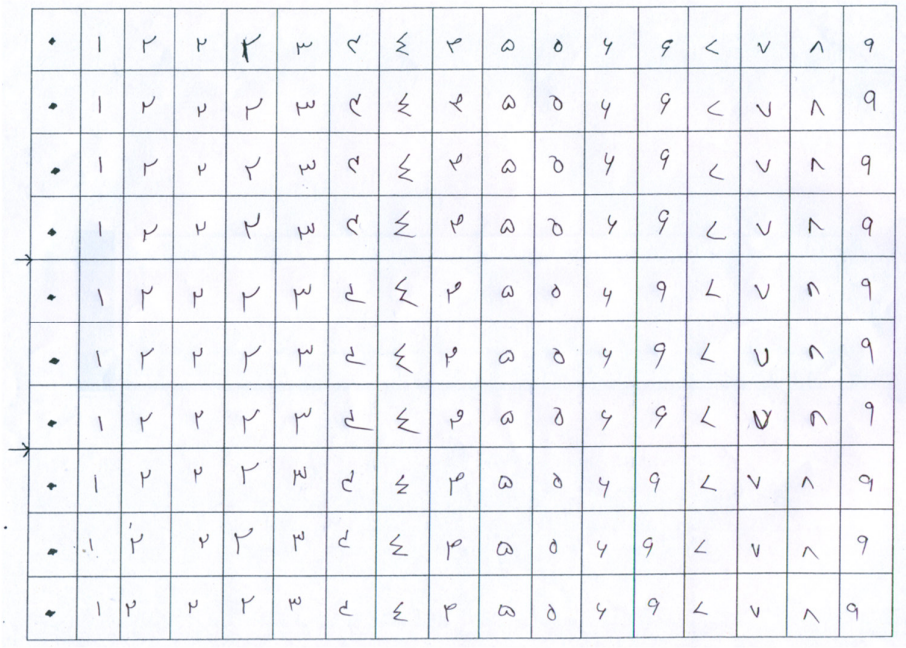

Figure 8. Sample sheet for data collection

In the first phase, the MLP classifier is run for 10 classes as shown in Figure 6. Numerals having two variants each have 600 samples that are divided into 400 training samples and 200 test samples. So, Class 4 {٤, ٤}, Class 5 {٥, ٥} and Class 7{ ٧, ٧} will have two variants each.

Table I Recognition performance with varying number of classes for different feature sets

| Sl | Name of Feature | Number of Features | Recognition Accuracy with 10 classes | Recognition Accuracy with 13 classes |
|---|---|---|---|---|
| 1 | Set 1 {Octant} | 16 | 90.92 | 91.46 |
| 2 | Set 2 {Longest Run} | 20 | 89.31 | 92.31 |
| 3 | Set 3 {Shadow} | 24 | 93.62 | 94.15 |
| 4 | Set 4 {Octant, Longest Run} | 36 | 93.15 | 95.46 |
| 5 | Set 5{Octant , Shadow} | 40 | 94.69 | 94.85 |
| 6 | Set 6{Longest Run, Shadow} | 44 | 94.85 | 95.15 |
| 7 | Set 7{Octant, Longest Run, Shadow} | 60 | 95.31 | 95.22 |

**Cite this article as:** Md. Sohail Siddique, Ayatullah Faruk Mollah. "Recognition of Isolated Handwritten Arabic and Urdu Numerals along with their Variants". *International Conference on Computer Applications 2016*: 01-05. Print.

In the second phase, the classifier is run for initially 13 classes and then the variants are merged in order to make them belong to the respective true classes. Recognition accuracy obtained from both the approaches for three feature sets and their combinations are shown in Table I and Figure 9. It may be noted from Table I that recognition accuracy with the latter approach is significantly higher compared to the former one except for the Set 7 where the accuracy with 13 class approach is slightly less. However, for six sets out of seven, 13 class approach yields better classification performance.

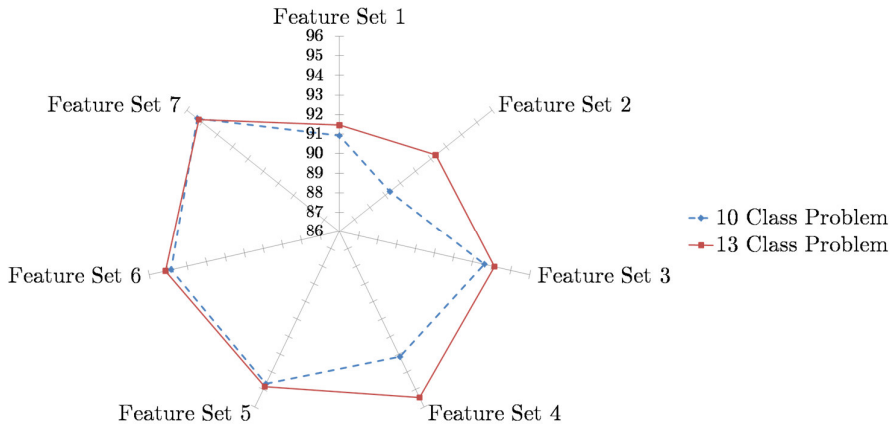


Figure 9. Comparative chart for recognition accuracy obtained with various feature sets for the conventional approach and the present approach

## IV. Conclusion

This paper presents an approach for taking the variants of handwritten Arabic and Urdu numerals into consideration while having high recognition accuracy. Instead of three fold validation, training and test samples are randomly chosen for ensuring generality of the system. Reasonably good accuracy i.e. more than 95% is obtained for feature sets having more than 30 features. However, the accuracy can be improved by feature optimization and post-processing. Designing an optimized feature set and stronger post-processing are left for future work.

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**Cite this article as:** Md. Sohail Siddique, Ayatullah Faruk Mollah. "Recognition of Isolated Handwritten Arabic and Urdu Numerals along with their Variants". *International Conference on Computer Applications 2016*: 01-05. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

| ISBN | 978-81-929866-5-4 |
|---|---|
| Website | icca.co.in |
| Received | 14 – March– 2016 |
| Article ID | ICCA002 |

| VOL | 05 |
|---|---|
| eMail | icca@asdf.res.in |
| Accepted | 02 - April – 2016 |
| eAID | ICCA.2016.002 |

# Study on Positive and Negative Rule Based Mining Techniques for E-Commerce Applications

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**Abstract-** *In the recent years the scope of data mining has evolved into an active area of research because of the previously unknown and interesting knowledge from very large database collection. The data mining is applied on a variety of applications in multiple domains like in business, IT and many more sectors. In Data Mining the major problem which receives great attention by the community is the classification of the data. The classification of data should be such that it could be they can be easily verified and should be easily interpreted by the humans. In this paper we would be studying various data mining techniques so that we can find few combinations for enhancing the hybrid technique which would be having multiple techniques involved so enhance the usability of the application. We would be studying CHARM Algorithm, CM-SPAM Algorithm, Apriori Algorithm, MOPNAR Algorithm and the Top K Rules.*

**Keywords:** *Data Mining, CHARM Algorithm, CM-SPAM Algorithm, Apriori Algorithm, MOPNAR Algorithm and the Top K Rules.*

## 1. INTRODUCTION

In today's world human beings are using multiple applications to ease their work. Every day a lot of data is generated in every field. The data can be in the form of Documents, graphical representation like picture or video and there can be multiple records also. Since there are multiple types of data there can be multiple types of format proper action should be taken for their better utilization of the available data. Since when the user wants to use the data the data can be retrieved in the proper format and information.

The technique to retrieve knowledge from the data is termed as data mining or knowledge hub or simple Knowledge Discovery process (KDD).The important reason that attracted a great deal of attention in information technology the discovery of useful information from large collections of data industry towards field of "Data mining" is due to the perception of "we are data rich but information poor". This perception is there because we have a very huge amount of data but we cannot convert it to useful information for decision making in different fields. To produce knowledge we require a lot of data and which could be in all possible formats like audio video images documents and much more. In data mining to get the full advantage not only the retrieval but also the tool for extraction of the essence of information stored, summarization of data and discovery of patterns in the data too is required for the knowledge extraction.

Since there is no lack of supply of data we are having a lot of data in different formats therefore it is important to develop a system which can convert this data into knowledge to help in decision making processes. The data mining tools can help in predicting behavior and future trends which can help organizations to make future knowledge-driven decisions. The data mining tools provides various features like automated, prospective analyses can help a better decision making scenario. In this paper we would be studying various data mining techniques and will review which technique can be used in the hybrid of the data mining technique.



**Cite this article as:** Kavita Yadav, Pravin, G Kulurkar. "Study on Positive and Negative Rule Based Mining Techniques for E-Commerce Applications". *International Conference on Computer Applications 2016*: 06-09. Print.

## 2. Charm Algorithm

CHARM is an efficient data mining technique which is used for enumerating the set of all frequent closed data item-sets. There are multiple innovative ideas implemented in the development of charm. This technique simultaneously explores both the item-set space and transaction space over item set-tides tree that is the search space of the database.

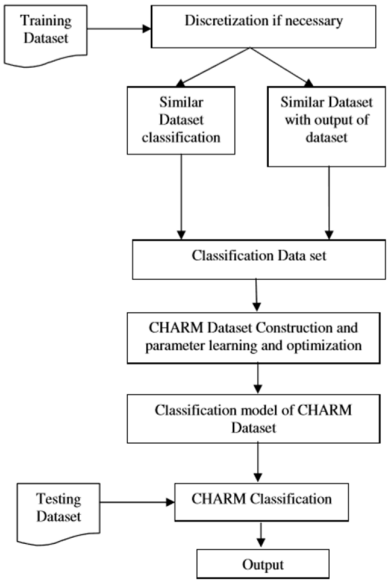


Figure 1: Charm algorithm

This technique uses a highly efficient hybrid search method that skips many levels of the tree to quickly identify the frequent closed set instead of having multiple possible subset to analysis. Fast Hash-based approach is used to eliminate item set during the execution. Charm also able to utilize a novel vertical data representation called diffset for fast frequency computations. Diffsets also keep track for differences in the tids of a candidate pattern from its prefix pattern. Since diffset reduce the size of the memory required to store intermediate result, therefore the entire working in some memory even for huge database.

## 3. CM-Spam Algorithm

In data mining getting useful patterns is a challenging task. In sequential database many techniques have been proposed for getting the patterns. A subsequence is called sequential pattern or frequent sequence if it frequently appears in a sequence database and its frequency is no less than a user-specified minimum support threshold minsup. This sequential pattern is very important in datamining as it helps in analysis of multiple applications like web medical data, program executions, click-streams, e-learning data and biological data. There are several efficient algorithm present for getting patterns amongst them the most efficient is the CM-SPAM Algorithm.

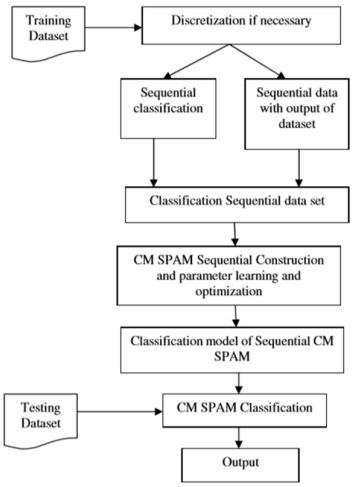


Figure: CM-spam algorithm

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The figure above shows the CM-SPAM Algorithm here first the trained dataset with known input and output is given as the input to the system. The data is divided equally if it is necessary as it gives the sequential classification from the known input and sequential classification form the known output. The combination of both the above dataset it provides us the classification sequential dataset.Then CM SPAM algorithm is applied to get the sequential construction, parameter learning and optimized dataset from the sequential dataset. All these combinations of parameters give us the Classification model of Sequential CM SPAM which is then used on testing the dataset for the output.

## 4. Apriori Algorithm

The apriori algorithm is one of the influential algorithm for mining for Boolean association rules. The key concept of the algorithm lies within Frequent Itemsets they are those sets of item which has minimum support and are denoted by Lifor ithItemset in the data. Secondly we have Apriori Property it is nothing butany subset of frequent itemset must be frequent and lastly we have join Operation it is required to find Lk which is a set of candidate k-itemsets is generated by joining Lk-1with itself. Here we will first find the frequent items the sets of items that have minimum support. Here a subset of a frequent itemset must also be a frequent itemset else the algorithm will not work that is if {t1 t2} is a frequent itemset both {t1} and {t2} should be a frequent itemset else the technique will fail to give a proper output. Once this is done iteratively find the frequrntitemset from 1 to k and use them to generate association rules.

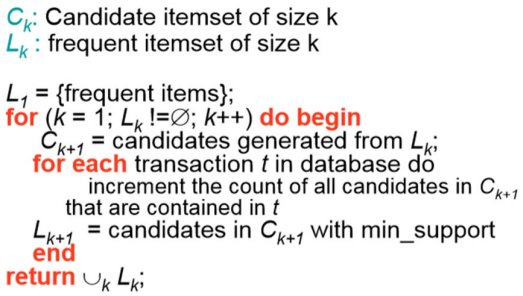


Figure: Apriori algorithm

The above figure shows the Apriori Algorithm. To enhance the efficiency of the apriori algorithm we have multiple techniques like Hash Based itemset counting, here a k itemset which has a hashing bucket count below the threshold cannot be tearmed as frequent. Another method is the Transaction reduction, here those transaction are ignored which doesn't contains the k itemset. The third method is the Partitioning in which if any item is frequent in the database it should also be frequent in partitions. Another method is sampling here the mining is done on the samples or the subsets f the data. Lastly we have Dynamic itemset counting here if all the subset of set is frequent then only it is selected.

## 5. Mopnar Algorithm

MOPNAR is an extension of multi-objective evolutionary algorithm (MOEA). It helps in mining with a low computational cost a reduced set of positive and negative QARs that are easy to understand and have good tradeoff between the number of rules, support, and coverage of the dataset. The main focus of the algorithm is to obtain a reduced set of PNQARs which are having good tradeoff considering three objectives which are comprehensibility, interestigness and performance. In order to perform a learning of rules it extends the traditional MOEA model. It also introduces two new components namely EP and Restarting process.

To decompose the MOEA it decomposes the muliobjective optimization problem into N scalar optimization. It uses EA to optimize the subproblems gathered. In this system to store all the nondominated rules found, provoke diversity in the population, and improve the coverage of the datasets the EP and the restart is introduced. Here EP will contain all the nondominated rules found and it will also generate the updated offspring for each solution. Since the size of EP is not fixed we can store a large number of rules and can reduce the size of population. Whereas restarting process here deals with the local optima and provoke diversity in the population. This process is applied when number of new individuals of the population in one generation is less than α% of the size of the current population.

The algorithm which MOPNAR uses is as follows:
Input:

1. N population size;
2. nTrials number of evaluations;

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3. m number of objectives;
4. Pmut probability of mutation;
5. λ1, …λN a set of N weight vectors;
6. T the number of weight vectors in the neighborhood of each weight vector;
7. δ the probability that parent solutions are selected from the neighborhood;
8. ηr the maximal number of solutions replaced by each child solution;
9. γ factor of amplitude for each attribute of the dataset;
10. α difference threshold.

Output: EP

## 6. Top K Rules Algorithm

As we have studied above all the above algorithms are depending on the threshold which leads to that the current algorithm leads to very slow execution and it generates excess, less or no results depending on the conditions and it also sometime omits valuable information to solve all the above disadvantages Top k rules came into the picture here the k would be the number of association rules to be found and is set by the user. It does not follow the traditional association rules here we can use rules with a single consequent else mining association rules from a stream instead of a transaction database.

```
TOPKRULES(T, k, minconf) R := Ø. L := Ø. minsup := 0.
1.  Scan the database T once to record the tidset of each item.
2.  FOR each pairs of items i, j such that |tids(i)| ×|T| ≥ minsup and |tids(j)| ×|T| ≥ minsup
3.      sup({i}→{j}) := |tids(i) ∩ tids(j)| / |T |.
4.      sup({j}→{i}) := |tids(i) ∩ tids(j)| / |T|.
5.      conf({i}→{j}) := |tids(i) ∩ tids(j)| / |tids(i)|.
6.      conf({j}→{i}) := |tids(i) ∩ tids(j)| / |tids(j)|.
7.      IF sup({i}→{j}) ≥ minsup THEN
8.          IF conf({i}→{j}) ≥ minconf THEN SAVE({i}→{j}, L, k, minsup).
9.          IF conf({j}→{i}) ≥ minconf THEN SAVE({j}→{i}, L, k, minsup).
10.         Set flag expandLR of {i}→{j} to true.
11.         Set flag expandLR of {j}→{i} to true.
12.         R := R∪{{i}→{j}, {j}→{i}}.
13.     END IF
14. END FOR
15. WHILE ∃r ∈ R AND sup(r) ≥ minsup DO
16.     Select the rule rule having the highest support in R
17.     IF rule.expandLR = true THEN
18.         EXPAND-L(rule, L, R, k, minsup, minconf).
19.         EXPAND-R(rule, L, R, k, minsup, minconf).
20.     ELSE EXPAND-R(rule, L, R, k, minsup, minconf).
21.     REMOVE rule from R.
22.     REMOVE from R all rules r ∈ R | sup(r) <minsup.
23. END WHILE
```

Figure: Top K rules algorithm

Mining in this algorithm is a tedious job as the algorithm cannot rely on both threshold that is minsup and minconf here minsup is more efficient and reliable. If the worst case scenario is present a naïve top k algorithm would generate all the rules for the basic algorithm. The figure shows the main algorithm. The algorithm runs as follows it first scans the database once to calculate the tids for each database item termed as c. It then generates all valid rules of size 1x1 with each having at least minsupx|T| tids the procedure save is called next to store the rules generated. The frequent rules are added to R set. The idea is to always expand the rule having the highest support because it is more likely to generate rules having a high support and thus to allow to raise minsup more quickly for pruning the search space

## 7. Conclusion

By reviewing all the above algorithms we found that if we have to increase the mining feature and create a hybrid approach we have to use Top K rules with the MOPNAR. As the MOPNAR has a high efficient rule mining results whereas with the help of Top K we can increase the speed and can save the memory of the system hence we propose improving the rule accuracy using positive and negative subgraph mining with top k-rules

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**Cite this article as:** Kavita Yadav, Pravin, G Kulurkar. "Study on Positive and Negative Rule Based Mining Techniques for E-Commerce Applications". *International Conference on Computer Applications 2016*: 06-09. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA003 | **eAID** | ICCA.2016.003 |


# Review on Document Recommender Systems Using Hierarchical Clustering Techniques

**Priya Mohite[1], Pravin G Kulurkar[2]**
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**Abstract-** *We the humans are surrounded with immense unprecedented wealth of information which are available as documents, database or other resources. The access to this information is difficult as by having the information it is not necessary that it could be searched or extracted by the activity we are using. The search engines available should be also customized to handle such queries, sometime the search engines are also not aware of the information they have within the system. The method known as keyword extraction and clustering is introduced which answers this shortcoming by spontaneously recommending documents that are related to users' current activities. When the communication takes place the important text can be extracted from the conversation and the words extracted are grouped and then are matched with the parts in the document. This method uses Natural Language Processing for extracting of keywords and making the subgroup that is a meaningful statement from the group, another method used is the Hierarchical Clustering for creating clusters form the keywords, here the similarity of two keywords is measured using the Euclidean distance. This paper reviews the various methods for the system.*

**Keywords:** *Natural Language Processing (NLP), Hierarchical Clustering, Euclidean Distance*

## 1. INTRODUCTION

The keyword extraction method which is used to extract keyword from the conversation is proposed with the goal of using the keyword to retrieve, for each short conversation fragment a small number of relevant documents automatically searched and recommended to the participants. This method spontaneously recommends the documents that are related to the activity that the user is doing. Here the main focus of activity would be the conversation. Since in conversation there are multiple potential words which can relate to multiple topics. When users participate in a meeting, their information needs can be modeled as keywords that can be extracted from text based conversation and documents. These keywords then organized into subgroups and can be matched to recommend relevant document to the user.

Keyword extraction method uses Natural Language Processing. NLP is the field concerned with human (language) and computer interaction. The subsets of the keywords are obtained by using hierarchical clustering. Hierarchical clustering algorithms are either top-down (Divisive) or bottom-up (Agglomerative). The recommendation lists were prepared by ranking the documents and measuring the similarity based on the Euclidean distance of the corresponding keywords extracted from conversation fragment and documents.

Document Recommender is a system that could provide relevant documents for an ongoing discussion, intended for use in meetings. The system can be use to make business to business communication easy and more productive.

In this system the main purpose of the meeting is to felicitate direct communication between participants and here the document plays



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a very important role. These documents contain facts that are currently discussed but can be not exactly same. However when using the chat the user do not have time to perform such searches therefore a system that could provide relevant documents for an ongoing discussion would be helpful.

## 2. Review of Techniques

### 2.1 Recommendation Classes

There are multiple recommendation classes available which are feature, knowledge, behavior, citation, context, and ruse based. Since all the approaches are correct within their specific domain then we cannot say that a particular system is good. The technique can be chosen from user needs and computation requirements. The recommendation techniques are

#### 2.1.1 Stereotyping

It is one of the earliest methods it was first introduced in the recommender system Grundy proposed by Rich to recommend novels to its users. The recommendation was inspired by the stereotypes from psychology that allow doctors to judge the patient on just few characteristics. This system proposed "Facets" which are the collection of the characteristics. For example to suggest novels to a male the facet contains that males prefer suspense, action thrill etc and on that bases the system generates the recommendation of the novels for them.

One major problem with stereotypes is that they can pigeonhole users. While many men may have a negative interest in romance, this is not true for all men. In addition, building stereotypes is often labor intensive, since the items typically need to be manually classified for each facet. This limits the number of items, for example, books that can reasonably be personalized

#### 2.1.2 Content Based Filtering

The Content based filtering (CBF) is the most used and researched algorithm for the recommendation system. This technique can be compared with the star schema here there is a central node which is termed as the user modelling processes. It is filled with the interest of the user which are derived from the items. Items are nothing but the set of transactions made by the user. The items could be the email transaction, search query etc. The features of items can be the typically word-based, i.e. single words, phrases, or n-grams. Some recommender systems also use non-textual features, such as writing style, layout information and XML tags. Here only the most descriptive features are used to model an item and the features and users are given a specific weight/priority. Once these features are identifies they are stored in a vector form that contains features and their respective weights. To generate the recommendation the user model and recommendation candidates are compared. for example using the vector space model and the cosine similarity coefficient.

This technique has a number of advantages compared to the previous stereotypes they are CBF allows a user-based personalization so the recommender system can determine the best recommendations for each user individually, rather than being limited by stereotypes. CBF also requires less up-front classification work since user models are created automatically. Whereas there are some disadvantages also like it requires more computing power than stereotyping and each item is analyzed before building the user model which takes a lot of time. It also ignores the popularity and quality of the items leading to low serendipity and overspecialization.

#### 2.1.3 Collaborative Filtering

This technique was proposed by the Goldberg et al his concept states that "information filtering can be more effective when humans are involved in the filtering process". The actual theory says that users like what like-minded users like image two users were considered like-minded if they rated items alike. When like-minded users were identified items that one user rated positively were recommended to the other userand vice versa. Compared to CBF the CF offers three advantages which are as follows. The first advantage is that CF is content independentthat is no error-prone item processing is required by the system. Secondly because humans do the ratings for the items they like and the CF takes into account real quality assessments to ensure the accuracy. Finally CF is supposed to provide serendipitous recommendations because recommendations are not based on item similarity but on user similarity i.e. the ratings.

A very general problem of CF is that here the rating matter a lot if we have to recommend a movie to any of the user here the number of users are more than the movie and the likings match the movie can be good recommendation for that user but that's not the case in documents. There can be thousands of documents and very few users so it will be difficult to optimize the users. The another disadvantage of the system is that its computing time is much more and is less scalable. In general it is termed as black box it recommend things only because some users like it. In CF manipulation is also not possible since most rated would be most recommended too.

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### 2.1.4 Co-Occurrence

Co-Occurrence is another documentation recommendation technique here only those items are recommended that have co-occur with some source item. It was first implemented in an application called as small, here two papers that are co cited are recommended. Same was also implemented in the Amazon. In Amazon if a user buys a particular item he would also co cited item like if a user buys a cell phone he will buy it cover so the system will recommend covers to the user.

One major advantage of this system is that the main focus here is on the relatedness and not on similarity hence we can say that this technique can provide more serendipitous recommendations. Here one addition is that no access to content is needed and complexity is rather low. It is also rather easy to generate anonymous recommendations, and hence to assure users' privacy. Whereas the major disadvantage is that if the source does not occur its related recommendation will also not be shown.

### 2.1.5 Global Relevance

It is the simplest technique from all the systems. It is based on the one-fits-all approach and it recommends items that is having the highest global relevance. The global relevance is not constrained that is it is not user specific like we studied above the user model and the rating model. Here Global measures are used like the overall popularity. As we seen in the rating the movie is recommended on the basis of the most tickets sold and average rating but here the first choice would be user likeness then the global measures like the rating and all would be used.

It is not used as standalone system but it used as an addition to the system for ranking factor. It can be be easily joined with the CBF. There is a lot of scope for research in this technique.

### 2.1.6 Hybrid

As the name suggests it is the mixture of multiple techniques to get more accurate outcome. Many of the above reviewed techniques have hybrid characteristic like for example several of the CBF approaches use global relevance attributes to rank the candidates or the graphs are used to extend or restrict the recommendation system results according to the user needs. This type of hybrid techniques are called as “feature augmentation”.

Since we can mix any two techniques together there is a lot of scope for the system to improve the above mixture is just the basic system for the hybrid. The very first successful implementation of this system was in TechLens it is a document recommendation system created by GroupLens. There were multiple updates of the system and are still going the first successful algorithm was given by Robin Burke which consists of three CBF variations, Two CF variations and Five Hybris approaches together.

### 2.1.7 Natural Language Processing

The Natural Language processing or the NLP is one of the advanced method to use in the document recommendation system. In here an intelligent system is created which is capable of keyword extraction and searching the content. The NLP has the following steps. Firstly the chat has to be analysed like for example is a meeting is going and the chat contains the topics of discussion, name of attendees etc. So the NLP system takes this system as the input and the analysis takes Place.

The second step is the Keyword Extraction, Here the keywords from the chat document is to be selected. In the language processing there are Main words and some supporting words etc and the sentence is made of keywords etc. Here the system will remove the words like is the etc and only the Nouns and The verbs are mostly stored for the keywords. For example the sentence says “This is an NLP paper”. Here is and an would be removed and This, Paper, NLP is stored. Always the keywords should have some meaning else it would be difficult by the system to analysis.

The third step is keyword association here image the user has a document of nearly thousand words and the NLP processed the document and the document is cut short to only few hundreds and from the remaining the main keywords are chosen and if the matches with the Extracted keyword the document is suggested.

For Example let us assume that there are two people who are chatting. The main agenda off the meeting is to buy a land in some locality. The user A has documents for land in the same locality soo while the chat is ongoing the NLP system should take input from the chat and should extraction the keywords and after extraction it should understand the meaning of the chat that is taking place by the keywords. Once the system understands it should search for the relevant documents and should give a suggestion of that document to the user while the chat is on so that the document can be used for the meeting.

**Cite this article as:** Priya Mohite, Pravin G Kulurkar. “Review on Document Recommender Systems Using Hierarchical Clustering Techniques”. *International Conference on Computer Applications 2016*: 10-14. Print.

## 2.2 Clustering Methods

In this section we will be reviewing some of the well known clustering methods which can help us in the formation of the logic or the intelligent statement from the set of keywords. It also helps in clustering same documents together. The clustering Methods are reviewed as follows:

### 2.2.1 Hierarchical Methods

In this method the cluster are constructed by recursively partitioning the instances in a top down or bottom up fashion. This method can be subdivided as follows:

Agglomerative hierarchical clustering: Here each object initially represents a cluster of its own. Then clusters are successively merged until the desired cluster structure is obtained.

Divisive hierarchical clustering: Here all objects initially belong to one cluster. Then the cluster is divided into sub-clusters, which are successively divided into their own sub-clusters. This process continues until the desired cluster structure is obtained.

Here in this method the result is stored in a dendrogram which represents the grouping of objects and the similarity of the grouping. A cluster of data is obtained by cutting the dendrogram at desired similarity level. The division is done on some similarity measures which are as follows:

Single-Link Clustering: It is also called as the nearest neighbor or the minimum method. Here the main criteria is the distance. If a distance between two clusters to be equal to the shortest distance from any member of one cluster to any member of the other cluster. If the data consist of similarities, the similarity between a pair of clusters is considered to be equal to the greatest similarity from any member of one cluster to any member of the other cluster.

Complete-Link Cluster: It is also called as the diameter or the maximum method. This method consider the distance between two clusters should be the longest distance from any member of one cluster to the second cluster.

Average-Link Cluster: It is also called the minimum variance method. In this method the distance between two clusters should be equal to the Average of the distance same should be with the every element from the set of second cluster element.

The main advantages of this technique is the versatility it maintain good performance on data sets containing non-isotropic clusters and the second advantage is Multiple Partition where the hierarchical methods produce not one partition, but multiple nested partitions. There are few disadvantages of the system too which are as follows. Firstly this method is unable to scale well and Hierarchical methods can never undo what was done previously. Namely there is no back-tracking capability

### 2.2.2 Partitioning Methods

In the partitioning method the instances are relocated by moving them from one cluster to another. It starts with the initial partitioning and continuing it. Such methods needs the number of cluster should be pre set by the user. To produce global optimization all the possible partitions should be made but since it not possible to do some of the greedy heurictics are used. Following are the various partitioning methods:

Error Minimization Algorithm: The most intuitive and most frequently used algorithms are the one which tend to work well with the isolated and compact clusters. The basic idea was to find a cluster structure that can minimize the error criteria here it measures the distance of each instance to its representative values. SSE may be globally optimized by exhaustively enumerating all partitions, which is very time-consuming, or by giving an approximate solution (not necessarily leading to a global minimum) using heuristics

Graph Theoretic Clustering: This method produce clusters via the graphs. The edge of the graph connect the instances are represented as nodes. A well known algorithm which is based Minimal Spanning tree is MST. Here the inconsistent edges are those edges whose weight is significantly larger than the average of nearby edge lengths.

### 2.2.3 Density Based

In the density based method the points that belongs to each cluster are drawn from a specific probability distribution whereas the overall distribution of the data is the mixture of several distributions. Here the main aim is to find the clusters and their distribution parameters. These methods are designed for discovering clusters of arbitrary shape which are not necessarily convex

**Cite this article as:** Priya Mohite, Pravin G Kulurkar. "Review on Document Recommender Systems Using Hierarchical Clustering Techniques". *International Conference on Computer Applications 2016*: 10-14. Print.

$$x_i, x_j \in C_k$$

This does not necessarily imply that:

$$\alpha \cdot x_i + (1 - \alpha) \cdot x_j \in C_k$$

Here the cluster will grow till the density exceeds some threshold. That is the radius of the cluster should contain some minimal amount of nodes, here when each cluster is characterized by the local mode or the maxima of the density function these methods are called mode-seeking. In this method the majority of workload is based on the assumption that the densities of component are multivariate Gaussian or multinominal. An acceptable solution in this case is to use the maximum likelihood principle. According to this principle, one should choose the clustering structureand parameters such that the probability of the data being generated by such clustering structure and parameters is maximized. Density-based clustering may also employ nonparametric methods, such as searching for bins with large counts in a multidimensional histogram of the input instance space.

### 2.2.4 Model Based

In this method the main aim is to optimize he fit between the given data and some mathematical models. It is not similar to the conventional clustering techniques It find characteristic descriptions for each group, where each group represents a concept or class. The most popular model based techniques used are the decision tree and the neural networks.

Decision Tree: Here the data is represented in the form of hierarchical tree where the leaf signifies a concept and contains a probabilistic description of that concept. Several algorithms produce classification trees for representing the unlabelled data. The most well-known algorithm is COBWEB.

Neural Networks: Here the clusters are termed as neurons or the prototype also the input data is also represented by neurons which are connected too their prototyped neurons. Each connection has some weight which is better understood in the learning level of the system. A very popular neural algorithm is the Self-Organizing map (SOM).

### 2.2.5 Fuzzy Clustering

In the traditional Clustering approaches partition takes place in a partition each instance belong to one and only one cluster therefore the clusters in a hard clustering are disjointed. Fuzzy Clustering extends it to match the soft clustering. Now each pattern is associated with every cluster using some sort of membership function, namely, each cluster is a fuzzy set of all the patterns. Larger membership values indicate higher confidence in the assignment of the pattern to the cluster. A hard clustering can be obtained from a fuzzy partition by using a threshold of the membership value. The most popular fuzzy clustering algorithm is the fuzzy c-means or the FCM.

## 3. Conclusion

From all the methods we reviewed above in the paper for this project we will use the NLP technique as it is the most flexible and is less time consuming. It can also provides results much faster than any other algorithm. Whereas we will use the Hierarchical Clustering method as it easy to implement, fast, Versatile and we can have as many partitions as we want in the systems.

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12. "A Document Recommendation System Blending Retrieval and Categorization Technologies" by Khalid Al-Kofahi, Peter Jackson, Mike Dahn*, Charles Elberti, William Keenan, John Duprey


**Cite this article as:** Priya Mohite, Pravin G Kulurkar. "Review on Document Recommender Systems Using Hierarchical Clustering Techniques". *International Conference on Computer Applications 2016*: 10-14. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|
| **ISBN** | 978-81-929866-5-4 |
| **Website** | icca.co.in |
| **Received** | 14 – March– 2016 |
| **Article ID** | ICCA004 |

| | |
|---|---|
| **VOL** | 05 |
| **eMail** | icca@asdf.res.in |
| **Accepted** | 02 - April – 2016 |
| **eAID** | ICCA.2016.004 |

# Hybrid Energy System fed ANFIS based SEPIC Converter for DC/AC Loads

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**Abstract—***This Paper mainly deals with the implementation of Adaptive Neuro Fuzzy Inference System (ANFIS) in Pulse Width Modulation control of Single Ended Primary Inductor Converter (SEPIC). Generally PID, Fuzzy techniques are being used to control DC – DC converter. This paper presents a ANFIS controller based SEPIC converter for maximum power point tracking (MPPT) operation of a photovoltaic (PV) system. The ANFIS controller for the SEPIC MPPT scheme shows a high precision in current transition and keeps the voltage without any changes represented in small steady state error and small overshoot. The proposed scheme ensures optimal use of photovoltaic (PV) array, wind turbine and proves its efficacy in variable load conditions, unity and lagging power factor at the inverter output (load) side. The performance of the proposed ANFIS based MPPT operation of SEPIC converter is compared to those of the conventional PID and Fuzzy based SEPIC converter. The results show that the proposed ANFIS based MPPT scheme for SEPIC can transfer power to about 20 percent (approx) more than conventional system.*

**Keywords—***ANFIS based MPPT control, Fuzzy control, dc-dc power converters, photovoltaic cells, proportional-integral controller, real-time system.*

## I. INTRODUCTION

Renewable Energy sources are gaining potential as conventional energy resources are minimum and pollution due to them are at alarming rates. Renewable energy technologies are suitable for off-grid services, serving the remote areas without having to build or extend expensive and complicated grid infrastructure. Therefore standalone system using renewable energy sources have become a preferred option. This paper is a review of hybrid renewable energy power generation systems focusing on energy sustainability. It highlights the research on the methodology, unit sizing, optimization, storage, energy management of renewable energy system.

The term hybrid power system is used to describe any power system combine two or more energy conversion devices, or two or more fuels for the same device, that when integrated, overcome limitations inherent in either [1]. The design and structure of a hybrid energy system obviously take into account the types of renewable energy sources available locally, and the consumption the system supports. Hybrid renewable energy systems have proven to be an excellent solution for providing electricity in future [2].Considering the harness of solar energy, solar array comes into picture. Solar array needs to be optimized for tracking maximum power from solar rays. So there is a need for tracking technique. The optimization of power on PV is known as Maximum Power point tracking (MPPT). Studies on MPPT by comparing several methods such as hill climbing / P&O, incremental conductance, fractional open circuit voltage, short circuit fractional voltage, fuzzy logic control, the current sweep, load voltage maximization, and dP/dI feedback control have been conducted [4]. In addition to these methods there are also other methods are used to maximize the PV MPPT using artificial intelligence such as PSO, ANFIS. In this case have been developed methods to maximize the power output of PV.



**Cite this article as:** Rammukesh Narayanaswamy, N P G Bhavani. "Hybrid Energy System fed ANFIS based SEPIC Converter for DC/AC Loads". *International Conference on Computer Applications 2016*: 15-21. Print.

## II. Proposed System

This paper presents a new system configuration of the front-end rectifier stage for a hybrid wind/photovoltaic energy system. This configuration allows the two sources to supply the load separately or simultaneously depending on the availability of the energy sources. The inherent nature of this SEPIC fused boost converter, additional input filters are not necessary to filter out high frequency harmonics. Harmonic content is detrimental for the generator lifespan, heating issues, and efficiency. The fused multi input rectifier stage also allows Maximum Power Point Tracking (MPPT) to be used to extract maximum power from the wind and sun when it is available. An adaptive MPPT algorithm will be used for the wind system and a standard perturb and observe method will be used for the PV system. Operational analysis of the proposed system will be discussed in this paper. Simulation results are given to highlight the merits of the proposed circuit. When a source is insufficient in meeting the load demands, the other energy source can compensate for the difference. For the continuous supply to be provided, we consider a SEPIC converter which is known for its fast switching characteristics. For switching the IGBT switches PWM controllers are implemented which are in turn controlled by ANFIS based controller.

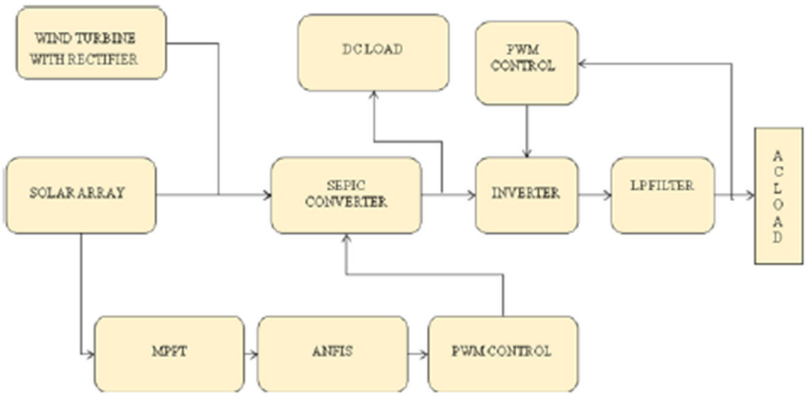


Fig 1: Proposed HES fed SEPIC converter.

## III. Modelling PV Array

PV array is formed by arranging PV cells in both series and parallel combinations to get particular output voltage and current.The output power of the PV modules is affected by light radiation and temperature [9]. A long with the increase of light radiation, the greater the output power can be generated by the PV module and vice versa. In this paper a single 12V solar cell is used for simulating purpose.

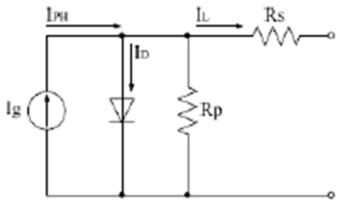


Fig 2: Equivalent circuit of a PV cell.

$$I_L = I_{PH} - I_S\left[\exp\left(\frac{qV_d}{AK_BT}\right) - 1\right] - \frac{V_d}{R_{SH}} \quad \ldots 1$$

$$I_{PH} = \left[I_{SC} + K_1\left(T_C - T_{Ref}\right)\right]G \quad \ldots 2$$

$$I_S = I_{RS}\left(\frac{T_C}{T_{Ref}}\right)^3 \exp\left[qE_B\left(\frac{1}{T_{Ref}} - \frac{1}{T_C}\right)/K_BA\right] \quad \ldots 3$$

$$I_{RS} = \frac{I_{SC}}{\left[\exp\left(\frac{qV_{OC}}{N_SKAT_C}\right) - 1\right]} \quad \ldots 4$$

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$$I_L = N_P I_{PH} - N_P I_S[\exp(qV/N_S K T_C A) - 1] \quad \ldots 5$$

Where, $I_{PH} = photo - current$

$I_L$ $= current\ at\ the\ output\ terminal$

$I_S$ $= saturation\ current\ of\ the\ diode$

$I_{RS}$ $= reverse\ saturation\ current$

$T_C$ $= cell\ working\ temperature$

$T_{ref} = reference\ temperature$

$R_S$ $= series\ resistance$

$K_B$ $= Boltzman\ constant$

$V_d$ $= diode\ voltage$

$G$ $= solar\ insolation$

$q$ $= electron\ charge$

## IV. Modelling of Wind Turbine

Double Fed Induction Generator is used as wind turbine for this simulink model [10]. Due to supply to the slip of induction machine, control over generation is easy.

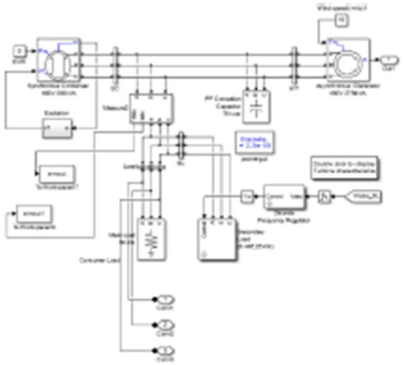

Fig 3: Wind turbine model for simulink.

## V. Modelling of Sepic

SEPIC converter is the development of a buck-boost converter with the same function that raising and lowering the voltage [9]. It gives non-inverted output and output voltage is controlled by switching single MOSFET switch.

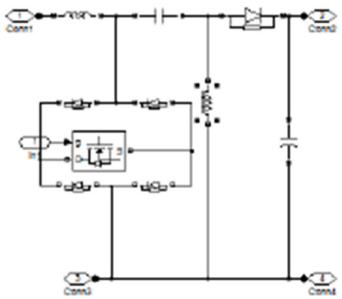

Fig 4: SEPIC modeling.

**Cite this article as:** Rammukesh Narayanaswamy, N P G Bhavani. "Hybrid Energy System fed ANFIS based SEPIC Converter for DC/AC Loads". *International Conference on Computer Applications 2016*: 15-21. Print.

$$V_o = V_{IN}\frac{D}{1-D} \quad \ldots 6$$

$$L_1 = \frac{V_{IN} \times D}{\Delta i_{L1} \times f_s} \quad \ldots 7$$

$$L_2 = \frac{V_{IN} \times D}{\Delta i_{L2} \times f_s} \quad \ldots 8$$

$$C_o = \frac{D}{R \times \frac{\Delta V_C}{V_o} \times f_s} \quad \ldots 9$$

## VI. Anfis and MPPT Modelling

ANFIS is a controller that combines the advantages possessed by the fuzzy controller and neural network. It is said to be the successor of both neural and fuzzy controller [8]. The ANFIS controller outputs the crisp value of maximum available power from the Solar PV module corresponding to specific temperature and solar irradiance conditions.Maximum power point trackers (MPPTs) play an important role in photovoltaic (PV) power systems because they maximize the power output from a PV system for a given set of conditions, and therefore maximize the array efficiency [14]. Thus, an MPPT can minimize the overall system cost. Considering the MPPT, perturb and observe method is used as MPPT technique.

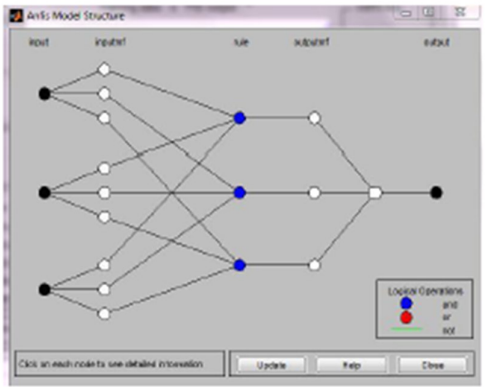


Fig 5: ANFIS structure.

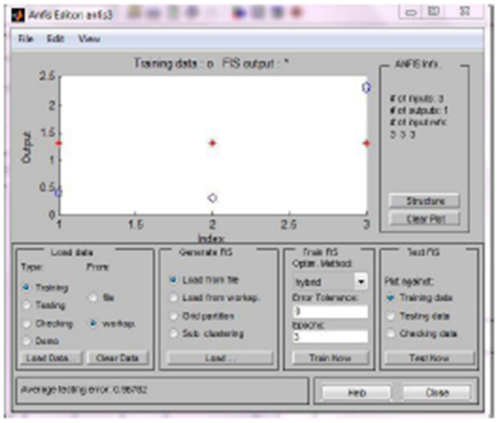


Fig 6: ANFIS editor.

The ANFIS algorithm is an adaptive network which has a similar training scheme to the neural network whilst offering equivalent performance to a fuzzy logic inference system. Although the

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ANFIS algorithm is a computationally complex algorithm to implement [7], the advancement of fast and affordable processing. Sugeno method is used to create ANFIS structure in this simulink model.

## VII. Simulation Results

MATLAB simulink model is as below.

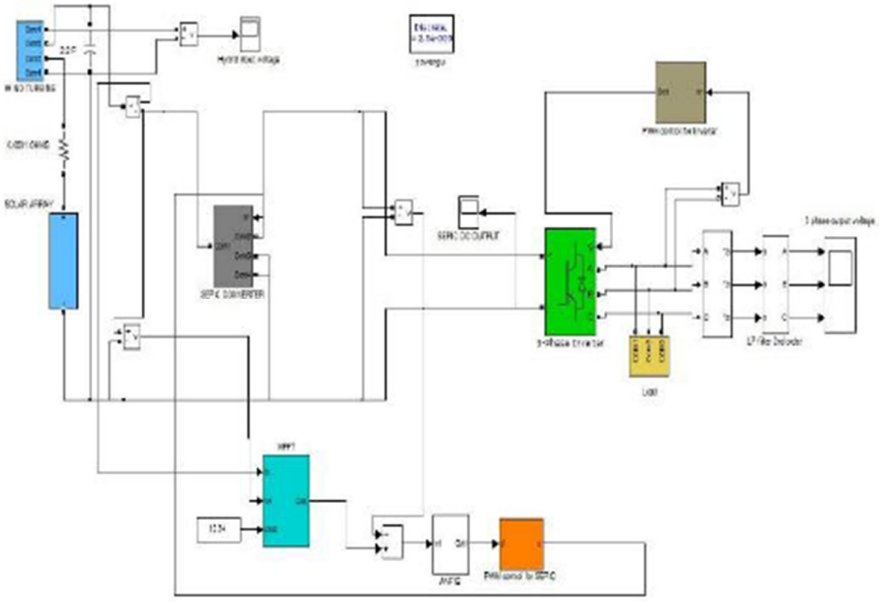

Fig 7: Simulink model.

Simulation parameters and their respective values are stated as below.

| SIMULATION PARAMETERS | VALUES |
|---|---|
| **SOLAR ARRAY PARAMETERS** | |
| Generation voltage | 180 V |
| Resistance | 10 Ohms |
| Capacitance | 2.2 micro Farad |
| **WIND TURBINE PARAMETERS** | |
| Generation voltage | 180 V |
| Capacitance | 2.2 micro Farad |
| **DIODE RECTIFIER** | |
| Resistance | 10 Ohms |
| Forward voltage | 0.8 V |

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| | |
|---|---|
| Snubber resistance | 500 Ohms |
| Snubber Capacitance | 250 nano Farad |
| **SEPIC CONVERTER** | |
| Inductance ($L_1$&$L_2$) | 3 milli Henry |
| Capacitance ($C_1$& $C_2$) | 2.22 nano Farad |
| **MOSFET (SEPIC)** | |
| Resistance | 2 Ohms |
| Internal diode Resistance | 0.01 Ohms |
| Snubber Resistance | $1*10^5$ Ohms |
| Snubber Capacitance | infinity |

Table 1: Simulation parameters for developed simulink model

Output voltage of SEPIC converter can be boosted according to the control of PWM signals. SEPIC output voltage is boosted to 220V. Then the inverter is used to invert the DC to AC (if required). Both DC and AC output waveforms are shown below.

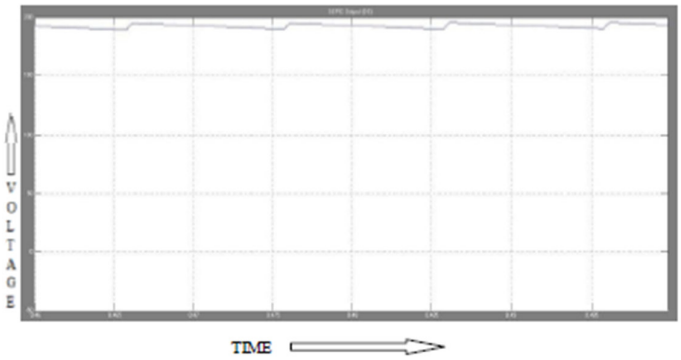


Fig 8: SEPIC DC output voltage.

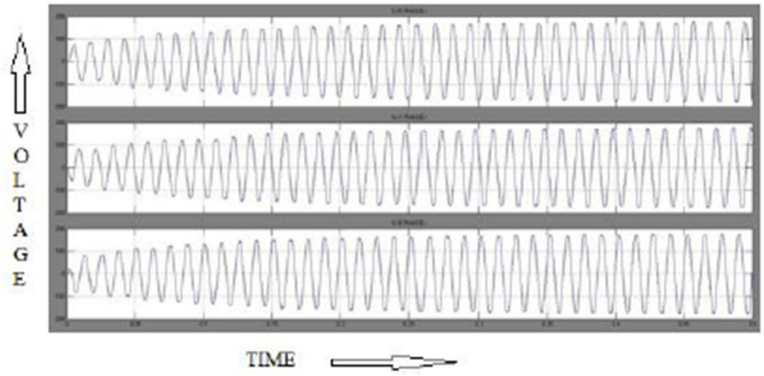


Fig 9: Three phase inverter output for an R load.

## VIII. Conclusion

This dissertation is on modelling of a hybrid wind/PV alternative energy system and connecting to HVDC grid usinga DC –DC converter which is controlled using ANFIS controller. The main part of the dissertation focuses on modelling different energy systems

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and the corresponding control scheme development. Special emphasis is put on the modelling ANFIS control of SEPIC converter based Hybrid system.The future work will be to model the proposed hybrid system using ANFIS combined with Genetic algorithm, and to design the proposed hybrid system and implement in hardware. Also, the system has to be extended to higher ratings and solve for the synchronization issues.

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**Cite this article as:** Rammukesh Narayanaswamy, N P G Bhavani. “Hybrid Energy System fed ANFIS based SEPIC Converter for DC/AC Loads”. *International Conference on Computer Applications 2016*: 15-21. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA005 | **eAID** | ICCA.2016.005 |


# Data Dimensional Reduction by Order Prediction in Heterogeneous Environment

**P Suganya[1], Thirupurasundari D R[2]**

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**Abstract** – *Equalizing the amount of processing time for each reducer instead of equalizing the amount of data each process in heterogeneous environment. A lightweight strategy to address the data skew problem among the reductions of MapReduce applications. MapReduce has been widely used in various applications, including web indexing, log analysis, data mining, scientific simulations and machine translations. The data skew refers to the imbalance in the amount of data assigned to each task.Using an innovative sampling method which can achieve a highly accurate approximation to the distribution of the intermediate data by sampling only a small fraction during the map processing and to reduce the data in reducer side. Prioritizing the sampling tasks for partitioning decision and splitting of large keys is supported when application semantics permit.Thus providing a reduced data of total ordered output as a result by range partitioner. In the proposed system, the data reduction is by predicting the reduction orders in parallel data processing using feature and instance selection. The accuracy of the data scale and data skew is effectively improved by CHI-ICF data reduction technique. In the existing system normal data distribution is calculated instead here still efficient distribution of data using the feature selection by χ 2 statistics (CHI) and instance selection by Iterative case filter (ICF) is processed.*

*The decision tree classifier is used to classify the data stream to produce an appropriate reduced data set.*

**Keywords** – *MapReduce, data skew, sampling, partitioning, CHI-ICF, data reduction.*

## Nomenclature

| | |
|---|---|
| CHI | χ 2 Chi-square statistic |
| ICF | Iterative Case Filter |
| LIBRA | Lightweight Implementation of Balanced Range Assignment |
| IS | Instance Selection |
| FS | Feature Selection |

## I. INTRODUCTION

Parallel programming is developed as a means of improving performance and efficiency. In a parallel program, the processing is broken up into parts, each of which can be executed concurrently. The parallel programs are faster, they can also be used to solve problems on large datasets using non-local resources.

MapReduce is inspired by these parallel programming concepts. It was developed by Google as a mechanism for processing large amounts of raw data, for example, crawled documents or web request logs. This data is so large, it must be distributed across



**Cite this article as:** P Suganya, Thirupurasundari D R. "Data Dimensional Reduction by Order Prediction in Heterogeneous Environment". *International Conference on Computer Applications 2016*: 22-28. Print.

thousands of machines in order to be processed in a reasonable time. This distribution implies parallel computing since the same computations are performed on each CPU, but with a different dataset. MapReduce is an abstraction that allows Google engineers to perform simple computations while hiding the details of parallelization, data distribution, load balancing and fault tolerance.

MapReduce has proven itself to be an effective tool to process large datasets. If one task takes significantly longer to finish than others are called straggler, it can delay the progress of the entire job due to various reasons, among which data skew is an important one. The data skew refers to the imbalance in the amount of data assigned to each task. To mitigate the data skew problem by Lightweight Implementation of Balanced Range Assignment for reduce-side applications in MapReduce.

The algorithm adjust its work load allocation in heterogeneous platform to deliver improved performance. In the proposed system, data reduction is carried out on the basis of the most efficient feature selection of data distribution by $\chi$ 2 statistics(CHI) and instance selection by Iterative case filter(ICF) instead of Zipf's distribution .The decision tree classifier is used to classify the data stream to enhance the parallelism and performance of data processing.

## II. Related Work

Qi Chen, Jinyu Yao, and Zhen xiao, [1] proposed a new sampling method for general user-defined MapReduce programs. The method has a high degree of parallelism and little overhead, which can achieve a much better approximation to the distribution of the intermediate data by zipfian distribution. It uses an innovative approach to balance the load among the reduce tasks in heterogeneous environment. The system can adjust its work load allocation and delivers improved performance even in the absence of data skew. Speculative execution is not effective for straggler, as it reduces the job execution time. A common measurement for data skew is the coefficient of variation is calculated.

Y.kwon, M.Balazinska, B.Howe and J.Rolia, [2] the focus of this paper was on UDOs in the form of MapReduce applications. In particular, skew is a significant challenge in many applications executed on this platform. When skew arises, some partitions of an operation take longer to process their input data than others, slowing down the entire computation. Load imbalance can occur either during the map or reduce phases. Such an imbalanced situation referred as map-skew and reduce-skew respectively. Skew can lead to longer job execution times and signicantly lower cluster throughput. The two very common types of skew: (1) skew caused by an uneven distribution of input data to operator partitions and (2) skew caused by some portions of the input data taking longer to process than others. The skewTune's approach to planning mitigators is presented to find a contagious order-preserving assignment of intervals. This performs scan in parallel than local scan to effectively keep the overheads low with large datasets to be repartitioned.

G.Benjamin, A.Nikolaus, R.Angelika, and K.Alfons, [3] addressed the problem of efficiently processing MapReduce jobs with complex reducer tasks over skewed data. It defined a new cost model that takes into account non-linear reducer-tasks and provided an algorithm to estimate the cost in a distributed environment. The two load balancing approaches proposed are fine partitioning and dynamic fragmentation, that are based on cost model and can deal with both skewed data and complex reduce tasks allowing improved load balancing. Varying execution times result in low resource utilisation and high overall execution time since the next MapReduce cycle can only start after all reducers are done. The empirical calculations are used to evaluate the solution on both synthetic data and real data on scientific applications.

Y.kwon, M.Balazinska, B.Howe and J.Rolia, [4] presented SkewReduce, a new API for feature-extracting scientific applications to generate parallel processing plans that leverages user-supplied cost functions. This method employs a static optimizer which reduces the impact of computational skew inherently. A high fidelity cost function benefits SkewReduce's optimization and offers a more general skew-resistant solution to improve application (scientific domains like Astronomy Simulation, Flow Cytometry and image processing) run times.

S.Ibrahim, J.Hai, L.Lu, W.Song, H.Bingsheng, and Q.Li, [5] investigated the problem of Partitoning Skew in MapReduce system which degrades the performance of huge data transfer during the shuffle phase particularly in reduce phase. Based on this a novel algorithm was developed named LEEN for Locality/ fairness-aware key partitioning in MapReduce. It improved the data locality by guaranteeing near optimal balanced reducer's input execution efficiency and fairness distribution of intermediate data during and after the shuffle phase which reduced the network congestion and achieves acceptable data distribution fairness. LEEN achieved both fair data distribution and performance under moderate and large key's frequency variations by the asynchronous map and reduce scheme among different data nodes.

Jeffrey Dean and Sanjay Ghemawat described about MapReduce is a programming model and an associ-ated implementation for processing and generating large data sets. Users specify a map function that processes a key/value pair to generate a set of intermediate key/value pairs, and a reduce function that merges all intermediate values associated with the same intermediate key.

## III. Existing Approach

In this paper the system which implements the LIBRA approach [1] to solve data skew for general applications like MapReduce framework. The design goals of LIBRA includes

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- Transparency - Data skew mitigation should be transparent to the users who do not need to know any sampling and partitioner details.
- Parallelism - It should preserve the parallelism of the original MapReduce framework as much as possible. This precludes any pre-run sampling of the input data and overlaps the map and the reduce stages as much as possible.
- Accuracy - Its sampling method should be able to derive a reasonably accurate estimate of the input data distribution by sampling only a small fraction of the data.
- Total order - It should support total order of the output data. This saves applications which require such ordering an extra round of sorting at the end.
- Large cluster splitting - When application semantics permit, it should be able to split data associated with a single large cluster to multiple reducers while preserving the consistency of the output.
- Heterogeneity consideration - When the performance of the worker nodes is heterogeneous, it should be able to adjust the data partition accordingly so that all reducers finish around the same time.
- Performance improvement - Overall, it results in significant improvement in application level performance such as the job execution time.

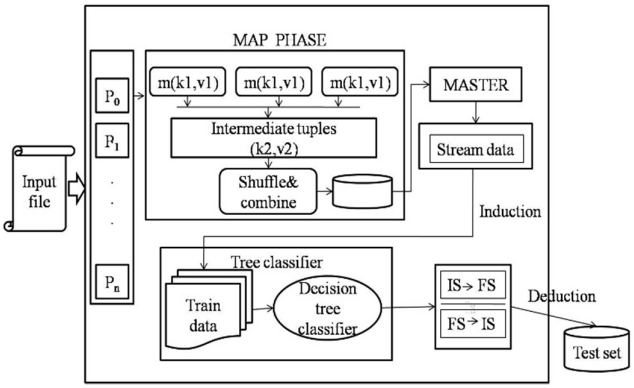


Fig.1 System Architecture

The architecture of the system is shown in Fig.1. Data skew mitigation of Straggler with LIBRA in a MapReduce system, 1) The input file is divided into multiple parts and assigned to a group of map tasks for parallel processing. 2) Each map task transforms its input (K1, V1) tuples into intermediate (K2, V2) tuples according to some user defined map and combine functions, and outputs them to the local disk. 3) Each reduce task copies its input pieces from all map tasks, sorts them into a single stream by a multiway merge, and generates the final (K3, V3) results according to some user defined reduce function.

As a result, the number of clusters is equal to the number of distinct keys in the input data. Each reduce task copies its partition (containing multiple clusters) from every map task and processes it locally. This require a total order of the output data.

The SkewTune technique tackles the data skew problem from a different angle. It does not aim to partition the intermediate data evenly at the beginning. Instead, it adjusts the data partition dynamically after detecting a straggler task, repartitioning the unprocessed data of the task and assigning them to new tasks in other nodes which reconstructed the output by concatenating the results from those tasks according to the input order. SkewTune and LIBRA are complementary to each other. When load change dynamically or when reduce failure occurs, it is better to mitigate skew lazily using SkewTune. On the other hand, when the load is relatively stable, LIBRA is better to balance the copy and the sort phases in reduce tasks and its large cluster split optimization improves the performance further when application semantics permit. The effective $\chi 2$ statistic distribution (CHI) and Iterative Case Filter (ICF) algorithm is proposed to improve the data reduction which is based on feature and instance selection.

Feature selection is a pre-processing technique for selecting a reduced set of features for large-scale data sets according to their feature values and a given number of words with large values are selected as representative features. An Instance selection provides a reduced data set by removing non-representative instances like noisy and redundant instances.

The tree classifier technique is employed to predict the reduction orders among parallel data processing by deducting from the stream of data to mitigate the data skew. Thus the performance of data reduction and scalability of the system is enhanced.

## IV. Random Sample Allocation

The Data Skew mitigation process of the system consists of following steps as shown in the below fig.2. we provide an effective cluster split strategy which allows large clusters to be split into multiple reduce tasks when appropriate. We modify the partition decision to

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include both the partition keys and the partition percentage. For example, a partition decision record (k,p) means that one of the partition point is p percent of key k. For map tasks issued before the partition decision is made, we can easily find these percentage partition points from the total-ordered intermediate outputs by adding some fields to the sparse index record.

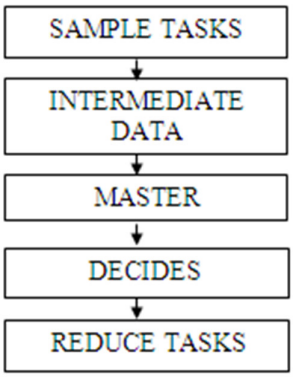


Fig.2 Data Skew Mitigation Process

The new fields we add are the current record number in the key cluster Kbi and the total record count of Kbi. By calculating the ratio of current record number in Kbi to the total count of Kbi, we can get the key and the percentage in its cluster for the start record in each index block. In this way, we can quickly locate the index blocks which contain the partition points. For map tasks issued after the partition decision is made, we calculate a random secondary key in the range [0, 100] for each record and compare (key, secondary key) to partition decision records to decide which partition it belongs to (the order within the key may not be the same as input order). Using this cluster split strategy, the solution of the example shown can be optimized with 60 percent of the large key A to reducer1 and the rest keys to reducer2. By doing so, the data skew is mitigated.

### A. Chunk Index for Partitioning

After the master notifies the worker nodes of the partition decision ready event, the worker nodes take responsibility for partitioning the intermediate data previously generated by the sampling tasks and already launched normal map tasks accordingly. This in general involves reading all the records from the intermediate output, finding the position of each partition key, and generating a small partition list which records the start and the end positions of each partition. When a reducer is launched later, the worker nodes can use the partition lists to help the reducer to locate and copy the data associated with its allocated key range from the map outputs quickly. The challenge here is how to find the partition breakpoints in a large amount of intermediate data. Since the intermediate data can be too large to fit into the memory, a brute force method using linear or binary search can be very time consuming.

When application semantics permit, cluster splitting provides substantially more flexibility in mitigating the data.

A small percentage of the map tasks are selected as the sample tasks. They are issued to the system when it has free slots. Sample tasks collects statistics on the intermediate data distribution during map process and transmit a digest of that information to the master after completion of all processes. The master collects all the sample information to derive an estimate of the data distribution, makes the partition decision and notifies to the reduce tasks.

## V. Data Reduction by Load Balancing

The sampling and partitioning algorithm in existing system is to balance the load across reduce tasks. The algorithm consists of three steps as given in the below diagram fig.3

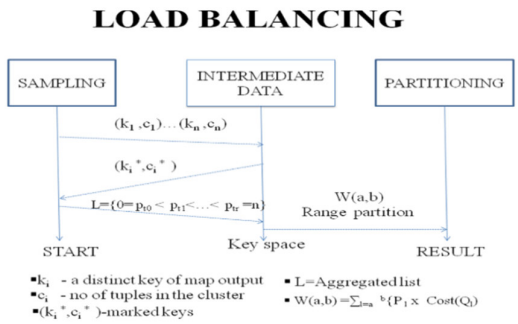


Fig.3 Load balancing sequences

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## B. LIBRA-Balanced Range Partitioning Algorithm

The approach of integrating sampling into a small percentage of the map tasks are prioritized for the execution of those tasks. An effective cluster split strategy which allows large clusters to be split into multiple reduce tasks.

The optimized cluster split strategy with 60 percent of the large key to reducer (P1) and rest keys to the reducer(P2). By doing so, the data skew is mitigated. Here, the translation of English dictionary to other languages like tamil, hindi and french is performed with the MapReduce concept.

- Sampling Strategy To Control Data Skew

A specific map task of English words 'j' is chosen for sampling its normal execution with a lightweight sampling procedure (ki j ,ci j ) where ci j is the frequency(no of records of ki j). A sample set SSample contains the following two parts:

- Slargest: p tuples with the largest ci j.
- Snormal: q tuples randomly selected according to uniform distribution

The master generates the total number of records S Sample = S largest U S normal.

The ratio of p/q is positively related to the degree of the data skew when it is heavier, the larger ratio should be chosen for good approximation.

By following a Zipf distributions with varying σ parameters from σ = 0.2 to 1.4 to control data skew. The COV is calculated for the English words with the frequency of words value.

For the optimal data reduction average coefficient variation (avg COV) of all σ for each p/q ratio as follows:

$$\text{Coefficient of variation} = \frac{stddev \quad \overline{(x)}}{mean \quad \overline{(x)}}$$

$$\text{Avg COVp/q} = \frac{\sum_{aEs} COV\sigma^{p/q}}{|S|}$$

- Estimating the Intermediate Data Distribution

Assuming two sample map tasks ,let m1 & m2 with their sample sets

m1={ (A,10),(B,5),(C,3),(D,2),(E,2)}

m2={(A,20),(B,3),(D,1),(F,1),(H,1)}

by summing up the frequencies of the same key, the merged sample set

S sample ={ (A,30),(B,8),(C,3),(D,3),(E,2),(F,1),(H,1)}.

There are m1 =50 keys &1000 records and m2= 60 keys &1500 records.

Therefore, Aggregated total records TR=2500 is used to estimate overlap degree of sample

$$\text{Degree} = \frac{2*\left(|L|+|S_{Sample}|+L-p\right)}{|L|+|S_{Sample}|-2p}$$

Where,

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L=Aggregated list , p=large tuple value.

The performance meteric for the existing system is the moving average of the process bandwidth and approximate the intermediate data.

- Range partition

Range partition : 0= pt0 < pt1<…< ptr =n of data distribution to get approximate data reduction and skew mitigation solution by generating a list of partition lists and it is minimized. The list of English words is partitioned logically for 26 alphabets and special characters.

$$\text{Minimize} = \max i=1,2,\ldots r \left\{ \frac{\sum_{j=p_{ti-1}+1}^{p_{ti}} \{P_j \; XCost \quad (Q_j)\}}{e_i} \right\}$$

## C. Accuracy of Sampling Method

The sampling method achieves a good approximation to the data distribution, which follows the Zipf distribution. The TopCluster sampling method and random sampler is used to split the data values.

## D. Degrees of the Data Skew

The coefficient of variation changes when the skew increases. The performance of the system with and without cuslter split strategy across reducers is produced.

## E. Sort, Grep, Inverted Index and Join

- Sort. We use the sort benchmark in our main workload because it is widely used and represents many kinds of data-intensive jobs. We generate 10 GB synthetic datasets following Zipf distributions with varying s parameters to control the degree of the skew. We choose Zipf distribution workload because it is very common in the data coming from the real world, e.g., the word occurrences in natural language, city sizes, many features of the Internet, the sizes of craters on the moon.
- Grep. Grep is a popular application for large scale data processing. It searches some regular expressions through input text files and outputs the lines which contain the matched expressions. We modify the grep benchmark so that it outputs the matched lines in a descending order based on how frequently the searched expression occurs. The dataset we used is the full English words.
- Inverted Index. Inverted indices are widely used in search area. We implement a job that builds an inverted index from given documents and generates a compressed bit vector posting list for each word. We use the Potter word stemming algorithm and a stopword list to pre-process the text during the map phase, and then use the RADIX partitioner to map alphabet to reduce tasks in order to produce a lexicographically ordered result. The dataset we used is also the full English Dictionary.
- Join. Join is one of the most common applications that experience the data skew problem. We implement a simple broadcast join job in which partitions a large table in the map phase, while a small table is directly read in the reduce phase to generate a hash table for speeding up join operation. When the small table is too large to fit into the memory, we use a buffer to keep only a part of the small table in memory and use the cache replacement strategy to update the buffer. We use synthetic datasets which follow Zipf distribution to generate the large tables, while use data-sets which follow either the uniform distribution or the Zipf distribution to generate the small tables.

## F. Heterogeneous Environment

To show the system can fit well with the variable environments, we set up a heterogeneous test environment by running a set of CPU and I/O intensive processes (e.g., heavy scientific computation and dd process which creates large files in a loop to write random data) to generate background load on two of the servers. We use sort bench-mark with (s ¼ 0:2). We intentionally choose a small s value so that all methods can partition the intermediate data quite evenly. This allows us to focus on the impact of environment heterogeneity.

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LIBRA: with or without considering environment heterogeneity, and with or without cluster split enabled. Thus the light weight data skew mitigation is reduced by the above explained algorithm and data reduction is performed.

## VI. Feature and Instance Selection

In the proposed system, the data size reduction is based on efficient feature selection of data distribution by $\chi$ 2 statistics(CHI) and instance selection by Iterative case filter(ICF) instead of Zipf's distribution .The decision tree classifier is used to classify the data stream to enhance the parallelism and performance of data processing. By predicting the reduction orders based on CHI and ICF for better performance and accurate result. The pseudo code for feature selection will be,

Select features(D,c,k)
V ← Extract vocabulary (D)
for each t V
do A(t,c) ← computer feature utility(D,t,c)
append(L, {A(t,c),t}
return features with largest values(L,k)

## VII. Performance Analysis -Libra vs CHI - ICF

The analysis of the system is based on their performance, accuracy and scalability is obtained. The comparison of both existing and future system will be evaluated and thus the later system is the best approach to data reduction is proven. At various platform the system performance will be processed by applying the enhanced feature and instance selection technique.

## VIII. Conclusion and Future Work

In this paper, the proposed data dimensional reduction by predicting the order using selection technique witnesses the explosive growth of data processing to routinely generate hundreds of tera-bytes of logs and operation records by MapReduce. Data skew mitigation has improved the MapReduce Performance by the implementation of LIBRA which supported a large cluster split and its adjustment for heterogeneous environments. In the future work, the MapReduce performance has been enhanced by chi-square $\chi$ 2 statistics (CHI) of feature selection and Iterative case filter (ICF) of instance selection instead of Zipf's distribution.The decision tree classifier is used to classify the data according to its stream to improve the parallelism and accuracy. The exact word in the file is retrieved by feature to instance selection.

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International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA006 | **eAID** | ICCA.2016.006 |

# Variable Frequency Digital PWM Control for Low-Power Buck Converters

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**Abstract—***This paper describes digital pulse width modulation (DPWM) controller technique for implementing low-power buck converters. The converter is operated at Discontinuous conduction mode to reduce the losses during switching. A DPWM controller is developed to achieve the best possible transient performance under load current change. Simulation of the converter is carried out using MATLAB/SIMULINK and the results indicate that it has good dynamic performance under load change.*

## I. INTRODUCTION

Advanced power management technique relies on integration of power control and conversion functions with digital systems [1-4]. Passive component count can be greatly reduced due to the programmable features. Sensitivity to process and parameter variations is insignificant in digital controllers. Control schemes that are considered impractical for analog realizations can be realised. [5].

While implementing a sophisticated control algorithm the sampling rate of the analog to digital - converter (ADC) is reduced by a factor of ten to achieve a high efficiency comparable to analog-controlled converters. A high computing power is not involved which is the precondition for a high overall efficiency of a low-power converter. In this project, a variable frequency DPWM controller for low-power buck converters is presented. The converter is designed to operate at DCM and found to have potential to reduce switching losses The DPWM based buck converter is studied using MATLAB/SIMULINK.

As the buck converter operates in the discontinuous conduction mode (DCM) the switching losses are reduced and the efficiency is increased [6]-[8].

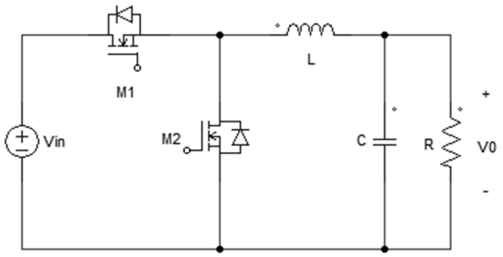


Fig-1. Circuit diagram of Buck Converter



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The DPWM is incorporated into the buck converter for closed loop operation. Line and load regulation performance comparable to a constant frequency DPWM is ensured through control rules for changing the switching frequency. A comparison of open loop buck converter and DPWM controlled buck converter is made with respect to their transient response using MATLAB-SIMULINK.

## II. Digital PWM Controller

Drastic reduction of system costs and power is possible through digital control of analog circuits [9-14]. Many microcontrollers and DSPs already include on-chip PWM controllers, making implementation easy. PWM is a way of digitally encoding analog signal levels. Through the use of high-resolution counters, the duty cycle of a square wave is modulated to encode a specific analog signal level. The PWM signal is still digital because, at any given instant of time, the full DC supply is either fully ON or fully OFF. The voltage or current source is supplied to the analog load by means of a repeating series of on and off pulses. The on-time is the time during which the DC supply is applied to the load, and the off-time is the period during which the supply is switched off. Given a sufficient bandwidth, any analog value can be encoded with PWM.

An Analog to Digital Converter (ADC) is a very useful feature that converts an analog voltage on a pin to a digital number. By converting from the analog world to the digital world, we can begin to use electronics to interface to the analog world around us.

The analog signal is continuous in time and it is necessary to convert this to a flow of digital values. It is therefore required to define the rate at which new digital values are sampled from the analog signal. The rate of new values is called the sampling rate or sampling frequency of the converter.

A proportional integral-derivative is control loop feedback mechanism used in industrial control system. In industrial process a PI controller attempts to correct the error between a measured process variable and desired set point by calculating and then giving corrective action that can adjust the process accordingly. The PI controller calculation involves two separate modes the proportional mode and integral mode. The proportional mode determine the reaction to the current error, integral mode determines the reaction based recent error. The weighted sum of the two modes output as corrective action to the control element. PI controller algorithm can be implemented as

where e(t) = set reference value – actual calculated.

## III. Buck Converter

A buck converter is a voltage step down and current step up converter. The simplest way to reduce the voltage of a DC supply is to use a linear regulator (such as a 7805), but linear regulators waste energy as they operate by dissipating excess power as heat. It operates in Continuous Conduction Mode. The relationship between the input voltage (Vs) and the output voltage (Vo) is given as,

$$d = \frac{V_o}{V_s} = \frac{T_{ON}}{T_S}$$

where d is the duty-cycle, TON is conducting time of the switch and Ts is the switching period. The switching period Ts can be expressed as,

$$Ts = \frac{I_L V_s}{V_o(V_s - V_o)}$$

where ΔI is the ripple current, L is the inductance of the circuit.

The value of L can be determined from,

$$L f_s I_L = V_s\, d(1-d)$$

The capacitor C is then determined by the allowed voltage ripple ΔVc. The ripple voltage is given as,

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$$V_c = \frac{V_s d(1-d)}{8LC\, f_s^{\,2}}$$

The value of capacitance depends on the change in the load.

### A. State Variable Modelling

The state-space averaging is an approximate technique that can be applied to describe the input and the output relation of a buck converter. All state variables are subscribe dx˙'s and all sources are subscribed as u's.

The state equation method as follows,

$$\dot{x} = A_1 x + B_1 u$$

$$\dot{x} = A_2 x + B_2 u$$

where,

$$\dot{x} = Ax + Bu$$

where x is a state vector, u is a source vector, A1, A2, B1, B2 are the state coefficient matrices.

$$A = dA_1 + (1-d)\,A_2$$

$$B = dB_1 + (1-d)\,B_2$$

where d is the duty cycle.

### B. Optimal Switching Frequency

Losses, which occur at buck converters, have to be examined to determine its optimal switching frequency. Our converter permanently operates in the discontinuous conduction mode (DCM)[15]. Furthermore, the synchronous buck converter is forced to work in DCM due to the dramatically reduction of the switching losses. In theory, the inductor current is zero at the beginning and at the end of a switching period in DCM.

Thus, no switching losses arise during turning on the high-side transistor and during turning off the low-side transistor. The same holds true for turning on the low-side transistor because the voltage drop over the transistor is zero. This means, remarkable switching losses only occur during turning off the high-side transistor. This will affect the efficiency negatively, if the switching frequency fsw rises. The gate charge losses also have a negative influence on the efficiency with increasing switching frequency.

## IV. Simulation Results

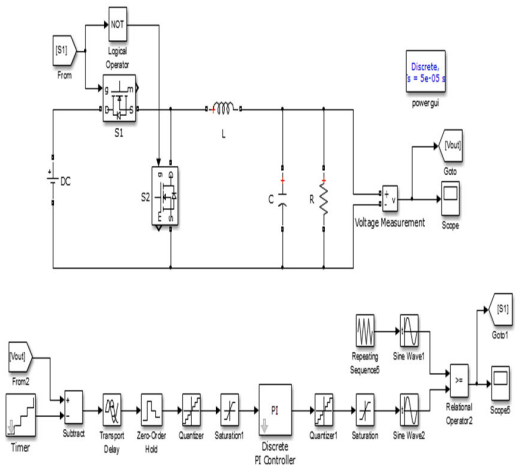


Fig-2. Simulation block diagram

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| PARAMETERS | VALUES |
|---|---|
| Battery voltage | 100 V |
| Output voltage | 80 V |
| Proportional gain of controller | .001 |
| Integral gain | .01 |
| Coil inductance | 1 µH |
| Coil resistance | 50 Ω |
| Capacitance | 750 Mf |
| esr | 1 Ω |
| Switching frequency | Variable |
| Resolution of ADC | 12 bits |
| Quantization step voltage | 1 mV |
| Sampling rate of ADC | 100 kHz |
| Delay of ADC | 7 µs |

Table 1. Simulation parameters

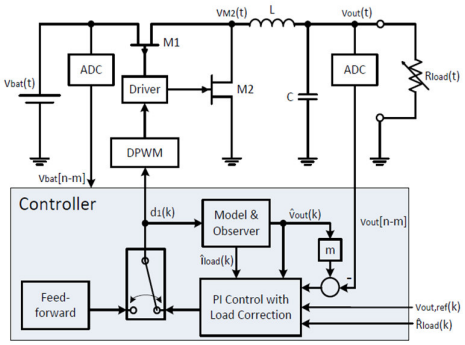


Fig 3. Functional Block Diagram

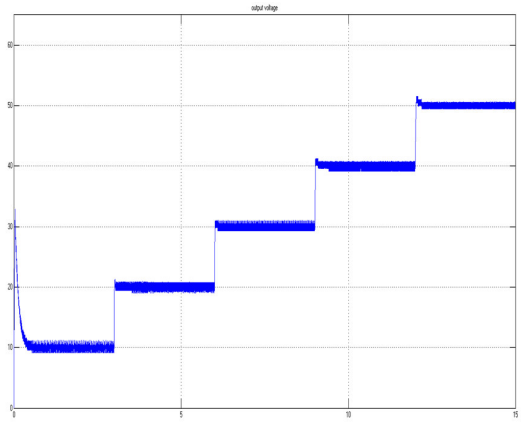

Fig-4. Output voltage

## V. Conclusion

The proposed digital PWM is implemented in a low-power buck converter controlled by UCD9220. It is shown that the proportional and integral gains of a PI controller can be selected based on the input error signal value to significantly improve the dynamic response

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of the buck converter. The DPWM controller exhibits a similar performance to a constant switching frequency DPWM while minimizing switching losses.

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International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA008 | **eAID** | ICCA.2016.008 |


# A Survey on Routing Protocols in Wireless Sensor Networks

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**Abstract:-** *Wireless sensor network is emerging field because of its wide applications. It is a wireless network which subsist a group of small sensor nodes which communicate through radio interface. These sensor nodes are composed of sensing, computation, communication and power as four basic elements. Many routing, power management, and data dissemination protocols have been specifically designed for WSNs where energy awareness is an essential design issue. But limited energy, communication capability, storage and bandwidth are the main resource constraints. The network should have self-organizing capabilities as the positions of individual nodes are not predetermined. The flexibility, fault tolerance, high sensing fidelity, low cost, and rapid deployment characteristics of sensor networks create many new and exciting application areas for remote sensing. Our survey is based on various aspects of routing protocols in wireless sensor networks.*

**Keywords:-***WSN, Sensor nodes, Routing, Ad hoc networks*

## I. INTRODUCTION

Wireless ad-hoc sensor networks have recently emerged as a premier research topic. They have great long-term economic potential, ability to transform our lives, and pose many new system-building challenges. Sensor networks also pose a number of new conceptual and optimization problems. Some, such as location, deployment, and tracking, are fundamental issues, in that many applications rely on them for needed information.

A wireless sensor network composed of hundreds to thousands of sensor nodes with much shorter distance between adjacent nodes and low application data rate.

In recent years WSN becomes emerging field in wide range of applications like health monitoring applications, environmental observation, forecasting system, battlefield surveillance, robotic exploration, monitoring of human physiological data etc. The sensors can be deployed at various places with different usages and each have different capability to sense different attributes like temperature, moisture, pressure humidity etc. But these sensors have limited power sources and also it is not cost effective to recharge the batteries. The batteries are usually irreplaceable. Therefore, there lifetime will depends on respective batteries of sensors. So the life time of wireless sensor network can be prolonged by using effective energy balancing methods.

Wireless sensors have become an excellent tool for military applications involving intrusion detection, perimeter monitoring, information gathering and smart logistics support in an unknown deployed area. Some other applications: sensor-based personal health monitor, location detection with sensor networks and movement detection. Routing in wireless sensor networks differs from conventional routing in fixed networks in various ways. There is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements [5]. Many routing algorithms were developed for wireless networks in general.



**Cite this article as:** N Mohana Priya, G Brindha. "A Survey on Routing Protocols in Wireless Sensor Networks". *International Conference on Computer Applications 2016*: 38-45. Print.

## II. Routing Protocols in Wireless Sensor Networks

### 1. Flat Routing Protocol

The first category of routing protocols are the multihop flat routing protocols. [1] Usually WSN consists of sensor nodes and base station. In flat topology all sensor nodes are treated uniformly.[19] In flat networks, each node typically plays the same role and sensor nodes collaborate together to perform the sensing task.[2,3] Due to the large number of such nodes, it is not feasible to assign a global identifier to each node. This consideration has led to data centric routing, where the BS sends queries to certain regions and waits for data from the sensors located in the selected regions.

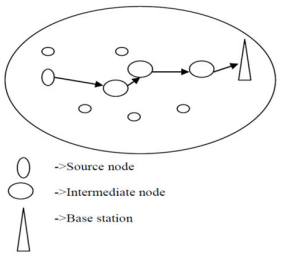


Figure 1.1: Example of flat routing

In Figure1.1 the source node senses their data like tracking object and sends the data to the base station through intermediate nodes.[20,21] Early works on data centric routing, e.g., SPIN and directed diffusion [18] were shown to save energy through data negotiation and elimination of redundant data.

**Minimum Cost Forwarding Algorithm (MCFA):** The MCFA algorithm [1, 3] exploits the fact that the direction of routing is always known, that is, towards the fixed external base-station. Hence, a sensor node need not have a unique ID nor maintain a routing table. Instead, each node maintains the least cost estimate from itself to the base-station.

**Directed Diffusion:** In [5], C. Intanagonwiwat et. al. proposed a popular data aggregation All sensor nodes in a directed diffusion-based network are application-aware, which enables diffusion to achieve energy savings by selecting empirically good paths and by caching and processing data in the network. [21]Caching can increase the efficiency, robustness and scalability of coordination between sensor nodes which is the essence of the data diffusion paradigm. At this stage, loops are not checked, but are removed at a later stage.

**Rumor Routing:** Rumor routing [3] is a variation of directed diffusion and is mainly intended for applications where geographic routing is not feasible. In general, directed diffusion uses flooding to inject the query to the entire network when there is no geographic criterion to diffuse tasks.[4] However, in some cases there is only a little amount of data requested from the nodes and thus the use of flooding is unnecessary.

**Sensor Protocols for Information via Negotiation (SPIN)**: Heinzelman et.al. in [3] and [5] proposed a family of adaptive protocols called Sensor Protocols for Information via Negotiation (SPIN) that disseminate all the information at each node to every node in the network assuming that all nodes in the network are potential base-stations. The SPIN family of protocols is designed based on two basic ideas:

1. Sensor nodes operate more efficiently and conserve energy by sending data that describe the sensor data instead of sending all the data; for example, image and sensor nodes must monitor the changes in their energy resources.
2. Conventional protocols like flooding or gossiping based routing protocols [19] waste energy and bandwidth when sending extra and un-necessary copies of data by sensors covering overlapping areas.

**Gradient-Based Routing:** Schurgers et al. [2, 21] proposed another variant of directed diffusion, called Gradient-Based Routing (GBR). In GBR, three different data dissemination techniques have been discussed (1) Stochastic Scheme, where a node picks one gradient at random when there are two or more next hops that have the same gradient, (2) Energy-based scheme, where a node increases its height when its energy drops below a certain threshold, so that other sensors are discouraged from sending data to that node, and (3) Stream-based scheme, where new streams are not routed through nodes that are currently part of the path of other streams. A packet is forwarded on a link with the largest gradient.

**Cougar:** Another data-centric protocol called Cougar [3] views the network as a huge distributed database system. The key idea is to use declarative queries in order to abstract query processing from the network layer functions such as selection of relevant sensors and so on.

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**Acquire:** In [4], Sadagopan et al. proposed a technique for querying sensor networks called Active Query forwarding in sensor networks (Acquire). Similar to Cougar, Acquire views the network as a distributed database where complex queries can be further divided into several sub queries.

**Information-driven sensor querying (IDSQ) and Constrained anisotropic diffusion routing (CADR)** two routing techniques, namely, information-driven sensor querying (IDSQ) and constrained anisotropic diffusion routing (CADR) were proposed in [4]. CADR aims to be a general form of directed diffusion.

**Energy Aware Routing:** The objective of energy-aware routing protocol [5], a destination initiated reactive protocol, is to increase the network lifetime. Although this protocol is similar to directed diffusion, it differs in the sense that it maintains a set of paths instead of maintaining or enforcing one optimal path at higher rates.

## 2. Location Based Routing Protocol

In location-based protocols, [2] sensor nodes are addressed by means of their locations. Location information for sensor nodes is required for sensor networks by most of the routing protocols to calculate the distance between two particular nodes so that energy consumption can be estimated. [7] Alternatively, the location of nodes may be available directly by communicating with a satellite, using GPS (Global Positioning System), if nodes are equipped with a small low power GPS receiver.[13] To save energy, some location based schemes demand that nodes should go to sleep if there is no activity. In order to stay with the theme of the survey, we limit the scope of coverage to only energy-aware location based protocols.

**Geographic Adaptive Fidelity (GAF):** GAF [3, 8] is an energy-aware routing protocol primarily proposed for MANETs, but can also be used for WSNs because it favors energy conservation. The design of GAF is motivated based on an energy model [12, 13] that considers energy consumption due to the reception and transmission of packets as well as idle (or listening) time when the radio of a sensor is on to detect the presence of incoming packets.

**Geographic and Energy-Aware Routing (GEAR):** GEAR [2] is an energy-efficient routing protocol proposed for routing queries to target regions in a sensor field. In GEAR, the sensors are supposed to have localization hardware equipped, for example, a GPS unit or a localization system [14] so that they know their current positions. Each node in GEAR keeps an estimated cost and a learning cost of reaching the destination through its neighbors. [7] There are two phases in the algorithm:

1. Forwarding packets towards the target region: Upon receiving a packet, a node checks its neighbors to see if there is one neighbor, which is closer to the target region than itself.
2. Forwarding the packets within the region: If the packet has reached the region, it can be diffused in that region by either recursive geographic forwarding or restricted flooding.

**Span: [1]** Coordination of Power Saving with Routing is a routing protocol also primarily proposed for MANETs, but can be applied to WSNs as its goal is to reduce energy consumption of the nodes. [7] A node should become a coordinator if two neighbors of a non-coordinator node cannot reach each other directly or via one or two coordinators (3 hop reach ability) [8].

**MECN Minimum Energy Communication Network (MECN):** MECN [12] is a location-based protocol for achieving minimum energy for randomly deployed ad hoc networks, which attempts to set up and maintain a minimum energy network with mobile sensors.[12] It computes an optimal spanning tree rooted at the sink, called minimum power topology, which contains only the minimum power paths from ach sensor to the sink. A minimum power topology for stationary nodes including a master node is found.

**Small minimum energy communication network (SMECN)** [7]. In MECN, it is assumed that every node can transmit to every other node, which is not possible every time. In SMECN possible obstacles between any pair of nodes are considered.[9] The subnetwork constructed by SMECN for minimum energy relaying is provably smaller (in terms of number of edges) than the one constructed in MECN if broadcasts are able to reach to all nodes in a circular region around the broadcaster.[14] Then, a sensor starts broadcasting a neighbor discovery message with some initial power and checks whether the theoretical set of immediate neighbors is a subset of the set of sensors that replied to that neighbor discovery message.

**Geographic Random Forwarding (GeRaF):** GeRaF was proposed by Zorzi and Rao [7], which uses geographic routing where a sensor acting as relay is not known a priori by a sender. After a certain number of attempts, the sending sensor either finds a relay sensor or discards the data packet if the maximum allowed number of attempts is reached.[10]This means that the neighbors of the sending sensor are not active.

## 3. Data Centric Routing Protocol

Data-centric protocols differ from traditional address-centric protocols in the manner that the data is sent from source sensors to the sink [7]. In many applications of sensor networks, it is not feasible to assign global identifiers to each node due to the sheer number of

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nodes deployed [13]. Such lack of global identification along with random deployment of sensor nodes make it hard to select a specific set of sensor nodes to be queried. In address-centric protocols, each source sensor that has the appropriate data responds by sending its data to the sink independently of all other sensors. [14] Since this is very inefficient in terms of energy consumption, routing protocols that will be able to select a set of sensor nodes and utilize data aggregation during the relaying of data have been considered.

**Flooding and Gossiping**: Flooding and gossiping [8] are two classical mechanisms to relay data in sensor networks without the need for any routing algorithms and topology maintenance.

**In flooding**, each sensor receiving a data packet broadcasts it to all of its neighbors and this process continues until the packet arrives at the destination or the maximum number of hops for the packet is reached.

1. **Implosion**: [19] If Sensor node sends data through multiple links duplicate messages may be retrieved (implosion). In Figure4 source node (1) sends the sensed data through all its outgoing links (2, 3). Hence destination node (4) receives duplicate copies of that packet which causes implosion.
2. **Overlap:** When the two sensor nodes sense the same information, it sends the overlapped data to the same node. [20] Eventually, Flooding wastes the available energy and bandwidth by sending duplicate copies. It produces high control overhead.

**In Gossiping**: Gossiping is the alternative to the flooding method where this technique uses randomization in selecting the neighbors.[8] In gossiping the sensor nodes select the relay nodes randomly instead of forwarding packets through every node. Hence it reduces the control overhead.

**Sensor Protocols for Information via Negotiation (Spin):** Spin [13] protocol was designed to improve classic flooding protocols and overcome the problems they may cause, for example, implosion sand overlap.[14] The SPIN protocols are based on two key mechanisms namely negotiation and resource adaptation. The sensors running the SPIN protocols are able to compute the energy consumption required to compute, send, and receive data over the network. [12].Therefore, SPIN is not a good choice for applications such as intrusion detection, which require reliable delivery of data packets over regular intervals.

**Directed Diffusion:** Directed diffusion [13] is a data-centric routing protocol for sensor query dissemination and processing. It meets the main requirements of WSNs such as energy efficiency, scalability, and robustness. Directed diffusion has several key elements namely data naming, interests and gradients, data propagation, and reinforcement.[10]The interests in the caches are then used to compare the received data with the values in the interests.

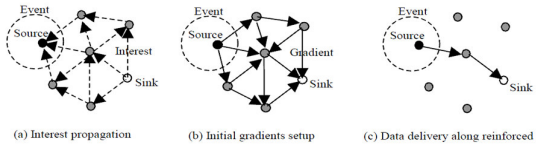


Fig. 4: Directed diffusion protocol phases

Fig.4, redrawn from [14], summarizes the Directed Diffusion protocol. The interest entry also contains several gradient fields. A gradient is a reply link to a neighbor from which the interest was received. It is characterized by the data rate, duration and expiration time derived from the received interest's fields.[12] In Directed Diffusion the sink queries the sensor nodes if a specific data is available by flooding some tasks. In SPIN, sensors advertise the availability of data allowing interested nodes to query that data.

**Rumor routing:** Rumor routing [7] is another variation of Directed Diffusion and is mainly intended for contexts in which geographic routing criteria are not applicable. Rumor routing is an efficient protocol if the number of queries is between the two intersection points of the curve of rumor routing with those of query flooding and event flooding. [13] Rumor routing is based on the concept of agent, which is a long-lived packet that traverses a network and informs each sensor it encounters about the events that it has learned during its network traverse.[9,15] An alternative approach is to flood the events if number of events is small and number of queries is large.

**Active Query Forwarding in Sensor Networks (Acquire):** Acquire [13] is another data centric querying mechanism used for querying named data. It provides superior query Optimization to answer specific types of queries, called one-shot complex queries for replicated Data. [7] ACQUIRE mechanism provides efficient querying by adjusting the value of parameter d. On the other hand, the query has to travel more hops if d is too small. In ACQUIRE, the next node to forward the query is either picked randomly or the selection is based on maximum potential of query satisfaction [12, 9].

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**Gradient-Based Routing**: Schurgers et al. [8] have proposed a slightly changed version of Directed Diffusion, called Gradient-based routing (GBR). [10] The idea is to keep the number of hops when the interest is diffused through the network. Nodes acting as a relay for multiple paths can create a data combining entity in order to aggregate data. [12]

**Energy-Aware Data-Centric Routing (EAD): [13]** EAD is a novel distributed routing protocol, which builds a virtual backbone composed of active sensors that are responsible for in-network data processing and traffic relaying.[7] In this protocol, a network is represented by a broadcast tree spanning all sensors in the network and rooted at the gateway, in which all leaf nodes' radios are turned off while all other nodes correspond to active sensors forming the backbone and thus their radios are turned on. [8, 9]

**Cadr**: Constrained anisotropic diffusion routing (CADR) [8] is a protocol, which strives to be a general form of Directed Diffusion. Two techniques namely information-driven sensor querying (IDSQ) and constrained anisotropic diffusion routing (CADR) are proposed. [10]This is achieved by activating only the sensors that are close to a particular event and dynamically adjusting data routes.

**Cougar:** A data-centric protocol that views the network as a huge distributed database system is proposed in [7]. A network can be viewed as a huge distributed database stem, where every sensor possesses a subset of data [9]. The leader node gets all the readings, calculates the average and if it is greater than a threshold sends it to the gateway (sink).The architecture is depicted in Fig. 5, which is redrawn from [9]. The gateway is responsible for generating a query plan, which specifies the necessary information about the data flow and in-network computation for the incoming query and send it to the relevant nodes. [14] Hence, current distributed management approaches cannot be applied directly, but need to be modified accordingly.

## 4. Hierarchical Routing Protocol

In hierarchical or clustered topology various nodes are combined together to form clusters [19]. Hierarchical or cluster-based routing, originally proposed in wire line networks, are well-known techniques with special advantages related to scalability and efficient communication [1]. A single-tier network can cause the gateway to overload with the increase in sensors density. [8] Such overload might cause latency in communication and inadequate tracking of events. Nodes are grouped into clusters with a cluster head that has the responsibility of routing from the cluster to the other cluster heads or base stations.

**Low-energy adaptive clustering hierarchy (LEACH):** LEACH [3] is the first and most popular energy-efficient hierarchical clustering algorithm for WSNs that was proposed for reducing power consumption LEACH uses a TDMA/CDMA MAC to reduce inter-cluster and intra-cluster collisions. [13]The operation of LEACH is divided into rounds having two phases each namely (i) a setup phase to organize the network into clusters, CH advertisement, and transmission schedule creation. ii) In the steady state phase, the actual data transfer to the base station takes place. [7]

**Pegasis & Hierarchical-Pegasis:** Power-Efficient Gathering in Sensor Information Systems (PEGASIS) [7] is an improvement of the leach protocol. The chain construction is performed in a greedy way. PEGASIS has two main objectives. [14] First, increase the lifetime of each node by using collaborative techniques and as a result the network lifetime will be increased. Second, allow only local coordination between nodes that are close together so that the bandwidth consumed in communication is reduced.

**Self Organizing Protocol (SOP)**: Subramanian et al. [1] describes a self-organizing protocol and an application taxonomy that was used to build architecture used to support heterogeneous sensors. Furthermore, these sensors can be mobile or stationary. Some sensors probe the environment and forward the data to a designated set of nodes that act as routers [8].

**Energy-aware routing for cluster-based sensor networks**: Younis et al. [9] have proposed a different hierarchical routing algorithm based on a three-tier architecture. Sensors are grouped in to clusters prior to network operation. A cost function is defined between any two nodes in terms of energy consumption, delay optimization and other performance metrics.

**Threshold Sensitive Energy Efficient Sensor Network Protocol (TEEN):** TEEN [7, 8] is a hierarchical clustering protocol, which groups sensors into clusters with each led by a CH. The sensors within a cluster report their sensed data to their CH. [2,4] In Teen, sensor nodes sense the medium continuously, but the data transmission is done less frequently. Teen is not good for applications where periodic reports are needed since the user may not get any data at all if the thresholds are not reached. The nodes sense their environment continuously. [9] The first time a parameter from the attribute set reaches its hard threshold value, the node switches its transmitter on and sends the sensed data. The sensed value is stored in an internal variable, called Sensed Value (SV).

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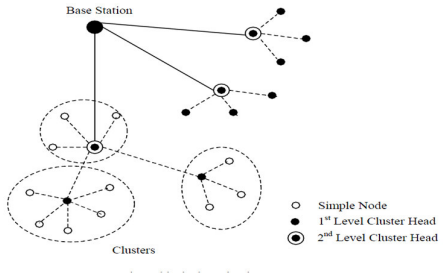


**Fig. 8:** Hierarchical Clustering in TEEN & APTEEN

**Adaptive Periodic Threshold Sensitive Energy Efficient Sensor Network Protocol (APTEEN):** [3] APTEEN is a hybrid clustering-based routing protocol that allows the sensor to send their sensed data periodically and react to any sudden change in the value of the sensed attribute by reporting the corresponding values to their CHs.[9] When the base station forms the clusters, the cluster heads broadcast the attributes, the threshold values, and the transmission schedule to all nodes.[13,14] APTEEN supports three different query types: historical, to analyze past data values; one-time, to take a snapshot view of the network; and persistent to monitor an event for a period of time.

**Hybrid, Energy-Efficient Distributed Clustering (HEED):** HEED [14, 15] extends the basic scheme of LEACH by using residual energy and node degree or density as a metric for cluster selection to achieve power balancing. In HEED, the proposed algorithm periodically selects CHs according to a combination of two clustering parameters.[17] HEED was proposed with four primary goals namely (i) prolonging network lifetime by distributing energy consumption, (ii) terminating the clustering process within a constant number of iterations, (iii) minimizing control overhead, and (iv) producing well-distributed CHs and compact clusters.

**Small Minimum Energy Communication Network (MECN):** In [2, 4], a protocol is proposed that computes an energy-efficient subnetwork, namely the minimum energy communication network (MECN) for a certain sensor network by utilizing low power GPS. MECN identifies a relay region for every node. The relay region consists of nodes in a surrounding area where transmitting through those nodes is more energy efficient than direct transmission.

**Sensor Aggregates Routing**: In [1], a set of algorithms for constructing and maintaining sensor aggregates were proposed. Three algorithms were proposed in [3, 5]. First, a lightweight protocol, Distributed Aggregate Management (DAM), for forming sensor aggregates for a target monitoring task. Second, Energy-Based Activity Monitoring (EBAM) algorithm estimate the energy level at each node by computing the signal impact area, combining a weighted form of the detected target energy at each impacted sensor assuming that each target sensor has equal or constant energy level. The third algorithm, Expectation-Maximization like Activity Monitoring (EMLAM), removes the constant and equal target energy level assumption.

## 5. Mobility-Based Routing Protocols

Mobility brings new challenges to routing protocols in WSNs. Sink mobility requires energy efficient protocols to guarantee data delivery originated from source sensors toward mobile sinks [13, 12]. Mobility of sink nodes requires energy –efficient protocols as well garmenting of data delivery from source sensor node to mobile sink node.[11] While designing mobility based protocol designer must keep these parameter in mind such as error , noise ,interference, random topology, guaranteed of data delivery and shortest route etc.

**Joint Mobility and Routing Protocol:[15]**A network with a static sink suffers from a severe problem, called energy sink-hole problem, where the sensors located around the static sink are heavily used for forwarding data to the sink on behalf of other sensors. [2, 13]In this concept the sensor node surrounding the sink node changes over the time by giving to all sensor node to act as relay node and thus maintaining load balancing of data routing among the sensor nodes. The trajectory with a radius equal to the radius of the sensor field maximizes the distance from the sink to the centre of the network that represents the hot spot.

**Scalable Energy-Efficient Asynchronous Dissemination (SEAD):** SEAD [14] is self-organizing protocol, which was proposed to trade-off between minimizing the forwarding delay to a mobile sink and energy savings.[14] SEAD considers data dissemination in which a source sensor reports its sensed data to multiple mobile sinks and consists of three main components namely dissemination tree (d-tree) construction, data dissemination, and maintaining linkages to mobile sinks. Every sensor node creates it d-tree rooted at itself and for all nodes it is built separately.[13] SEAD can be viewed as an overlay network that sits on top of a location-aware routing protocol, for example, geographical forwarding.

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**Dynamic Proxy Tree-Based Data Dissemination:[1, 6]**A dynamic proxy tree-based data dissemination framework [48] was proposed for maintaining a tree connecting a source sensor to multiple sinks that are interested in the source.[14] Due to mobility of sink node source node changes from time to time as new sensor closer to target mobile node become source node. Each source is represented by a stationary source proxy and each sink is represented by a stationary sink proxy.

**Low Energy Adaptive Cluster Hierarchy (LEACH)** [8] is a cluster based approach [4]. LEACH works in rounds. Each round begins with set up phase followed by steady phase. In set up phase, Cluster Head (CH) is selected. Each node generates random number between 0 and 1.[9] In steady phase, all Non-CH nodes send data to CH and then CH aggregate all data and send it to the base station.

## 6. Multipath Routing Protocols

Considering data transmission between source sensors and the sink, there are two routing paradigms: single-path routing and multipath routing. In single-path routing, each source sensor sends its data to the sink via the shortest path. In multipath routing, each source sensor finds the first k shortest paths to the sink and divides its load evenly among these paths.[1,2] The primary path will be used until its energy falls below the energy of the backup path at which the backup path is used. [25]Using this approach, the nodes in the primary path will not deplete their energy resources through continual use of the same route, hence achieving longer life. The path with the largest residual energy when used to route data in a network, may be very energy- expensive too. [15]Various techniques have been proposed in efficient multipath routing protocol design, for example, network coding is used, where data at the source node is fragmented and transferred into chunks to different discovered paths, and controlled flooding is used to find proficient neighbors.

**Directed diffusion** [3, 4] is a good candidate for robust multipath routing and delivery. Based on the directed diffusion paradigm, a multipath routing scheme that finds several partially disjoint paths is studied in (alternate routes are not node disjoint, i.e., routes are partially overlapped). It has been found that the use of multipath routing provides viable alternative for energy efficient recovery from failures in WSN. The motivation of using these braided paths is to keep the cost of maintaining the multipath low.

**N-to-1 Multipath Discovery: [18]** N-to-1 multipath discovery is based on the simple flooding originated from the sink and is composed of two phases, namely, branch aware flooding (or phase 1) and multipath extension of flooding (or phase 2). Both phases use the same routing messages whose format is given by {mtype, mid, nid, bid, cst, path}, where mtype refers to the type of a message.

## 7. Heterogeneity-Based Routing Protocols

In heterogeneity sensor network architecture, there are two types of sensors namely line-powered sensors which have no energy constraint, and the battery-powered sensors having limited lifetime, and hence should use their available energy efficiently by minimizing their potential of data communication and computation[13,14]. Cluster head node gather all the data from other sensor nodes in cluster, aggregates it and transmit to the sink node. Thus, only few nodes are required to transmit the data over a long distance while rest of them are required to transmit in a short range of distance result in saving more energy and enhancing the overall network lifetime period [12,3].

**Information-Driven Sensor Query (IDSQ): [15]** IDSQ addresses the problem of heterogeneous WSNs of maximizing information gain and minimizing detection latency and energy consumption for target localization and tracking through dynamic sensor querying and data routing.[2,3] Useful information can be sought based on predicting the space and time interesting events would take place.

**Cluster-Head Relay Routing (CHR)**: [12] CHR routing protocol uses two types of sensors to form a heterogeneous network with a single sink: a large number of low-end sensors, denoted by L-sensors, and a small number of powerful high-end sensors, denoted by H-sensors. [13]The H-sensors, on the other hand, are responsible for data fusion within their own clusters and forwarding aggregated data packets originated from other cluster heads toward the sink in a multihop fashion using only cluster heads. While L-sensors use short-range data transmission to their neighboring H-sensors within the same cluster, H-sensors perform long-range data communication to other neighboring H-sensors and the sink.

## 8. QOS –Based Routing Protocol

QOS-aware protocols consider end-to end delay requirements while setting up the paths in the sensor network. In QOS-based routing protocols, the network has to balance data quality [3]. In particular, the network has to satisfy certain QOS metrics, e.g., delay, energy, bandwidth, etc.[13,11] when delivering data to the BS. In addition to minimizing energy consumption, it is also important to consider quality of service (QOS) requirements in terms of reliability, and fault tolerance in routing in WSNs.

**Sequential Assignment Routing (SAR)** [13] SAR is one of the first routing protocols for WSNs that introduces the notion of Qos in the routing decisions. Routing decision in SAR is dependent on three factors: energy resources, Qos on each path, and the priority level of each packet.[2,3] The paths of the tree are built while avoiding nodes with low energy or QoS guarantees. [7,8]Failure recovery is done by enforcing routing table consistency between upstream and downstream nodes on each path. Any local failure causes an automatic path restoration procedure locally.

**Cite this article as:** N Mohana Priya, G Brindha. "A Survey on Routing Protocols in Wireless Sensor Networks". *International Conference on Computer Applications 2016*: 38-45. Print.

**Speed:** [12] Speed is another QoS routing protocol for sensor networks that provides soft real time end-to-end guarantees. SPEED strive to ensure a certain speed for each packet in the network so that each application can estimate the end-to-end delay for the packets by dividing the distance to the sink by the speed of the packet before making the admission decision. [19]And finally, the backpressure-rerouting module is used to prevent voids, when a node fails to find a next hop node, and to eliminate congestion by sending messages back to the source nodes so that they will pursue new routes. When compared to Dynamic Source Routing (DSR) and Ad-hoc on-demand vector routing, SPEED performs better in terms of end-to-end delay and miss ratio.[3] Moreover, the total transmission energy is less due to the simplicity of the routing algorithm, i.e., control packet overhead is less.

**Energy-Aware QoS Routing Protocol:** In this QoS aware protocol [5, 7] for sensor networks, real time traffic is generated by imaging sensors. The proposed protocol extends the routing approach in [6, 2] and finds a least cost and energy efficient path that meets certain end-to-end delay during the connection. The link cost used is a function that captures the nodes' energy reserve, transmission energy, error rate and other communication parameters. The queuing model allows service sharing for real-time and non-real-time traffic.[14] The bandwidth ratio r, is defined as an initial value set by the gateway and represents the amount of bandwidth to be dedicated both to the real-time and non-real-time traffic on a particular outgoing link in case of a congestion.

## III. Conclusion

Wireless Sensor Network is one of the emerging fields in research area. The flexibility, fault tolerance, high sensing fidelity, low-cost and rapid deployment characteristics of sensor networks create many new and exciting application areas for remote sensing. In the future, this wide range of application areas will make sensor networks an integral part of our lives. Wireless sensor network has a remarkable feature to monitor environmental and physical conditions. In this paper we discussed various types of routing protocols wireless sensor networks. In the future, the wide range of application areas will make sensor networks an integral part of our lives. Wireless sensor network energy efficient is one of the great areas for future work.

One of the main challenges in the design of routing protocols for WSNs is energy efficiency due to the scarce energy resources of sensors. The ultimate objective behind the routing protocol design is to keep the sensors operating for as long as possible, thus extending the network lifetime. The energy consumption of the sensors is dominated by data transmission and reception. Therefore, routing protocols designed for WSNs should be as energy efficient as possible to prolong the lifetime of individual sensors, and hence the network lifetime. In this paper, we have surveyed a sample of routing protocols by taking into account several classification criteria, including location information, network layering and in-network processing, data centricity, path redundancy, network dynamics, QoS requirements, and network heterogeneity.

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**Cite this article as:** N Mohana Priya, G Brindha. "A Survey on Routing Protocols in Wireless Sensor Networks". *International Conference on Computer Applications 2016*: 38-45. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

| ISBN | 978-81-929866-5-4 |
|---|---|
| Website | icca.co.in |
| Received | 14 – March– 2016 |
| Article ID | ICCA009 |

| VOL | 05 |
|---|---|
| eMail | icca@asdf.res.in |
| Accepted | 02 - April – 2016 |
| eAID | ICCA.2016.009 |

# Power Analysis of Embedded Low Latency Network on Chip

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**Abstract—** *A Network-on-chip (NOC) is a new paradigm in complex system-on-chip (SOC) designs that provide efficient on chip communication networks. The data is routed through the networks in terms of packets. The routing of data is mainly done by routers. So the architecture of router must be an efficient one with a lower latency and higher throughput. In this project we designed, implemented and analyzed crossbar router architectures for a network on chip communication in a FPGA. The routers have five ports, four ports connected to other ports in four different directions and the fifth port connected to the processing element through a network interface. Our Proposed architecture contains 4x4 crossbar switch, switch allocator, path and channel request, data ram and 4 i/o ports. The datas ere sent through the routers in order to prevent congestion. The swich allocator and VC allocator are used to allocate the datas in priority order. The switch allocator will allocate the datas according to the path and channel request. The XY algorithm with a scheduler is used in this project for proper destination of the datas.*

**Keywords:** *NOC, FPGA, switch allocator, VC alloctor, ports.*

## I. INTRODUCTION

Very large-scale integration (VLSI) is the process of integrating or embedding hundreds of thousands of transistors on a single silicon semiconductor microchip. This is the field which involves packing more and more logic devices into smaller and smaller areas. VHDL (VHSIC Hardware Description Language) is a hardware description language used in electronic design automation to describe digital and mixed signal systems such as FPGA and integrated circuits. VHDL can also be used as a general purpose parallel programming language.

The disadvantage of using VHDL are, the modules must be defined by a prototype, the use of the keyword "down to" in every bit vector definition is tedious, missing a single signal in the sensitivity list can cause catastrophic differences between simulation and synthesis , each process must have a sensitivity list that may sometimes be very long. Verilog, standardized as IEEE 1364, is a hardware description language (HDL) used to model electronic systems. It is most commonly used in the design and verification of digital circuits at the register-transfer level of abstraction. It is also used in the verification of analog circuits and mixed-signal circuits.

The advantages of using verilog coding are verification through simulation, it allow architectural trade of bit short turn around, enable automatic synthesis, reduce time for design capture and it is easy to change.

Today's SoCs need a network on chip IP interconnect fabric to reduce wire routing congestion, to ease timing closure, for higher operating frequencies and to change IP easily. Network on chips are a critical technology that will enable the success of future system on chips for embedded applications. This technology of network on chip is expected to dominate computing platforms in the near future. The paper is organized as follows: Section II explains about the existing overview of the algorithms. Section III explains the proposed method. Section IV discusses about results. Finally, Section V provides the conclusion



**Cite this article as:** Hemasundari H, R Anandha Praba. "Power Analysis of Embedded Low Latency Network on Chip". *International Conference on Computer Applications 2016*: 46-49. Print.

## II. Existing Overview

The input ports buffer input flits and send requests to the allocators. The routing computation module determines the output port based on the routing algorithm. After the route computation, a free output VC (OVC) in the next router is assigned to the input VC (IVC) by sending request to the VC allocator. If an OVC is successfully assigned, then another allocation request will be sent to the switch allocator. The crossbar is then configured to send the desired flit to the output port if the switch allocation request is granted. In order to send requests to the switch allocator, the available space in the next router buffer must be known. In the existing system the routers ore used by using the dynamic algorithms like XY algorithm.

The design tradeoffs for hard and soft FPGA-based networks-on-chip proposed by M. S. Abdelfattah and V. Betz, presents the design of NOC by using the router. In this paper there is a chance of congestion since it does not have the allocator. We remove control overheads (routing and arbitration logic) from the critical path in order to minimize cycle-time and latency.

The Design of On-the-fly Virtual Channel Allocation for Low Cost High Performance On-Chip Router proposed the on-the-fly virtual channel (VC) allocation for low cost high performance on-chip routers. By performing the VC allocation based on the result of switch allocation, the dependency between VC allocation and switch traversal is removed and these stages can be performed in parallel.

## III. Proposed Method

In the proposed system low latency router micro architecture with VC allocator and switch allocator is used. Any input flit that is passing through the switch can be successfully delivered at the output as the path request is sent through the VC allocator. The switch and VC allocator is designed in parallel. The scheduler is used with the XY algorithm in order to transfer the datas properly. To reduce the communication latency while maintaining good throughput, a router needs to perform several stages such as route computation, VC allocation, and switch allocation in parallel.

In the proposed NOC router architecture as shown in figure 1, any request which has been granted service by the switch allocator is able to pass a flit to the output port successfully. An efficient masking technique is proposed to filter all switch allocation requests that are not able to pass flits to the output port, either due to the lack of free space in assigned VC or due to the lack of free VC in the output port for non assigned VC requests. Our proposed technique has minimal impact in timing and area overhead of an NOC router. It is also fully parameterizable in terms of number of VCs, buffer width, and flit width.

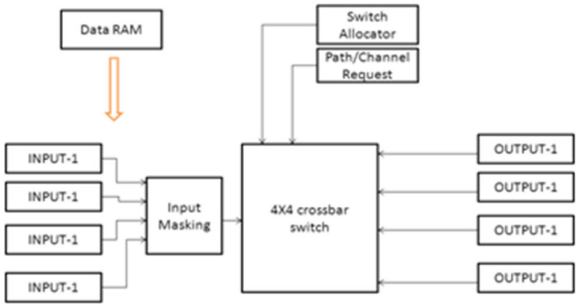


Fig 1. Block Diagram

A crossbar switch (cross-point switch, matrix switch) is a collection of switches arranged in a matrix configuration. A crossbar switch has multiple input and output lines that form a crossed pattern of interconnecting lines between which a connection may be established by closing a switch located at each intersection, the elements of the matrix.

Virtual channel router (VCR) is a router which uses wormhole network flow control with virtual channels. This router architecture has 5 input and output ports. Four of them are connected to neighbor routers and one is for router's local core. Each input port has 4 virtual channels which are de-multiplexed and buffered in FIFOs. After FIFOs the virtual channels are multiplexed again to a single channel that goes to a crossbar. Routing operations in the crossbar are controlled by an arbitration unit (AU). Arbitration unit also takes care that there are no conflicts between virtual channels and that the arbitration is fair.

Each packet maintains state indicating the availability of buffer space at their assigned output VC. When flits are waiting to be sent, and buffer space is available, an input VC will request access to the necessary output channel via the router's crossbar. On each cycle the switch allocation logic matches these requests to output ports, generating the required crossbar control signals.

After masking the IVC requests, these requests are sent to the switch allocator. Due to having two levels of arbitrations in the switch allocator, arbiter delay is an important parameter in defining the NOC critical path. Hence, to minimize the arbitration delay, fast arbiter proposed. The VC allocation stage assigns an empty VC in the neighboring router connected to the output port. Since several header flits may send requests for the same VC, arbitration is required. The routing computation as well as the VC allocation only requires the header flit. The body and tail flits will follow their respective header flit.

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If VC allocation is successful, the third stage sends request to the switch allocator to allocate the output port. Each packet maintains state indicating the availability of buffer space at their assigned output VC. When flits are waiting to be sent, and buffer space is available, an input VC will request access to the necessary output channel via the router's crossbar. The separable input-first allocators have the advantage of lower communication delay, area overhead, and power consumption compared to other schemes. Hence, the separable input-first allocator has been chosen to be implemented in our low latency NOC router. A separable input-first allocator consists of two levels of arbitrations.

Routing algorithm determines the output port which a packet must be sent to reach its destination. Deterministic routings act well when dealing with uniform traffic where congestion has been distributed equally across all links in an NOC. However, the nature of NOC traffic is bursts which results in imbalanced distribution of traffic across all links. Hence, deterministic routing results in poor performance for such traffic. As packets can be sent to multiple ports, a port selection module is required to select the desired output port among them. In the case of look-ahead deterministic routing algorithm, only single output port is selected and it can be directly used in our proposed design.

## IV. Results

In this paper, the datas can easily reach the destination by using the routers. The routers help in guiding the datas to the required output ports. The switch has fours input and output ports. The inputs are given in four directions north,south,east and west. In the same way the outputs are obtained.

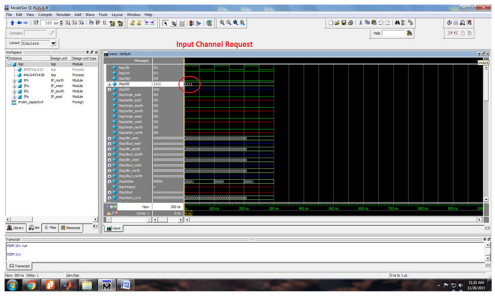


fig 2.Input Request

In this fig 2,the input channel is requested through the router and waiting for the acknowledgement from the output side.The datas are given in four directions.

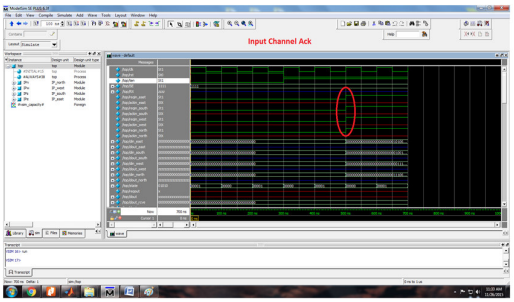


Fig 3.Input Acknowledgement

The input channel acknowledgement is shown in Figure 3.

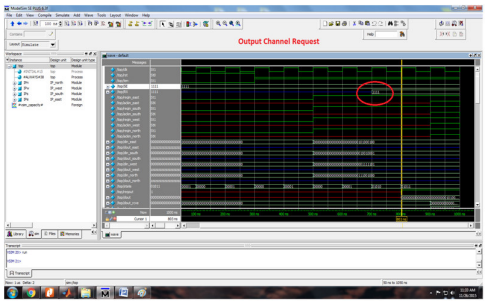


Fig 4. Output channel request .

The output channel request is shown in Figure 4.

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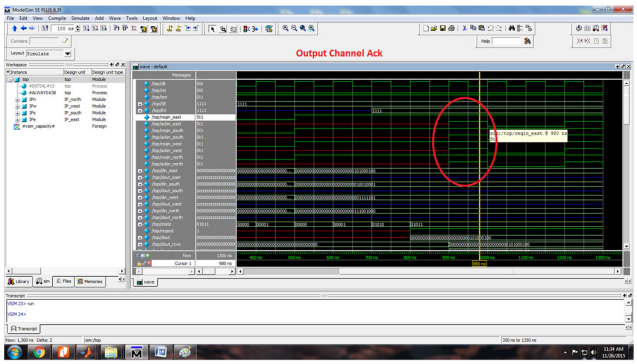


Fig 5.output acknowledgement

The output channel acknowledgement is shown in figure 5.

Table I.

| Device Utilization Summary (estimated values) | | | |
|---|---|---|---|
| Logic Utilization | Used | Available | Utilization |
| Number of Slices | 25 | 704 | 3% |
| Number of Slice Flip Flops | 43 | 1408 | 3% |
| Number of 4 input LUTs | 11 | 1408 | 0% |
| Number of bonded IOBs | 111 | 108 | 102% |
| Number of GCLKs | 1 | 24 | 4% |

The number of slices, flip flops and I/O ports that are used is shown in table 1.

## V. Conclusion

In this work a Network-on-chip (NOC) is a new paradigm in complex system-on-chip (SOC) designs that provide efficient on chip communication networks was proposed. It allows scalable communication and allows decoupling of communication and computation. In this project we designed, implemented and analyzed crossbar router architectures for a network on chip communication in a FPGA. Our Proposed architecture is optimized in five main criteria, which are 4x4 crossbar switch, switch allocator, path and channel request, data ram and 4 I/O ports compared to existing works.

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**Cite this article as:** Hemasundari H, R Anandha Praba. "Power Analysis of Embedded Low Latency Network on Chip". *International Conference on Computer Applications 2016*: 46-49. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA010 | **eAID** | ICCA.2016.010 |


# Analyzing the Signal Flow and RF Planning in GSM Network

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**Abstract:** *RNS (Radio Network Sub-system) is one of the important subsystem in GSM (Global System for Mobile communication) architecture. It connects the mobile user to the GSM backbone for switching. This project involves in a study on the functions carried out by each part of the system and how the nodes or equipments involved in GSM Radio network are connected to each other designing of air interface in GSM is one of the vital parts in GSM planning. This project involves in a study of how the air interface in mobile environment is planned and engineered.*

**Keywords:** *Frequency planning, cell planning; BCCH, BSIC, HSN, MAIO, TCH Drop.*

## I. INTRODUCTION

Wireless communication plays a key role to transmit enough information to the longer distance, now a day's research in wireless communication is increasing towards effective frequency planning for a cellular network in a city. A GSM (Global System for Mobile Communication) is an open, digital cellular technology used for transmitting mobile voice and data services. It digitizes and compresses data, then sends it down through a channel with two other streams of customer data, each in its individual time slot. GSM deals with 900 and 1800MHz uplink and downlink frequency. The information taken from customer complaint, drive test and traffic statistics of cellular network helps to optimize using relevant tools and by fine parameter tuning, one can increase the KPI's [1]. A practical implementation of handover success rate and voice quality are improved by participating over several BTS sites during BBH (Bouncing Busy Hour) and NBH (National Busy Hour) period [2]. QoS (Quality of Service) reports based on different key parameters such as CCSR(Call set up success rate) ,HSR(Handover Success Rate),CDR(Call Drop Rate) and TCH (traffic channel) congestion rate are duly beneficial for management team to compare network performance with the competitor's one called as benchmarking and to plan network evolution and strategy [5]. From the survey above, some authors have suggested several ideas to improve the KPI of GSM networks. However, some ideas had not implemented in live GSM network. In this paper, the analysis of signal flow is made and RF planning is done using ATOLL tool to a particular range of area. The results are shown using ATOLL tool as comparative screenshots between existing and designed areas. The remainder of this paper is as follows: Section 2 depicts the architecture model and description of the network layout and rules of planning. The comparative results obtained are discussed as well as matlab results are shown accordingly in Section 3. At last, the conclusion remarks are presented in Section 4.

## II. Architecture Model

RF Planning is the process of assigning frequencies, transmitter location and parameters of a wireless communication system to provide sufficient coverage and capacity for the services required.



**Cite this article as:** S GaneshBabu, I Vatsala Priya. "Analyzing the Signal Flow and RF Planning in GSM Network". *International Conference on Computer Applications 2016*: 50-53. Print.

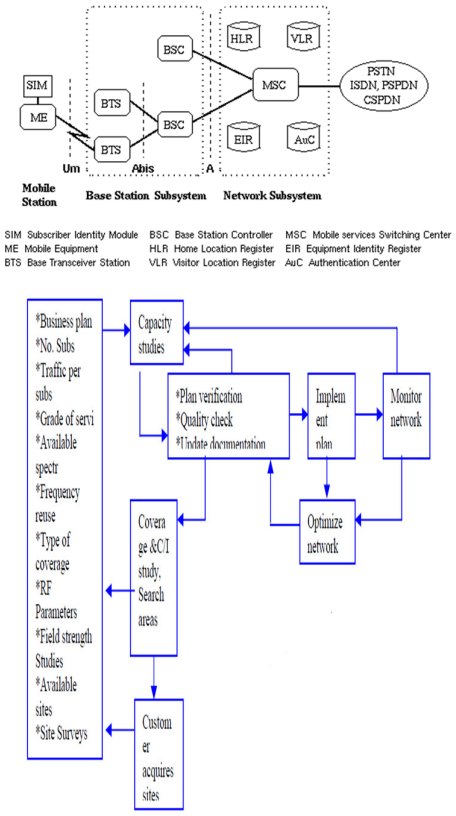



Fig. 2: Simple planning process

The effective RF planning should follow:

## A. Capacity Planning

The capacity that a network can handle is measured in terms of the subscribers or the traffic load. Here, the Erlang is calculated for 20 BTS coverage area, which gives the number of traffic channels for different number of carriers.

## B. Coverage Planning

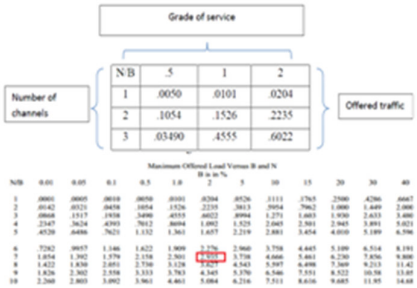
The objective of coverage planning phase is to find a minimum amount of cell sites with optimum locations for producing the required coverage for the target area. It is normally performed with prediction modules on digital map database.

## C. Frequency Planning

The main objective of the frequency planning task is to increase the efficiency of the spectrum usage by keeping the interference under some predefined level in the network. Therefore it is always related to interference predictions. The frequency assignment problems can be solved by two basic approaches:

- Frequency reuse patterns
- Automatic frequency allocation

Table I Erlong Analysis




**Cite this article as:** S GaneshBabu, I Vatsala Priya. "Analyzing the Signal Flow and RF Planning in GSM Network". *International Conference on Computer Applications 2016*: 50-53. Print.

## III. Results and Discussion

The results are presented in the form of screenshots obtained from ATOLL tool. The network layout is Chennai city and the particular area is taken for RF planning. The planning results in low interference and higher signal strength.

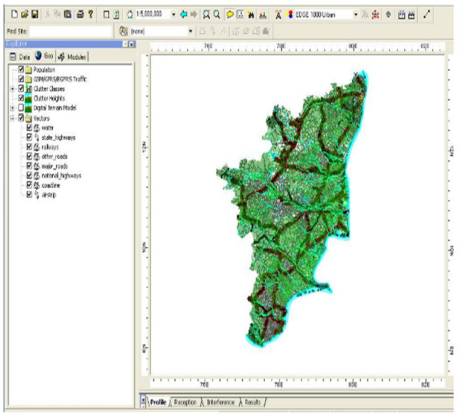


Fig. 3: Digital terrain model

The fig. 3 shows the digital terrain which has latitudinal and longitudinal information of the area to be frequency planned.

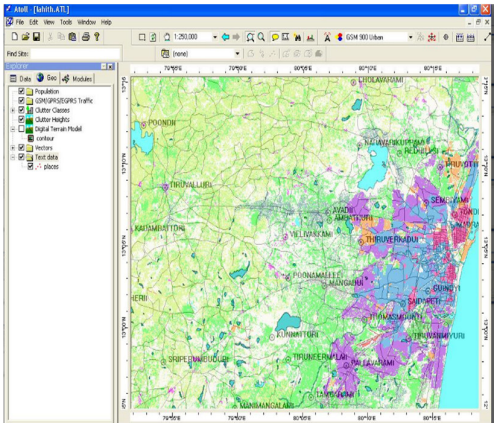


Fig. 4: Area chosen for planning in Chennai city

The frequency planning of 4BTS covers in and around areas of Guindy, which covers about 1kms approximately. The frequency planning of 20BTS covers from Avadi in the north to Thambaram in the south of about 35kms approximately.

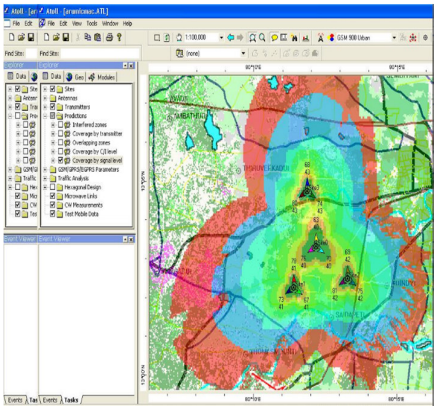


Fig. 5: Signal level of 4BTS

**Cite this article as:** S GaneshBabu, I Vatsala Priya. "Analyzing the Signal Flow and RF Planning in GSM Network". *International Conference on Computer Applications 2016*: 50-53. Print.

The fig. 5 shows the signal level of 4 BTS in GSM network.The value of the signal level varies between -43 to -110dBm. The green color depicts the very good signal strength of the network that is around -43dbm. The blue color is the optimum signal strength of the network.The red colordepictsthe poor signal strength of the network that is below -110dBm.The higher the value will higher be the signal strength.

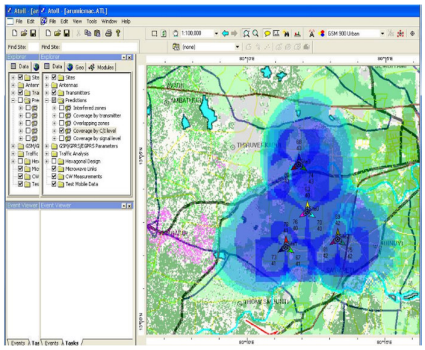


Fig.6: C/I level of 4BTS

The fig.6 shows the channel to interference level of 4 BTS in GSM network. Generally, a standard value for best C/I level is >=9dB whereas in practical it is found to be >=12dBas a best result. Here, the dark blue represents the lowest interference range. The light blue depicts the optimum C/I level of the network. The green color depicts the area where highest interference occur.

## Conclusion

The report focuses on reviewing the concept of frequency planning and neighbor management in GSM mobile network. RF Network planning is the foundation of a mobile communication network, especially the wireless parts in a mobile communication network. Network Dimensioning (ND) is usually the first task to start the planning of a given cellular network. The main result is an estimation of the equipment necessary to meet the capacity, coverage and quality. The capacity of the frequency is calculated by using the Erlang table. Coverage planning and site selection are performed on parallel with the site acquisition in interactive mode. The main goal of the frequency-planning task is to increase the efficiency of the spectrum usage, keeping the interference in the network below some predefined level.

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**Cite this article as:** S GaneshBabu, I Vatsala Priya. “Analyzing the Signal Flow and RF Planning in GSM Network”. *International Conference on Computer Applications 2016*: 50-53. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA011 | **eAID** | ICCA.2016.011 |


# An Image Segmentation and Classification for Brain Tumor Detection using Pillar K-Means Algorithm

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**Abstract -** *Human brain is the most complex structure where identifying the tumor like diseases are extremely challenging because differentiating the components of a brain is complex. In this paper, pillar k-means algorithm is used for segmentation of brain tumor from magnetic resonance image (MRI).Generally, the brain tumor is detected by radiologist through analysis of MR images which takes longer time. The pillar k-means algorithm's experimental results clarify the effectiveness of our approach to improve the segmentation quality, accuracy, and computational time. Classify, the tumor from the brain MR images using Bayesian classification.*

**Keywords –** *Pillar k-means algorithm, Magnetic resonance image (MRI), Brain tumor, Bayesian classification.*

## I. INTRODUCTION

Each cell in the human body has its special function and will grow and divide in an order to keep the body healthy. When cells lose the ability to control their growth the cell division starts without any order. The extra cells form as a mass of tissue called as tumor. Tumors that originate within brain tissue are known as primary brain tumor. Brain tumor will be differentiated by grade I to grade IV. Cells from higher grade tumors are more abnormal and grow faster than grade I tumors. The amount of drug to be pumped into the human body to cure the tumor cells depends on the size of the tumor and this can be obtained accurately by Magnetic Resonance imaging (MRI) scan or a CT scan (Computed Tomography). However, in this paper, MRI scan images are used for the analysis. MRI is a very powerful tool to diagnose the brain tumors. It gives pictures of the brain and requires no radiation. The acquired image is analyzed using image processing methods. Image segmentation and clustering procedure are introduced to estimate the area of the tumor. Image segmentation is classified into Pixel based methods, regional methods and edge based methods. In this paper the brain tumor images are partitioned into multiple segments as sets of pixels using pixel based segmentation. The MRI Image represents white and grey color pixel elements. White color pixel data points are related to tumor cells and the Gray color pixel data points relate to normal cells. Collection of data points of the pixels that belongs to the same color will be quantified using Euclidian distance method. The clusters may contain large number of pixels. The pixels may be either close or far from the cluster center. If the cluster centers are known, allocate each pixel point to the closest cluster center. Each center is the mean of the points allocated to that cluster. In order to estimate the area of the tumor, Manual segmentation, Fuzzy C-Means, K-Means and Pillar K-Means clustering algorithms are used to obtain the true area of the tumor.

## II. Existing Overview

Markov random field is used along with the CS algorithm to find the optimum values for a function. Threshold for the segmentation process is obtained by calculating centre pixel intensity from the label's kernel. The existing method is based on the threshold and region growing. In case of the region growing based segmentation it needs more user interaction for the selection of the seed. Seed is nothing but the center of the tumor cells the regional growing method ignored the spatial characteristics. Normally spatial characteristics are important for malignant tumor detection. This is the main problem of the current system.



**Cite this article as:** Kumar A, R Anandha Praba. "An Image Segmentation and Classification for Brain Tumor Detection using Pillar K-Means Algorithm". *International Conference on Computer Applications 2016*: 54-58. Print.

## III. Proposed Algorithm

The proposed method is a combination of two algorithms. In the literature survey many algorithms were developed for segmentation. But they are not good for all types of the MRI images. This paper proposes a new approach for MRI brain tumor detections that utilizes Pillar Algorithm to optimize K-means clustering. The Pillar algorithm performs the pillars placement which should be located as far as possible from each other to withstand against the pressure distribution of a roof, as identical to the number of centroids amongst the data distribution. It designates the initial centroids positions by calculating the accumulated distance metric between each data point and all previous centroids, and then selects data points which have the maximum distance as new initial centroids. The segmentation process by this approach includes a new mechanism for clustering the elements of high-resolution images in order to improve precision and reduce computation time. It can improve significantly performance of the information extraction, such as color, shape, texture, and structure.

The Pillar algorithm is described as follows. Let X={xi |i=1,…,n} be data, k be number of clusters, C={ci | i=1,…,k} be initial centroids, SX ⊆ X be identification for X which are already selected in the sequence of process, DM={xi |i=1,…,n} be accumulated distance metric, D={xi | i=1,…,n} be distance metric for each iteration, and m be the grand mean of X. The following execution steps of the proposed algorithm are described as:

1. Set C=Ø, SX=Ø, and DM=[ ]
2. Calculate D□ dis(X, m)
3. Set number of neighbors = α* n / k
4. Assign □ (D)
5. Set neighborhood boundary = β*
6. Set i=1 as counter to determine the initial centroids
7. DM = DM + D
8. 8. Select ж □ xargmax (DM) as the candidate for initial centroids
9. SX=SX U ж
10. Set D as the distance metric between X to ж.
11. Set no□ number of data points fulfilling D ≤
12. Assign DM (ж) = 0
13. If no < , go to step 8
14. Assign D (SX) = 0
15. C = C U ж
16. i = i + 1
17. If i ≤ k, go back to step 7
18. Finish in which C is the solution as optimized initial centroids.

Steps involved in this system are: pre-processing, feature extraction, association with segmentation and classification. The pre-processing step has been done using the median filtering process and features have been extracted using adaptive histogram equalization technique. This paper presents a new approach to image segmentation using Pillar K-means algorithm. This segmentation method includes a new mechanism for grouping the elements of high resolution images in order to improve accuracy and reduce the computation time. The system uses K-means for image segmentation optimized by the algorithm after Pillar.

The Bayesian algorithm is a set of rules for using evidence (data) to change your beliefs, an algorithm is a set of rules for doing a calculation. Here we using Bayesian algorithm for classification of tumor (i.e) stage I, stage II, stage III, or stage IV.

### Block Diagram

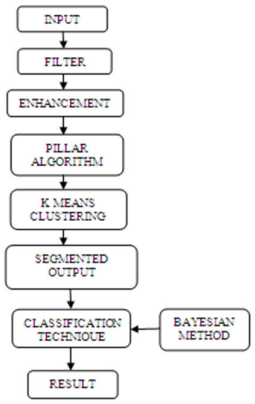



Figure 1.1. block dragram of brain tumor segmentation using pillar k-means algorithm

**Cite this article as:** Kumar A, R Anandha Praba. "An Image Segmentation and Classification for Brain Tumor Detection using Pillar K-Means Algorithm". *International Conference on Computer Applications 2016*: 54-58. Print.

### Feature Extraction

The feature extraction is extracting the cluster which shows the predicted tumor at the FCM output. The extracted cluster is given to the thresholding process. It applies binary mask over the entire image. It makes the dark pixel become darker and white become brighter. In threshold coding, each transform coefficient is compared with a threshold. If it is less than the threshold value then it is considered as zero. If it is larger than the threshold, it will be considered as one. The thresholding method is an adaptive method where only those coefficients whose magnitudes are above a threshold are retained within each block. Let us consider an image 'f" that has the k gray level. An integer value of threshold T, which lies in the gray scale range of k. The thresholding process is a comparison. Each pixel in 'f 'is compared to T. Based on that, binary decision is made. That defines the value of the particular pixel in an output binary image 'g': g (n) = „0" if f (n) >= T „1" if f (n) < T

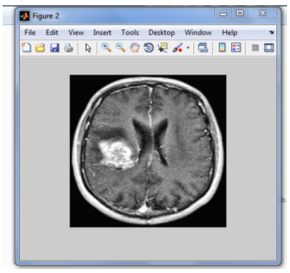
Approximate Reasoning In the approximate reasoning step the tumor area is calculated. That is the image having only two values either black or white (0 or1). Here 256x256 jpeg image is a maximum image size. The binary image can be represented as a summation of total number of white and black pixels.

Where, P = number of white pixels 1 Pixel = 0. 264 mm

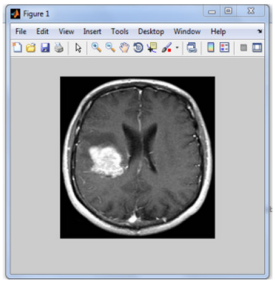
The area calculation formula is

$$Size\_of\_Tumor, S = (\sqrt{P})*0.264$$

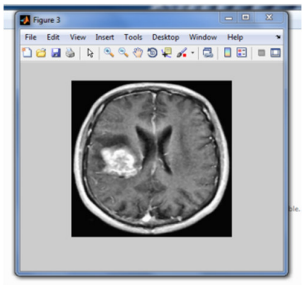
## IV. Comparison and Results



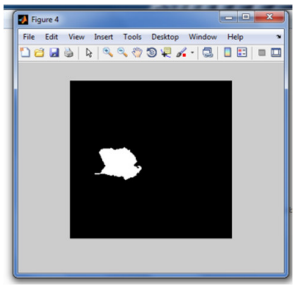
Input MRI



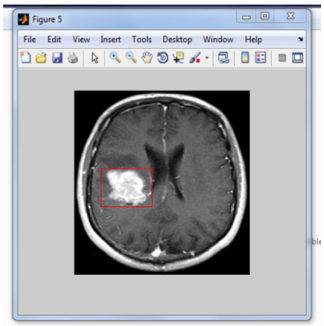
Filter output



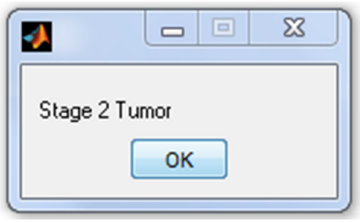
Enhancement output



Pillar output



Segmentation output




Bayesian classification output

The above pictures are the step by step output of pillar k-means algorithm.

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```
Time for Segmentation:
Pillar K Mean:

eptime =

    6.1098

Cuckoo Search:

ectime =

   10.3453

Finding keypoints...
59 keypoints found.
Stage 2 Tumor
```

Here, from above figure we show computation time comparison between pillar k-means algorithm and cuckoo search algorithm. Where, cuckoo search takes 10.3 seconds for segmentation but pillar k-means algorithm takes just 6.1 seconds for segmentation and additionally it describes the classification of tumor (i.e) stages of tumor like stage I, stage II, stage III, or stage IV.

## V. Conclusion

For treatment of Brain tumor, size and location of the tumor is to be determined. K-Means and Pillar K-Means Algorithms are used to estimate the area of the tumor. The proposed Pillar K-Means algorithm has shown better results than the other methods and is able to optimize the computation time and hence improved the precision and enhanced the quality of image segmentation. And also location of the tumor may be determined in addition with the size i.e. area of the tumor and the location of the tumor is very important for applying the radiation or chemo therapy.

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**Cite this article as:** Kumar A, R Anandha Praba. "An Image Segmentation and Classification for Brain Tumor Detection using Pillar K-Means Algorithm". *International Conference on Computer Applications 2016*: 54-58. Print.

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International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA012 | **eAID** | ICCA.2016.012 |


# An adjustable Comparator for 2-bit/step SAR ADC Configuring with multiple samples per second in 40nm CMOS

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**Abstract:** *A low-power 2-bit/step operation technique is proposed which uses dynamic threshold configuring comparator instead of multiple digital-to-analog converters (DACs). Power and area overhead is minimized by successively activated comparators. The comparator threshold is configured by simple Vcm biased current source, which keep the ADC free from power supply variations over 10%. To implement power efficient and high performance analog-to-digital converters the designers are urged to design an optimized dual tail comparator. In this paper, It is shown that in the proposed dual tail comparator both the power and delay time is significantly reduced.*

**Keywords:** *Successive Approximation Register (SAR), high speed analog to digital converter (ADC), Dynamic threshold comparator, Dual tail comparator.*

## I. INTRODUCTION

To Provide ubiquitous computing, demand for low power circuits is expanding. Handheld mobile devices such as smartphones communicate with a server to provide various functions. However, in the future, smartphones will also connect to other hardware devices, such as medical devices and sensor nodes, as well [1]. Such ubiquitous computing will create more innovative applications but there are severe challenges in hardware design. As the wireless trafficis predicted to increase massively, the power consumption of wireless circuits is to increase simultaneously as well, far beyond the growth of battery capacity. Therefore, we focus on designing low-powered analog-to-digital converters (ADCs)

Many low-power ADCs for radios and sensor nodes has been proposed, most using the successive-approximation register (SAR) ADC architecture [2]–[4]. This architecture has a superior power efficiency compared with the other architectures which use power-hungry op-amps. A number of highly power efficient designs has been presented at low-speed domains. By improving the charge-redistribution digital-to-analog converters (DACs) [2] and using 500 Af unit capacitors in the DAC [3], analog power consumption was reduced significantly. SAR ADC can achieve high power efficiency at a high resolution by designing reconfigurable comparators [4] and majority voting [5].Although in most of the research, the operating speed is within sensor application and insufficient for radio requirements which often demand ADCs operating over few tens of MS/s. The SAR ADC has a bottleneck of speed, because the SAR search algorithm requires n clock cycles to obtain an n bit resolution. We have worked on improving the speed of lowpower SAR ADCs in the past, by optimizing the delay time of each cycle. However, the speed increased by only 20% [6]. Considering that SAR ADC consumes only dynamic power, time interleaving will be a good way to provide high-speed operation [7].In this paper, a comprehensive analysis about the delay of dynamic comparators has been presented for various architec-tures. Furthermore, based on the dual tail structure proposed in [10], a new dynamic comparator is presented, which does not require boosted voltage or stacking of



**Cite this article as:** A Gouthaman, I Vatsalapriya. "An adjustable Comparator for 2-bit/step SAR ADC Configuring with multiple samples per second in 40nm CMOS". *International Conference on Computer Applications 2016*: 59-63. Print.

too many transistors. Merely by adding a few minimum-size transistors to the conventional dual tail dynamic comparator, latch delay time is profoundly reduced. This modification also results in con-siderable power savings when compared to the conventional dynamic comparator and dual tail comparator.

## II. Architecture Model

### A. 2-bit/Step WithDynamic Threshold Comparators

2-bit/step ADC with successively activated comparators (SAC) and the block diagram and operation concept is shown in Fig. 2. After the external sampling clock (CLK ext) sets down, an SA cycle 1starts by rising φ1 and CP1 decides the first bit (OUTCP1).After the first bit decision, VTH comp of CP2 (VTHCP2) isset and reflects the result of OUTCP1. In this case OUTCP1is 1, thus VTHCP2 is set to 12/16 V ref and the second bit (OUTCP2) is decided. In the proposed ADC, the 2-bit quantizer operates like a binary-search ADC [8], where the second comparator is activated reflecting the preceding comparator's results.

Because the second comparator threshold is configured dynamically every cycle, only two comparators are required instead of three. The register units (Cyc. N reg.) and a synchronous internal clock generator (Clock gen.) are custom designed dynamic logic cells and specific details are discussed in [9]. The results of SA cycle 1 are stored in MSB and 2ndMSB registers, respectively.

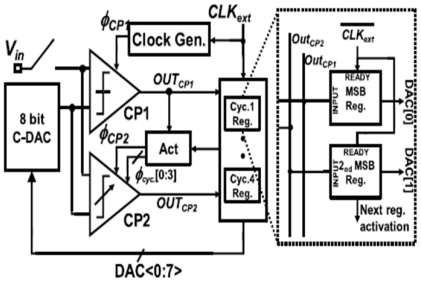
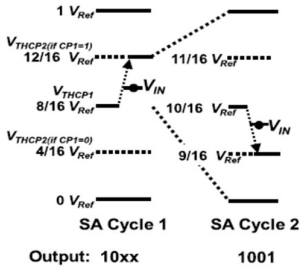



Fig. 1. Proposed 2-bit/step SAR ADC with successively activated comparators Block diagram.

Fig. 2. Operation of dynamic threshold comparator in SAR ADC



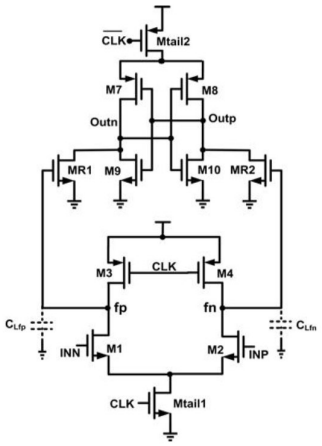




Fig. 3. Schematic diagram of the conventional dual tail dynamic comparator

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## B. Conventional Dual tail Dynamic Comparator

A conventional dual tail comparator is shown in Fig. 3 [10]. Which has comparatively less power consumption. This topology has less stacking and therefore can operate at lower supply voltages compared to the conventional dynamic comparator. The double tail enables both a large current in the latching stage and wider Mtail2, for fast latching independent of the input common-mode voltage (Vcm), and a small current in the input stage (small Mtail1), for low offset [10]. The operation of this comparator is as follows (see Fig. 4).

During reset phase (CLK = 0, Mtail1, and Mtail2 are off), transistors M3-M4 pre-charge fn and fp nodes to VDD, which in turn causes transistors MR1 and MR2 to discharge the output nodes to ground. During decision-making phase (CLK = VDD, Mtail1 and Mtail2 turn on), M3-M4 turn off and volt-ages at nodes fn and fp start to drop with the rate defined by IMtail1/Cfn(p) and on top of this, an input-dependent differential voltage _Vfn(p) will build up.

The intermediate stage formed by MR1 and MR2 passes Vfn (p) to the cross coupled inverters and also provides a good shielding between input and output, resulting in reduced value of kick back noise [10].

## III. Proposed Dual Tail Dynamic Comparator

Fig. 5 demonstrates the schematic diagram of the proposed dynamic dual tail comparator. Due to the betterperformance of dual tail architecture in low-voltage applications, the proposed comparator is designed based on the dualtail structure.

The mainidea of the proposed comparator is to increase _Vfn/fp in order to increase the latch regeneration speed. For this purpose, two control transistors (Mc1 and Mc2) have been added to the first stage in parallel to M3/M4 transistors but in a cross-coupled manner [Fig. 3].

## A. Operation of the Proposed Comparator

The operation of the proposed comparator is as follows. During reset phase (CLK = 0, Mtail1 and Mtail2 are off, avoiding static power), M3 and M4 pulls both fn and fp nodes to VDD, hence transistor Mc1 and Mc2 are cut off. Intermediate stage transistors, MR1 and MR2, reset both latch outputs to ground.

During decision-making phase (CLK = VDD, Mtail1, and Mtail2 are on), transistors M3 and M4 turn off. Furthermore, at the beginning of this phase, the control transistors are still off (since fn and fp are about VDD). Thus, fn and fp start to drop with different rates according to the input voltages.

Suppose VINP > VINN, thus fn drops faster than fp, (since M2 provides more current than M1). As long as fn continues falling, the corresponding pMOS control transistor (Mc1 in this case) starts to turn on, pulling fp node back to the VDD; so another control transistor (Mc2) remains off, allowing fn to be discharged completely.

In other words, unlike conventional dual tail dynamic comparator, in which _Vfn/fpis just a function of input transistor trans conductance and input voltage difference, in the proposed structure as soon as the comparator detects that for instance node fn discharges faster, a pMOS transistor (Mc1) turns on, pulling the other node fp back to the VDD. Therefore by the time passing, the difference between fn and fp (_Vfn/ fp) increases in an exponential manner, leading to the reduction of latch regeneration time.

Despite the effectiveness of the proposed idea, one of the points which should be considered is that in this circuit, when one of the control transistors (e.g., Mc1) turns on, a current from VDD is drawn to the ground via input and tail transistor (e.g., Mc1, M1, and Mtail1), resulting in static power consumption.

## IV. Simulation Results

In order to compare the proposed comparator with the conventional and double-tail dynamic comparators, all cir-cuitshave been simulated.

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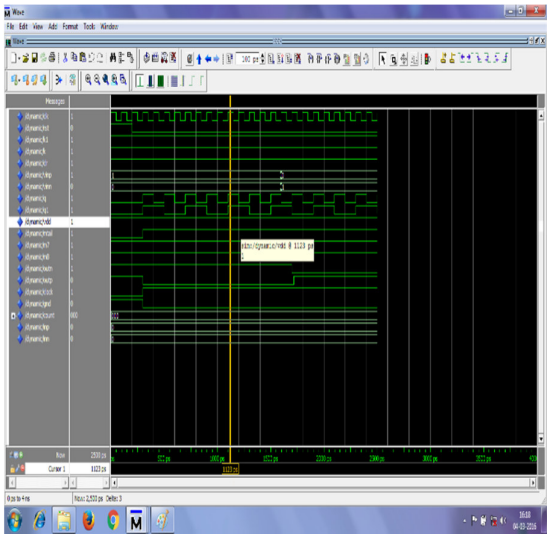

Fig.4. Simulation result of dynamic threshold comparator

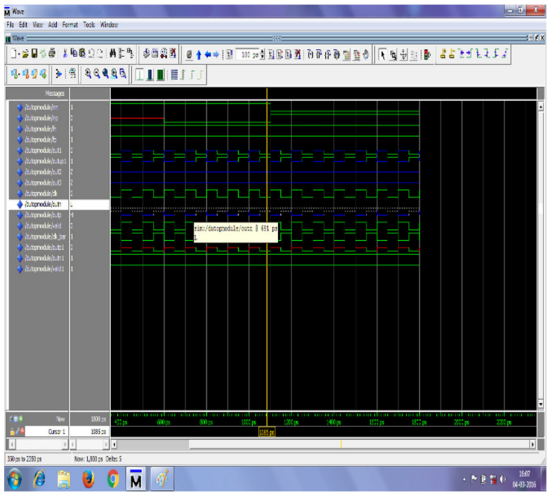

Fig.5. Simulation result of proposed dynamic dual tail comparator

Fig. 5 demonstrates the schematic diagram of the proposed dynamic dual tail comparator which is applied in SAR ADC to the application of phase generator.

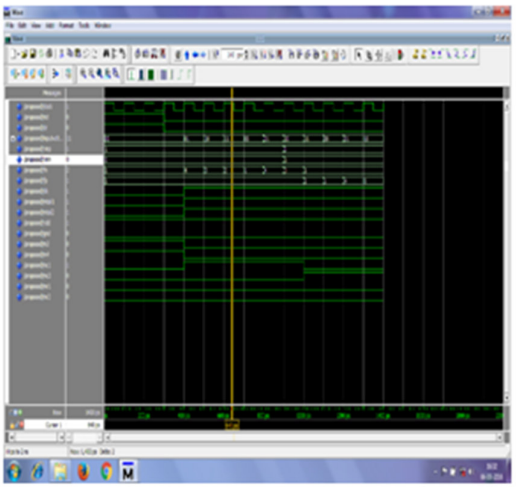

Fig.6 Simulation result of proposed comparator with SARADC

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From the figure.6, the proposed method of comparator (dual tail comparator) which has applied to the SAR ADC can be clear with power consumption and time delay.

## Conclusion

In this paper, we presented a analysis of dual tail comparator in SAR ADC in terms of power, area and delay. Both comparators namely conventional threshold dynamic comparator and conventional dual tail dynamic comparators were analyzed. By Compared with conventional threshold configuring techniques, the proposed method can generate large comparator offset with small power.

The design method of the variable current source was presented and the power supply noise immunity was studied. The effect was confirmed by measurement and ADC had immunity against power supply variation of over 10%. Therefore this method can applied to the various applications of SAR ADC in which have already applied in Phase generator. With the proposed techniques, the ADC achieved over 50% speed improvement and achieved power efficiency competing with the state-of-the-art works.

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International Conference on Computer Applications 2016 [ICCA 2016]

| ISBN | 978-81-929866-5-4 |
|---|---|
| Website | icca.co.in |
| Received | 14 – March– 2016 |
| Article ID | ICCA013 |

| VOL | 05 |
|---|---|
| eMail | icca@asdf.res.in |
| Accepted | 02 - April – 2016 |
| eAID | ICCA.2016.013 |

# Applying Microservices in Webservices, with An Implementation Idea

**J Sylvia Grace[1], R Sreeranjani[2], A Rubika[3]**
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**Abstract:** *Web Services are self-describing services that will perform well defined tasks and can be accessed through the web. Service Oriented Architecture (SOA) is an architecture paradigm that focuses on building systems through the use of different Web Services, integrating them together to make up the whole system.*

*The Micro-service style is an approach to develop a single application as a suite of small services, each running in its own process and communicating with lightweight mechanisms. Preferring Micro-services over others, it makes the work on both client and server side smooth. This paper explains about the emerging Micro-services - which is the practice of applying SOA principles at a small level of granularity. This implementation idea explains how the Anna University result webpage can be divided using micro-services for easy access of results to students.*

**Keywords:** *Web-servies, Micro-service, SOA, Monolithic*

## INTRODUCTION

The big idea behind micro-services is to architect large, complex and long-lived applications as a set of cohesive services that evolve over time It is even been called lightweight or fine-grained SOA and is different than traditional SOA. More importantly, it solves many of the problems that many organizations currently suffer from. The goal of decomposition is not to have tiny services but to address the problems and limitations of the monolithic (large) architecture.

## 1. Web Services

A Web service, is a method of communication between two applications or electronic devices over the World Wide Web (WWW). Also called as application services, these are services including a combination of programming and data, which are made available from a Web server for Web users or other Web-connected programs. Providers of Web services are generally known as application service providers. Users can access some Web services through a peer-to-peer arrangement rather than by going to a central server. Some services can communicate with other services and this exchange of procedures and data is generally enabled by a class of software known as middleware. Web services are also increasingly enabled by the use of the Extensible Markup Language (XML). [1] Web-based applications using the XML, SOAP, WSDL and UDDI open standards over an Internet protocol backbone, where

- XML is used to tag the data
- SOAP and REST are used to transfer the data
- WSDL is used for describing the services available
- UDDI is used for listing what services are available. [2]



**Cite this article as:** J Sylvia Grace, R Sreeranjani, A Rubika. "Applying Microservices in Webservices, with An Implementation Idea". *International Conference on Computer Applications 2016*: 64-69. Print.

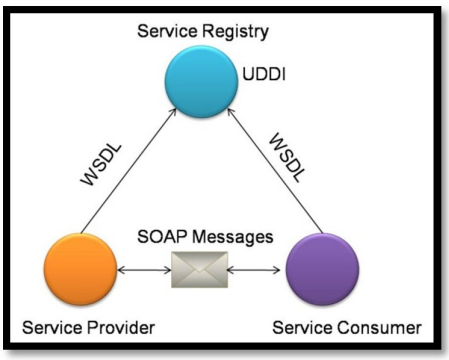


Figure 1: Web service

### 1.1 Soap and Rest

Web services are of two kinds:

1. Simple Object Access Protocol (SOAP)
2. Representational State Transfer (REST)

SOAP defines a standard communication protocol (set of rules) specification for XML-based message exchange. SOAP uses different transport protocols, such as HTTP and SMTP. [3]. SOAP defines its own security and is less preferred than REST. [4]

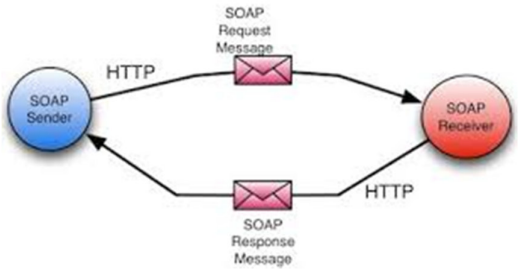


Figure 2: SOAP

REST describes a set of architectural principles by which data can be transmitted over a standardized interface (such as HTTP). A client can access the resource using the unique URI and a representation of the resource is returned. While accessing RESTful resources with HTTP protocol, the URL of the resource serves as the resource identifier and GET, PUT, DELETE, POST and HEAD are the standard HTTP operations to be performed on that resource. [4]

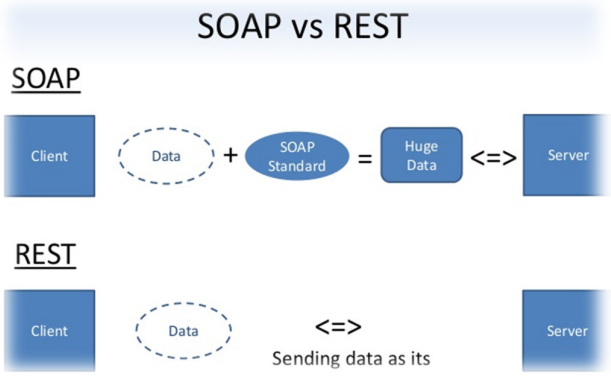


Figure 3: SOAP vs REST

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## 2. SOA

Service oriented architecture (SOA) is the application of service requester/provider concepts to middleware technology. With its loosely coupled nature, it allows enterprises to plug in new services or upgrade existing services in a granular fashion. It brings better reusability of existing assets and lets you create applications that can be built on top of new and existing applications. [5]

SOA is essentially a collection of services which communicate with each other. The communication can involve either simple data passing or it could involve two or more services coordinating some activity.

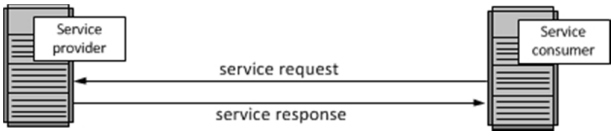


Figure 4: SOA Working

The benefit of implementing SOA with Web services is that you achieve a platform-neutral approach to access services and better interoperability as more vendors support more Web services specifications. [6]

## 3. Microservices

The emerging viewpoint on SOA is Microservices. Microservices is the practice of applying service-oriented architecture principles at a small level of granularity. These are self-contained and don't necessarily require an application server to host them. They enable you to implement much smaller deployable units, which then helps to push out updates or do features and capabilities much more quickly.

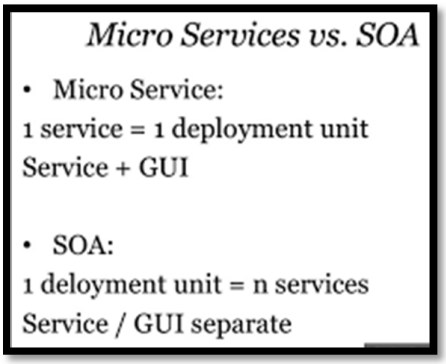


Figure 5: Microservices vs SOA

### 3.1 WHY Microservices in SOA?

Microservices are self-contained and don't necessarily require an application server to host them. These enables to implement much smaller deployable units, which then allows to push out updates or enhance features much more quickly.

Being just a small section of a much larger application, it helps to replicate and create multiple instances. Also, it spreads the load for just that one small piece of the application instead of having to do the entire system.[4]

Figure 6: Representing Microservices

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## 4. Monoliths

Monolithic servers are developed and deployed as a single unit. They increase the complexity and size and decrease the development, testing and deployment speed. This approach works well for relatively small applications. A large monolithic application can be difficult for developers to understand and maintain. To deploy changes to one application component you have to build and deploy the entire monolith, which can be complex, risky, time consuming, require the coordination of many developers and result in long test cycles.

This architecture also makes it difficult to trial and adopt new technologies. [5]

## 5. Upper Hand of Microservices over Monoliths

The concept of breaking monolithic applications into smaller applications began with SOA, in terms of breaking applications into modules and then to smaller services, called Microservices. This approach is to break the apps into separate containers in a way that enables intra-application communication rather than inter-application communications. Thus, this concept coincides with continuous delivery practices, where the goal is to push out small units without having to create a monolithic system.[5]

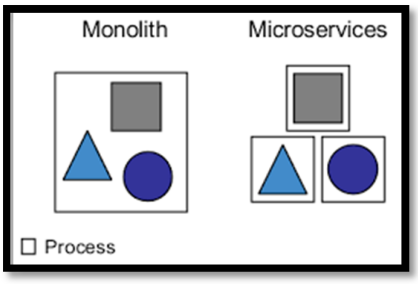


Figure 7: Differentiating Monolith & Microservices

## 6. Enabling Microservices in Frequently used Websites

In the recent days, students encounter the problem while checking their results. Considering one such web page - The Anna University Result Web page - we implement the concept of microservices into it. Microservices are an approach to development of a single application composed of small services. The key to idea of microservices is independence. Each service is developed, tested and deployed separately from each other and every service runs as a separate process. The only relation between different microservices is data exchange accomplished through APIs they're exposing. [7]

### 6.1 Execution of Suggested Example

The result page of Anna University intakes the student register number, date of birth and a security question in normal fashion. We have brought the idea of implementing microservices into it by adding 2 more input attributes to the result page, namely 'Place of college' and 'Department'. The 'Place of college' will be a drop down list which shows all the places where affiliated colleges are located.

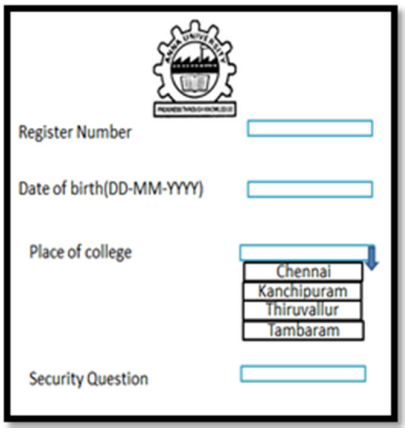


Figure 8: Suggested new webpage

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A student can give his/her register number, date of birth, place of college and a security question in the first page, and click Submit. This will validate all details and if they are correct, it directs to another page which shows all the college names located at the place given. The student can choose his/her college name, which directs to another page asking for the department. On giving this, the result of the student is easily located on the server, as many input queries filter the data's.

Since we direct the student to many pages unlike before, each page can be deployed using microservices.

That is, development of each page (referred by college name and place) can be done and stored in an individual fashion. This reduces load in both server side and client side. This methodology can even be applied to mobile applications, thus providing flexibility over monolith.

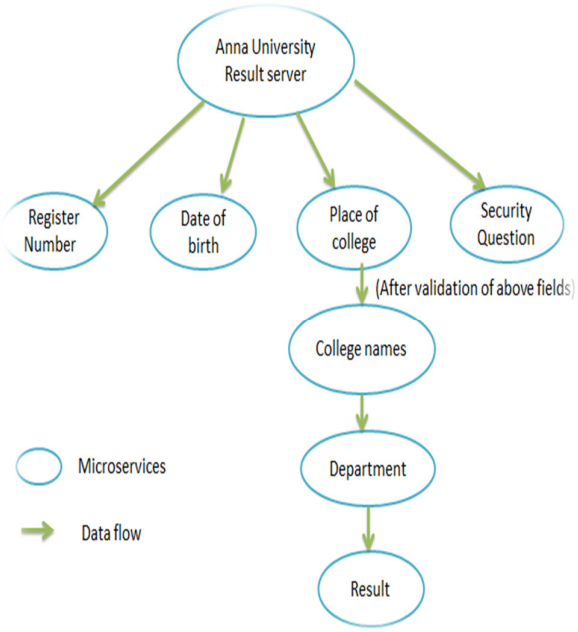


Figure 9: Information flow using Microservices

Now results can be viewed soon because the number of service requestors (students) get filtered continuously during progress of checking results. Thus, there will be around 552 microservices created for college names and around 15 microservices for Place of college. The number sounds large, but it produces great results. It's advantages are given below:

## 7. Positives

By deploying through microservice, both the service requestor and provider become advantageous. Few advantages are:

- Small and Simpler
- Independent Deployment:
- Independence in execution
- Improves fault isolation
- Reusability [8]

## 8. Implementing Microservices using Docker

Docker is an open-source project which aims to automate the deployment of applications inside portable containers that are independent of hardware, host operating system, and language. [9]

Containers allow a developer to package up an application with all of the parts it needs. The concept of Docker is all about making it easier to build, ship and run any application by using containers. [10]

- Build - Package your application in a container.

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- Ship - Move that container from a machine to another.
- Run - Execute that container (the application) [11].


Figure 10: Docker

One of the major positive of Docker is, it suits best for microservices architecture. Containers also support micro services architecture. Each micro service can be deployed without interrupting the other micro services and containers provide an ideal environment for service deployment in meaning of speed, isolation management, and lifecycle. [12]

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**Cite this article as:** J Sylvia Grace, R Sreeranjani, A Rubika. "Applying Microservices in Webservices, with An Implementation Idea". *International Conference on Computer Applications 2016*: 64-69. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|
| **ISBN** | 978-81-929866-5-4 |
| **Website** | icca.co.in |
| **Received** | 14 – March– 2016 |
| **Article ID** | ICCA014 |

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|---|---|
| **VOL** | 05 |
| **eMail** | icca@asdf.res.in |
| **Accepted** | 02 - April – 2016 |
| **eAID** | ICCA.2016.014 |

# MIMO Wireless based Cryptosystem using Electronic Key Generation Unit

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**Abstract:** *Wireless communication systems, multi-input multi-output (MIMO) technology has been recognized as the key ingredient to support higher data rate as well as better transmission quality after using this algorithm of a XTEA or MTEA scheme. Modified TEA is used for encryption of the text. Then decryption unit for decrypting the cipher text and convert that to plain text. Key generation unit is to generate 128bit key and these keys are send along with cipher text. Encryption and decryption system ensures the original data are send and received by the users in secured environment. The Received data are retrieving by the authorized users by providing key generation like private keys this Key Pattern generations provide more security to the messages. Extended tiny encryption algorithm or modified tiny encryption algorithm and tiny encryption algorithm are used to enhance the size, speed and security in the system. These algorithms are better compared to configurable joint detection decoding algorithm (CJDD) and valid symbol finder algorithm.*

**Keywords:** *Multi-input multi-output (MIMO), Modified or extended tiny encryption algorithm (MTEA), software defined radio (SDR).*

## I. INTRODUCTION

As computer systems become more pervasive and complex, security is increasingly important. This paper attempts to develop a simple, stronger and safer cryptographic algorithm which would not only be a secure one, but also reduces total time taken for encryption and decryption. In the existing system, there are some security issues. Hence in order to provide security mechanism, we propose an algorithm called Modified Tiny Encryption Algorithm (MTEA). The modified algorithm MTEA is a new secret-key block cipher of 64 bit that uses good features of Tiny Encryption Algorithm (TEA). TEA consumes more time and security level is very low. So we go for MTEA. In this paper we use MIMO wireless based cryptosystem.

This paper proposes a field-programmable gate array (FPGA)-based software defined radio (SDR). The implementation of digital FTS in SDR platform is purely a new kind. In this paper, we present a Software Defined Radio (SDR) platform which replaces a multiple platform-based system with a single platform. In the existing paper only one flight can be controlled but in the proposed paper more than one flight can be controlled. As computer systems become more pervasive and complex, security is increasingly important. This paper attempts to develop a simple, stronger and safer cryptographic algorithm which would not only be a secure one, but also reduces total time taken for encryption and decryption. In the existing system, there are some security issues. Hence in order to provide security mechanism, we propose an algorithm called Modified Tiny Encryption Algorithm (MTEA). The modified algorithm MTEA is a new secret-key block cipher of 64 bit that uses good features of Tiny Encryption Algorithm (TEA). TEA consumes more time and security level is very low. So we go for MTEA. In this paper we use MIMO wireless based cryptosystem.

This is one of the most modern developments in IC integration. They include more than 10000 transistors per chip. They cannot be operated by normal programming and have specialized programming and coding techniques. Also they paved the way for ASIC designs, VLSI design flows and complex integrated circuits. They helped in revolutionizing the IC technology.



**Cite this article as:** R Sowndharya, K Sasi Kumar. "MIMO Wireless based Cryptosystem using ELECTRONIC Key Generation Unit". *International Conference on Computer Applications 2016*: 70-73. Print.

Structured VLSI design is a modular methodology originated by Carver Mead and Lynn Conway for saving microchip area by minimizing the interconnect fabrics area. This is obtained by repetitive arrangement of rectangular macro blocks which can be interconnected using wiring by abutment. An example is portioning the layer of an adder into a row of equal bit slices cells. In complex designs this structuring may be achieved by hierarchialnesting. Structured VLSI design has been popular in the early 1980s, but lost its popularity later because of advent of placement and routing tools wasting lot of area by routing, which is tolerated because of the progress of Moore's law, When introducing the hardware description language KARL in the mid-1970s, Reiner Hartenstein coined the term "structured VLSI design".

## II. Architecture Model

### A. Description

The Key Generation unit is to provide the key for the Plain text. It is encrypted using Tiny Encryption Algorithm and transmitted either serial or wireless. Decryption unit is to decrypt the encrypted text to plain text by verifying the secure key. The Tiny Encryption Algorithm (TEA) and DES.

### B. Tiny Encryption Algorithm (TEA)

We design a short program which will run on most machines and encipher safely. It uses a large number of iterations rather than a complicated program. It is hoped that it can easily be translated into most languages in a compatible way. The first program is given below. It uses little set up time and does a weak non linear iteration enough rounds to make it secure. There are no preset tables or long set up times. It assumes 32 bit words.

The Tiny Encryption Algorithm is a Feistel type cipher (Feistel, 1973) that uses operations from mixed (orthogonal) algebraic groups. A dual shift causes all bits of the data and key to be mixed repeatedly. The key schedule algorithm is simple; the 128-bit key K is split into four 32-bit blocks K = ( K[0], K[1], K[2], K[3]). TEA seems to be highly resistant to differential cryptanalysis (Biham et al., 1992) and achieves complete diffusion (where a one bit difference in the plaintext will cause approximately 32 bit differences in the cipher text).

Time performance on a workstation is very impressive. There has been no known successful cryptanalysis of TEA. It's believed to be as secure as the IDEA algorithm, designed by Massey and Xuejia Lai. It uses the same mixed algebraic group's technique as IDEA, but it's very much simpler, hence faster.

Also its public domain, whereas IDEA is patented by Ascom-Tech AG in Switzerland. IBM's Don Coppersmith and Massey independently showed that mixing operations from orthogonal algebraic groups performs the diffusion and confusion functions that a traditional block cipher would implement with P- and S-boxes. As a simple plug-in encryption routine, it's great. The code is lightweight and portable enough to be used just about anywhere. It even makes a great random number generator for Monte Carlo simulations and the like.

## III. Results and Discussion

For achieving the faster communication most of confidential data transmitted through the network. Cryptographic algorithms are used to improve the security. These algorithms are classified into symmetric and asymmetric. The symmetric cipher is further classified into stream and block ciphers.

To increase the speed and security of communication system. To reduce hardware complexity. To adapt with many real time constraints by using Modified Tiny encryption algorithm. This section explains the related concept to be identified and the existing techniques and method how can use in the project explanation specified. Over all introductions about the previous system to be discussed follows. The exponential growth in the ways and means by which people need to communicate-data communications, voice communications, video communications, broadcast messaging, command and control communications, emergency response communications. Software defined radio (SDR) technology brings the flexibility, cost efficiency and power to drive communications forward, with wide-reaching benefits realized by service providers and product developers through to end users.

It consists of three units: Key generation Unit, Encryption unit and decryption unit.Key generation unit is to generate the key and these keys are sending along with cipher text.Modified TEA is used for encryption of the text.Then decryption unit for decrypting the cipher text and convert that to plain text.

Modified Tiny Encryption Algorithm (MTEA) is a block cipher designed to correct weaknesses in TEA.This also uses the same three primitive operations like TEA.Plain text blocks size -64bits.Key size is 128 bits.32 rounds of operation.

**Cite this article as:** R Sowndharya, K Sasi Kumar. "MIMO Wireless based Cryptosystem using ELECTRONIC Key Generation Unit". *International Conference on Computer Applications 2016*: 70-73. Print.

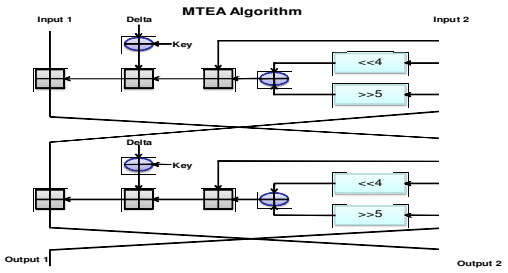
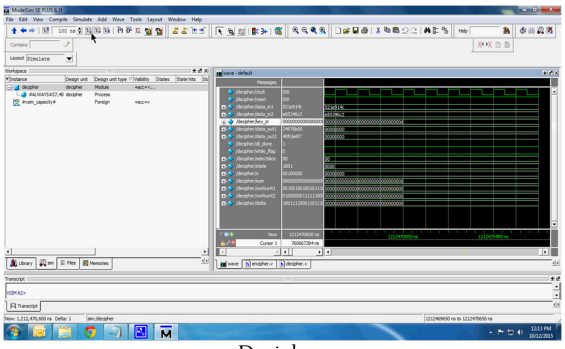



Fig 1 Block Diagram of Proposed System

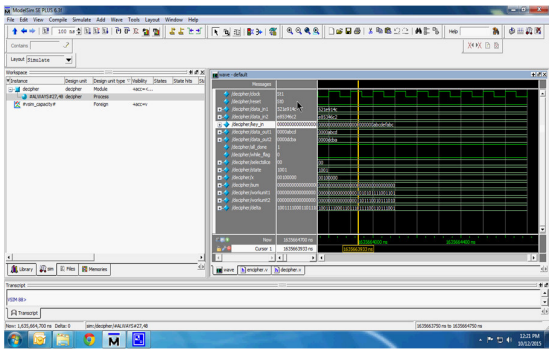
- Thousands of software defined radios have been successfully deployed in defense applications
- Cellular infrastructure systems are increasingly using programmable processing devices to create "common platform" or "multiband multiprotocol" base stations supporting multiple cellular infrastructure standards.

Snapshot is nothing but every moment of the application while running. It gives the clear elaborated of application. It will be useful for the new user to understand for the future steps.

Encipher



Decipher



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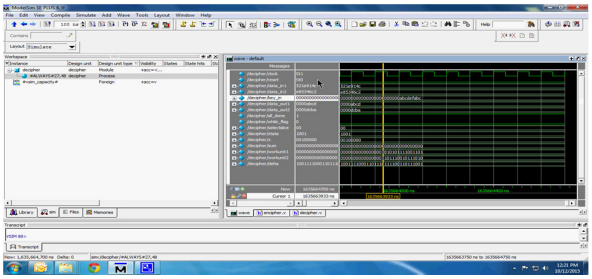
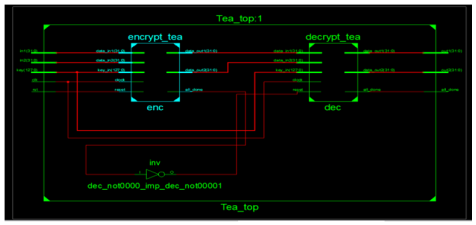
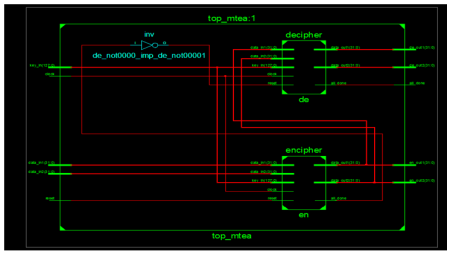


**Cite this article as:** R Sowndharya, K Sasi Kumar. "MIMO Wireless based Cryptosystem using ELECTRONIC Key Generation Unit". *International Conference on Computer Applications 2016*: 70-73. Print.

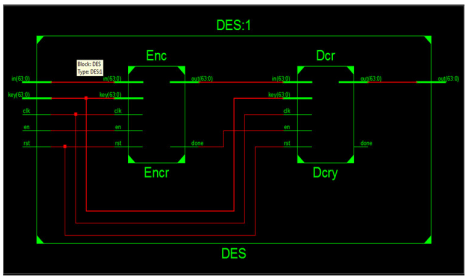
Schematic Digram for Tiny Encryption Algorithm




Schematic Diagram for MTEA




Schematic Diagram for DES




## Conclusion

This project have implemented MTEA algorithm suitable for short distance communication. MTEA architecture is well suited for devices in which low cost and low power consumption are desired. The proposed folded architecture achieves good performance and occupies less area than TEA. I have compared size, complexity and security level of TEA and MTEA crypto system. This paper improved the size and security level. Complexity level of MTEA is reduced. Which was compared using graph. The encryption speed, functionality, and cost make this solution perfectly applicable for resource constrained applications passive RFID and wireless sensor networks.

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**Cite this article as:** R Sowndharya, K Sasi Kumar. "MIMO Wireless based Cryptosystem using ELECTRONIC Key Generation Unit". *International Conference on Computer Applications 2016*: 70-73. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

| | |
|---|---|
| **ISBN** | 978-81-929866-5-4 |
| **Website** | icca.co.in |
| **Received** | 14 – March– 2016 |
| **Article ID** | ICCA015 |

| | |
|---|---|
| **VOL** | 05 |
| **eMail** | icca@asdf.res.in |
| **Accepted** | 02 - April – 2016 |
| **eAID** | ICCA.2016.015 |

# An Artificially Intelligent Device for the Intellectually Disabled

**S Anitha Angayarkanni[1], M C Shobana[2], V Sarala[3]**
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**Abstract:** *A new wave of artificial intelligence breakthroughs is making it possible for technology to do all sorts of things providing advances in machine learning, neural networks and probabilistic models. Implication of these power-packed technological developments for making a positive application in terms of helping the intellectually disabled people in our society is the key idea. This paper constructs a device, named AiderBot which is specially being designed for the improvisation of people having basic intellectual disability problems. The central concept is integrating various techno-devices like chip's, sensors and GPS trackers into the device which in turn provides communication and independence for the affected. Giving a hand over for such people and their caretakers, AiderBot behaves as a perfect example for Artificial Intelligence as it is designed to support when the human brain dysfunctions.*

**Keywords:** *Artificial Intelligence, Mental Retardation, AiderBot, Artificial Neural Network.*

## INTRODUCTION

Artificial Intelligence (AI) is defined as the science of making computers to do things that require intelligence when done by humans. It combines science and engineering in order to build machines capable of intelligent behaviour.

Artificial intelligence involves two basic ideas.

1. It involves studying the thought processes of human beings.
2. Next, it deals with representing those processes via machines (like computers, robots, etc).

Figure 1 shows how machines are beginning to work human-friendly. AI is the study of ideas that enable computers to be smarter and more useful. It is found to be less expensive than natural intelligence. [1]

Figure 1: Artificial Intelligence on par with human behaviours



**Cite this article as:** S Anitha Angayarkanni, M C Shobana, V Sarala. "An Artificially Intelligent Device for the Intellectually Disabled". *International Conference on Computer Applications 2016*: 74-78. Print.

## 1. What is Mental Retardation?

Mental retardation or intellectual disability, (MR/ID), exists in children whose brains do not develop or function properly within the normal range. MR/ID can result in learning, speech, physical, and social disabilities.

Severe cases are diagnosed at birth. However, milder forms might not be noticed until a child fails to meet a common developmental goal. Almost all cases of MR/ID are diagnosed by the time a child reaches 18 years of age. Mental retardation involves both a low IQ and problems adjusting to everyday life. There are four levels of retardation:

1. Mild (IQ from 50-55 to 70-75)
2. Moderate (IQ from 30-40 to 50-55)
3. Severe (IQ from 20-25 to 30-40)
4. Profound (IQ below 20-25)

The common behavioural issues with mentally retarded persons are:

- Problems in learning to talk.
- Memory problems.
- Inability to think logically.
- Childish behaviour beyond a normal age.
- Lack of curiosity.
- Learning difficulties [2].


Figure 2: Better way of pronouncing Mental Retardation

## 2. Connecting Artificial Intelligence with Mental Retardation

Artificial Intelligence is not only the making of robots, but also making the machines think where humans can't.

The normal human brain keeps thinking without pause. To implement AI in human life, we need the scenario where the human brain slows down to think. That is where 'Mental Retardation' comes to role. Mentally retarded people cannot think, act, speak, read or write as fast as other humans. So we can we use AI as an application in helping mentally retarded people to act independent.

Here, we design a device named AiderBot which provides the mentally challenged people (level 1 &2) the ability to perform 3 most important tasks:

1. Learn
2. Communicate
3. Be independent

## 3. Tools within Aiderbot

- A chip having Artificial Neural Network
- A chip enabling communication
- GPS Tracking device
- Two sensors
- Two cameras
- Harmless alarm

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- Harmless vibrator ring
- Mike (Attachable when needed)
- Keyboard (Attachable when needed)
- Speakers (Attachable when needed)

Figure 3 shows the pictorial representation of the tools.


Figure 3: Tools AiderBot is made up of.

## 4. Model of Aiderbot

Figure 4: Model of AiderBot

AiderBot will have a two way connection. Let the mentally challenged person be the client and the parent be the server. The whereabouts of the client are always displayed in the server through a wireless connection.

The camera in the front keeps recording the actions of the client and parallely displays it to the server either on a computer or mobile phone, like a live telecast.

The 2 chips are placed inside and enable learning and communication.

The GPS tracker keeps giving the location of the client to the server through a wireless network. If the client either goes in the wrong direction or does anything harmful, the alarm and the vibrator rings in both client and server side.

### 4.1 Solution for Learning

The mentally retarded people have an IQ below 70. They find it difficult to learn as fast as other people. Thus this AiderBot device has a chip that follows the procedure of Artificial Neural Networks (ANNs). ANNs are a family of statistical learning models used to estimate the functions that depend on large number of inputs. They are presented as systems of interconnected neurons which can exchange messages between each other.

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Example: A neural network for handwriting recognition is defined by a set of input neurons which may be activated by the pixels of an input image. After being weighted and transformed by a function, the activations of these neurons are then passed on to other neurons. This process is repeated until finally, an output neuron is activated. This determines which character was read, depicted in Figure 5. [4]. Deploying the ANNs into the chip will make the person identify the character, not immediately but definitely.

This device also facilitates learning through pictorial representations. When the projector is activated and the topic to be learnt is chosen, the projector projects the information and a voice reads the information displayed, so that it can get registered in the mind of the person with the help of ANNs.

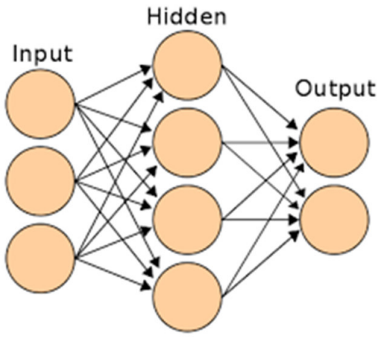


Figure 5: Artificial Neural Network Functioning

## 4.2 Solution for Communication

Mentally challenged people always find it difficult to communicate their needs and to have a conversation with other people. So a chip named 'easeCommnunicate' brings a solution to this problem. It is an ASIC (Application Specific Integrated Circuit) specially designed for communication purpose. It has programmed answers to frequently asked basic questions. With this, the person wearing it can talk as well as answer to others talk.

### To Respond to Others Talk

Using speech-to-text mechanism, the chip hears what others are asking and converts it to text. It finds the matching answer for the converted text within the program it has. Once the answer is found, it can be either said or displayed through projector. [3]. The microphone within the device keeps repeating the answer until the person wearing it opens his mouth and tells. Once this process is over, the question and answer asked is stored within the device. There is a 'reTeach' button on the side of the device, which when switched on, replays all the questions discussed that day multiple times, so that those answers are registered in the persons mind strongly. This will help the person to answer the question next time automatically without the help of this device. [5] Figure 6 shows the working of this chip.

### To Talk by Self

Example: For food, every 2-3 hours from the day starts, the machine will speak a message for food to the person. The person, on hearing it multiple times will try to pronounce the same word and thus the guardian/parent will serve the food. Also, the chip can sense unusual feelings too. It will give an alarm in the guardian/parent side when the person's behaviour seems abnormal (ex: pain in body, urinated in same place etc) and then he/she can come for help.

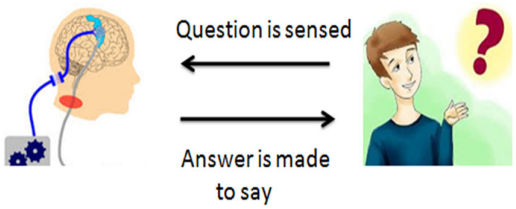


Figure 6: How the chip works

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### 4.3 Solution to Act Independent

Here, we make use of a GPS tracker, camera, alarm and vibrator which is present in both the ends (client and server). As the person wearing this device stays or walks alone, the camera keeps reflecting the actions of this person to the parent at other end via mobile or laptop. We use an active Autofocus camera as it focuses the person correctly despite disturbances. If any misbehaviour is sensed, the device rings an alarm or vibrates in both the ends. Either the patient will stop the misbehaviour as he hears a new sound or passersby can help him or the parent will come for help.

The GPS tracker will continuously send location of the person to the parent through the mobile number attached to this, which is represented in Figure 7. Here we make use of an active GPS as it two way and live process. The GPS tracker used in our device is SilverCloud Tag. The SilverCloud Tag is a real-time GPS tracker which is a compact and pocket-sized. The ultra-portable size, allows users to place it virtually anywhere and thus we place it within our AiderBot. Finally, this device will intimate the parent when the person moves beyond the prescribed limit and thus the patient can stay safe.

Figure 7: Mobile phone showing the location of the person while walking alone.

### 5. Conclusion and Future Enhancement

Mental retardation is a problem which is alive for more than years and yet, no proper cure is found. AiderBot may not completely cure the disease but can surely make the affected act better. This is specially designed for Level 1 (Mild) and Level 2(Moderate) patients and can make them go to the lower level of the disease.

Thus, we conclude that this artificially intelligent AiderBot understands the human situation, supports him and grooms him for his betterment. Deploying this device in the upcoming years using the developing trends in technology will create a spark in life of the intellectually disabled, thus providing it a future enhancement.

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International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|
| **ISBN** | 978-81-929866-5-4 |
| **Website** | icca.co.in |
| **Received** | 14 – March– 2016 |
| **Article ID** | ICCA016 |

| | |
|---|---|
| **VOL** | 05 |
| **eMail** | icca@asdf.res.in |
| **Accepted** | 02 - April – 2016 |
| **eAID** | ICCA.2016.016 |

# Method to Provide Mobile Signal when the Network Provider Has Failed

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**Abstract:** *Mobile communication plays a vital role in every human's life. The basic requirement to initiate this communication is a mobile signal. A mobile signal, which is also known as reception, is the signal strength received by a mobile phone from a cellular network. This signal is detected by the SIM (Subscriber Identity Module) card that is inserted into the phone and helps to send and receive calls/text messages. Various network (signal) providers include Airtel, Vodafone and BSNL etc, whose primary goal is to facilitate their customers with their best reception. But, at the situations where the signal vanishes, the network subscribers (users) become helpless.*

*In this paper, we suggest a method which helps the subscribers to gain signal from other network providers, in case of emergency situations, when their own network provider has failed. This is implemented by making changes in the ICCID (Integrated Circuit Card ID) of the SIM. By implementing this concept, we can also provide signal to those subscribers in the dead zones of a particular network, where a dead zone is defined as an area in which mobile phones cannot transmit to a nearby tower or a base station.*

**Keywords**: *Reception, Network, SIM card, ICCID*

## 1. INTRODUCTION

A mobile phone sends and receives information by radio communication. Radio frequency signals are transmitted from the phone to the nearest base station and incoming signals are sent from the base station to the phone, at a slightly different frequency. Base stations link mobile phones to the rest of the moving and fixed phone network.

Once the signal reaches a base station it can be transmitted to the main telephone network, either by telephone cables or by higher frequency radio links between an antenna (e.g. dish) at the base station and another at a terminal connected to the main telephone network, represented by Figure 1. [1] Thus the communication takes place.

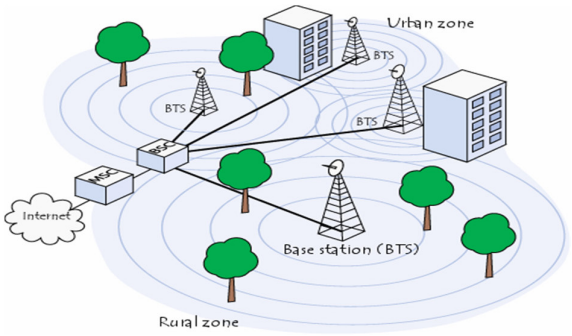


Figure 1: Communication using base stations



**Cite this article as:** V Vidhya, S Avinash, A Hemalatha Dhevi. "Method to Provide Mobile Signal when the Network Provider Has Failed". *International Conference on Computer Applications 2016*: 79-82. Print.

## 2. Problem Statement

"Communication becomes difficult for the network subscribers when their corresponding network provider's reception is unavailable."

In remote areas or situations like train journeys /disastrous incidents/ emergency bearings, the signal of some network providers may stay strong while others may become inaccessible, giving distress to the subscribers. Hence, the ultimate aim of provisioning the mobile users with uniform, endless and satisfying signal strength goes in vain.

## 3. Role of SIM Card

SIM's are small cards which contain a chip that must be inserted into GSM (Global System for Mobiles) phones for those phones to work. A GSM phone will not be able to receive any mobile network without a SIM card. [1] This card is important since it holds all of the critical information, like:

1. **ICCID = Integrated Circuit Card Identifier:** This is the identifier of the actual SIM card itself - i.e. an identifier for the SIM chip.
2. **IMSI = International Mobile Subscriber Identity:** This is the identifier of the user of the cellular network and is unique.
3. **MSISDN = Mobile Station ISDN Number:** This is the full phone number of a subscriber. It allows a device to be called. [2]

## 4. Solution Identified

We hereby provide a solution to this problem by making alterations in the ICCID code of the SIM card.

### 4.1 Introduction TO ICCID

Each SIM is subjected to a unique ICCID (Integrated Circuit Card Identifier) code which helps in identifying a particular SIM card, as shown in Figure 3. ICCID's are stored in the SIM cards and are also printed on them during the personalization process. A full ICCID is of 19 to 20 characters.

The format of ICCID is
MMCC IINN NNNN NNNN NN C x,
MM = Constant
CC = Country Code
II = Issuer Identifier
N {12} = SIM number
C = Checksum calculated using Luhn Checksum Algorithm. [5]
Example: 89914 00000 07027 90060

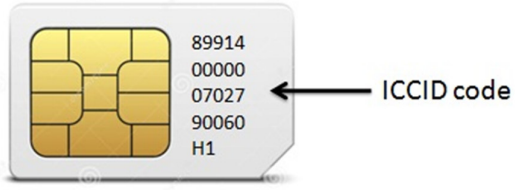


Figure 2: Normal ICCID in a SIM card

### 4.2 Working OF ICCID

Any SIM card gains mobile signal only through its ICCID code. It is possible to change the information contained on a SIM (including the IMSI), but the identity of the SIM (ICCID) remains the same. We know that the mobile signals are transmitted in the form of radio waves via transmitter. Once they are transmitted, they reach their corresponding subscribers through this code, i.e.) the ICCID sends an alert to the transmitter that there is a subscriber who is yet to access the signal. If the transmitter finds the ICCID as a valid one, the subscriber then receives the mobile signal and turns capable of sending and receiving calls or text messages. Once this is done, IMSI

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identifies the SIM card's user details and MSISDN identified the phone number associated with that SIM. Thus, all the primary information is obtained.


Figure 3: Steps undertaken to connect to a signal

### 4.3 Solving the Problem

Since the ICCID is a unique code, it allows the SIM to access only to its corresponding network provider of a user. Let 'A' be the corresponding network provider and 'B' be other network providers.

But in situations where 'A' becomes unreachable, how will the subscriber receive the signal? Hence, we bring a solution to this where we suggest adding a second ICCID code to the SIM card which will help the subscriber to access 'B' when 'A' is unreachable. The first ICCID code in the SIM has higher priority and is designed to have preference to the main network ('A') used by the subscriber, and second ICCID code, with lesser priority, is made open to other networks ('B') available, pictorially represented in Figure 4.


Figure 4: Modified ICCID code

At a point where 'A' becomes unreachable the mobile asks permission from the subscriber if it can go in search of 'B'. If a yes is received as response, the subscriber is connected to the nearby 'B', for which the particular cost will be included in bills. If a no is received, the user will still remain unreachable until 'A' regains its strength.

Deals/tie-ups between various network providers would bring profit to the business where they decide methods to transfer the money, a particular subscriber of 'A' has used for 'B'. As networks are shifted, the information will be stored in the SIM. It will come to the notice of 'A' and they will either transfer the amount to 'B' immediately or as a total in the end of the month.

## 5. Practical Application

Consider a situation where you are stuck alone in a disastrous incident and there is no mobile signal of your network provider, which makes you unable to dial calls. Technically, this means that your ICCID number is not recognized by the transmitter.

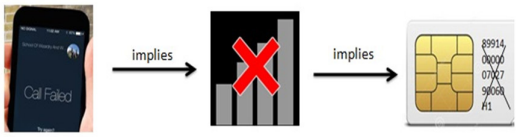


Figure 5 (a) Failed call

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In this situation, your mobile phone beeps a notification asking if you would wish to connect to other nearby networks available.

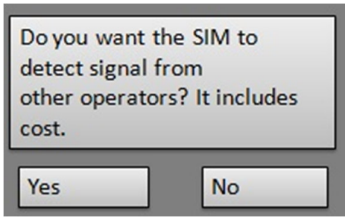


Figure 5(b) Mobile phone requesting permission

Once you press the yes button, your SIM starts searching for other signals. Technically this means that the second ICCID code is trying to get recognized by nearby transmitters of other network providers and the signal with high frequency gets connected, if available, helping you to contact others for help.

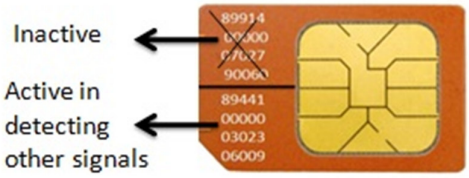


Figure 5(c) Second ICCID working to get signal

This complete process is depicted in Figure 5(a) to Figure 5(c). The shift of network will be stored in your SIM along with other details like contacts which is already present inside it. It comes to the notice of your network provider in the end of the month in case of postpaid for which money will be paid separately, and the balance is reduced and transferred to other network provider immediately in case of prepaid.

## 6. Conclusion

"Communication works for those who work at it", said by John Powel, favours this paper. Increasing the frequency of signal gives satisfaction only to those who can access it, but sharing the signal gives satisfaction to those who have not even imagined of accessing it. Such implementation gives a handover during any calamities like floods, cyclones or train travel or to those located in remote areas where seeing the red light in all towers is a boon. Helping people to contact others at any point of time, this idea also serves as a profit in business to various network providers.

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International Conference on Computer Applications 2016 [ICCA 2016]

| | | | |
|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA017 | **eAID** | ICCA.2016.017 |

# Algorithm for Security in Autonomous Cars

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**Abstract:** *An autonomous vehicle is capable of sensing its environment and navigating without human input. Imbibing intelligence to these devices is through a system called embedded systems. Embedded Systems are combinations of hardware and software that are mounted on compact electronic circuit boards integrated into devices. Autonomous vehicles sense their surroundings with such techniques as radar, GPS, and computer vision. These systems are more intelligent and autonomous.*

*The challenge faced by this system is that; there are many possible ways for hacking the GPS. This system also contains alternate way for moving the car even if still the GPS is blocked. But the alternative ways are still focused on connection with the satellite. Now there needs to be a total security for preventing hackers from hacking the satellite. This is going to be done by encrypting the signal sent from car to the satellite. There are many ways of encrypting, among which we are going to use the concept of Secret key Encryption method. We use One-Time-Pad concept where the data is converted to cipher text and then it is going to be decrypted by the satellite. By this way, we could create a high level security where only that particular car and the satellite will have a common code and each time the car moves to a location, there is going to be a random key generated.*

*The current topic which we had chosen is one of a major problem in autonomous cars, which needs to be focused on. Our objective is to bring a complete security for the car and its owner.*

**General-Terms:** *Autonomous cars, embedded systems, Security, Total security, resolutions for problems faced by autonomous cars.*

## 1. INTRODUCTION

Embedded system is a combination of hardware and software that forms the component of a larger system; this in turn is programmed to perform a range of dedicated functions usually with a minimal operator intervention. In embedded systems the hardware is normally unique to a given application; computer chips are embedded into the control electronics to manage the products functionality.

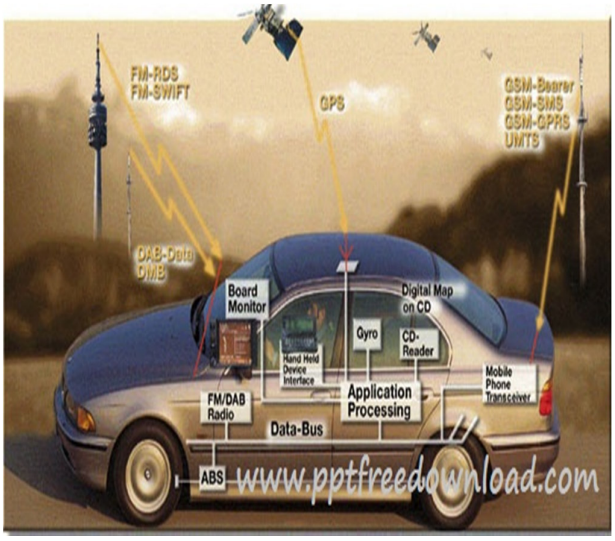
**Autonomous Cars:** These cars have the ability to control it. The car, which is embedded, can simulate the human driver completely and direct the vehicle on the road. Autonomous vehicle is the drastic change in technical brilliance and developments in different fields with EMBEDDED SYSTEM as pioneer. A fully computerized car capable of doing almost everything a car lover would want to. Almost all automobiles will interact with computer on dashboards. From ordering food materials to booking tickets at the nearest theatre, things would be as easy as giving orders to your servant. As a matter of fact, vehicles all over the world is now fitted with intelligent devices that makes the vehicles to respond to various factors like - climate control, sudden accelerations or braking or even self-repair of modules.

The finger print technologies have been introduced to enter and start your car with the touch of a finger. The fingerprint, which is acting as a key, would trigger a check of the mirrors, steering wheel, radio and temperature to ensure that they're the way you like



**Cite this article as:** J C Kavitha, Akash Venugopal, S Pushparani. "Algorithm for Security in Autonomous Cars". *International Conference on Computer Applications 2016*: 83-88. Print.

them. The convenience of fingerprint recognition technology comes with heightened security. Unlike personal identification numbers, passwords and keys, each person's unique fingerprints can't be duplicated, lost or forgotten.




## 2. Illustration

As mentioned above, this car system runs on it won through the embedded system concept. For this purpose Global Positioning System (G.P.S) using satellites can provide positioning information. For still higher accuracy wide area differential GPS is used, which offers a robust system that readily deals with selective availability errors and satellite clock errors.

The models for GPS also include aiding sensors, e.g. dead reckoning, radar and camera. A computer is simply required to feed destination into a dashboard computer. Highly sensitive actuators simulate a human driver completely and direct the vehicle on the road. The vehicle transmitter broadcasts its position and velocity to other immediate participants for collision-avoidance and lane changing man oeuvres. Forward and reverse motions and U-turns are precisely achieved as per route guidance requirements. Furthermore, an accurate steering control is obtained using Pulse Code Modulation technique and acceleration/braking control is successfully implemented using learning adaptive system The reliability, efficiency and cost effectiveness of an autonomous vehicle depend mainly on how judiciously its navigation sensors, perception unit and computer control is incorporated. The driver's activity is influenced by several factors that depend on driver itself and is environment such as traffic density, traffic status, time of travel and weather. Thus the driving activity deals with a combined driver vehicle-environment system shown in figure. The vehicle is required to blend its environmental perception capabilities with its intelligent controls in order to affect optimal path-planning strategies that not only avoid obstacles but also minimize criteria such as time of travel, fuel consumption, exposure to pollution/danger, etc. however basic driving functions consists of lane-keeping, safe distance maintenance, timely lane changing and overtaking. The key to all these driving tasks is collision avoidance.

The Master Control Station (MCS) receives the positioning information from the satellite by employing WADGPS concept. The MCS is linked to GPS instrumented position location systems (PLS) installed on the autonomous vehicles through a data link sub system (DLS). The DLS can either use VHF or UHF or L-band, incorporating time division multiple access protocol to handle on the roads. A

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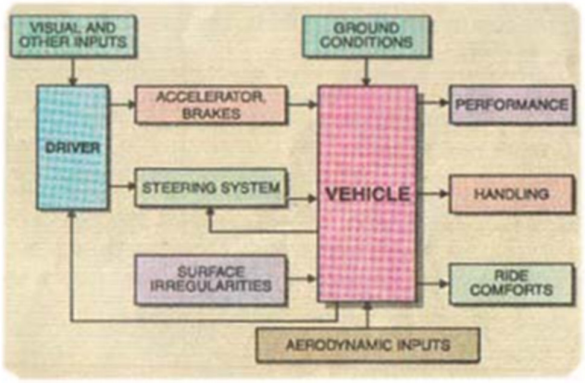
block forward error correction code is employed to protect and maintain the message integrity. The desired destination and starting position of the vehicle together with the time of travel, manifest an optimal route on the road network. Once the vehicle commences the journey the sensors continuously keep track of the direction and displacement of the vehicle initial calibration is a little crucial for dead reckoning performance; however a feedback calibration indicated in fig suggested obtaining distance accuracy better than 99.9 percent.




GPS navigation guides you through the traffic. The GPS interface in the car pinpoints your exact location on a map. In case the GPS signal can't be received due to high density of tall buildings or other magnetic interface, the 'dead reckoning ' technique, which works for short durations guides you effectively. The system is also loaded with GSM/CDMA protocol standards further modified on the CANBUS standard to give uninterrupted information.

## 3. Challenge Faced

Now-a-days computers are more and more prone to hacking and vulnerabilities. In our concept of embedded system in car automation, we utilize the GPS technology for effective guidance of the vehicles. Hackers today are able to crack the security features present in the satellites. Few software's in net helps these hackers. If such software's goes to the hands of evil doers and anti-social elements, car automation could become a nightmare.

Let us consider that a VIP is using the autonomous car to visit a place. A person who could perform a MITM (man in the middle) attack can drive away or change the destination of the car. This is the major weak spot or vulnerability that a hacker could use to kidnap the individual.

The only solution to prevent a MITM or any hack attack would be implementing strong security feature such as encryption.

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## What is Encryption?

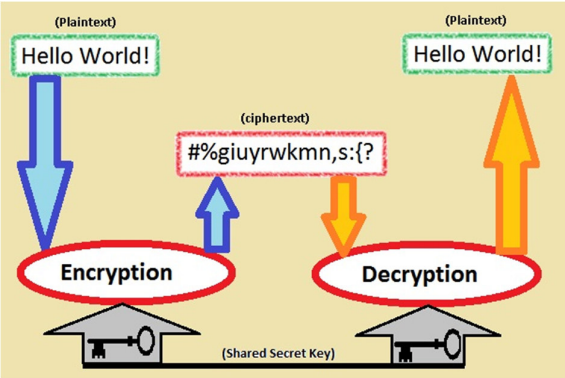
Encryption is a technique for transforming information on a computer in such a way that it becomes unreadable. So, even if someone is able to gain access to a computer with personal data on it, they likely won't be able to do anything with the data unless they have complicated, expensive software or the original data key.

The basic function of encryption is essentially to translate normal text into cipher text. Encryption can help ensure that data doesn't get read by the wrong people, but can also ensure that data isn't altered in transit, and verify the identity of the sender.

There are three different basic encryption methods, each with their own advantages. We are choosing Secret key encryption method.

The encryption key is same as the decryption key.

**Implementation of One-Time-Pad Method:** The One time pad method has a common key between the sender and receiver. The message which is sent from the sender is going to be converted as cypher text by using the common key and this encrypted code is sent to the receiver. The receiver further with the same code, decrypts the data.




The secret key which is going to be given for each car are unique. We are going to implement this like a normal bank system (where we get an ATM pin which only we know and we access). The key given is going to be 15 digits key. The key is going to be alphabets. The first four places are going to be the starting four alphabets found in number plate. The remaining 11 places in the key are going to be assigned by the central database. Each time an autonomous car is registered, the unique 15 digit key is going to be given to the owner. Example: (TNAH**********).

Each time the car moves to different locations, the data is sent to satellite in a randomize manner. The randomly produced code is going to be cypher texted using the 15 digit unique key. This text is going to be sent to the satellite along with the signals from the GPS. The satellite will further decrypt this cypher text and send back the information of location and timing to the GPS. The hacker

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will have a probability of choosing one out of a quadrillion or one thousand billion. This will give a high security to the autonomous car. Also the satellite coding is done in such a way that, if the hacker accidently finds the correct key, and tries to access our car, the secret key will be blocked. The blocking is done if two signals from same key number are received. Now the person's car will stop, and he will be alerted by the incoming problem and he can inform the police or alert his security guards. He then has to reset his pin by going to the control database.

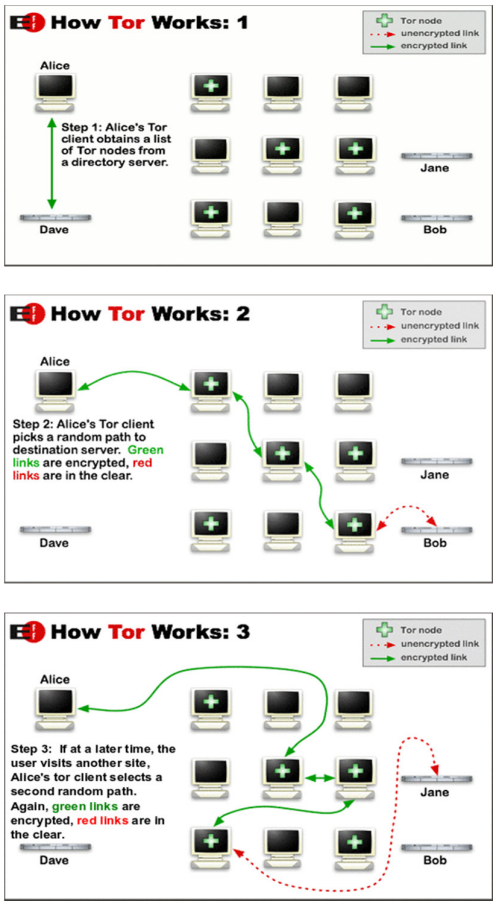
## Added Feature (using TOR Project)

Using Tor protects you against a common form of Internet surveillance known as "traffic analysis." Traffic analysis can be used to infer who is going where over a public network. Knowing the source and destination of your Internet traffic allows others to track your behavior and interests. It can even threaten your job and physical safety by revealing who and where you are.

## Staying Anonymous

Tor can't solve all anonymity problems. It focuses only on protecting the transport of data. You need to use protocol-specific support software if you don't want others to see your identifying information. This is where encryption kicks in.

## Working of TOR Project




## Result

As we encrypt our data it is not easy for hackers to penetrate into the data exchange between the car and the satellite. The probability of a computer and the human, to guess the randomize code is going to be one quadrillion which is seriously unimaginable. Also, if the evil doer tries to crack the encryption, it would take at least a couple weeks for him. Even though if it's a long journey, the passenger will each time go to a different zone of the satellite control which would make the hacker get delayed each time, and by the time he finds the next address of the location, the passenger would have reached his destination.

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## 4. Conclusion

Autonomous car had been implemented in reality and being tested in various countries. In this fast advancing world, security acts as most important feature.

We would like to present that there must be further developments in this technology to make autonomous car more common all over the world with a high security level system. This can be happened by making the autonomous easy to operate for the user and the designers should concentrate more in producing autonomous cars, which should not cost a lot.. With this type of vehicles there will be great advantages in the coming future. Speed control technique and tracking system based cars would reduce amount of accidents. In the near future, autonomous car become more common all over the world. Indian efforts in the embedded technology can assure that these autonomous cars will become cheaper and may evolve with many more advantages. By this way we could find ourselves using these autonomous cars in the near feature in a totally secured way.

Thus the complexity to track a person will multiply exponentially depending upon the number of people using this service.

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International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA018 | **eAID** | ICCA.2016.018 |


# An Application for Performing Real Time Speech Translation in Mobile Environment

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**Abstract:** *This paper presents the method of applying speaker-independent and bidirectional speech-to-speech translation system for spontaneous dialogs in real time calling system. This technique recognizes spoken input, analyzes and translates it, and finally utters the translation. The major part of Speech translation comes under Natural language processing. Natural language processing is a branch of Artificial Intelligence that deals with analyzing, understanding and generating the languages that humans use naturally in order to interface with computers in both written and spoken contexts using natural human languages instead of computer languages. Speech Translation involves techniques to translate the spoken sentences from one language to another. The major part of speech translation involves Speech Recognition which is the translation of spoken speech to text and identifying the context and linguistic structure of the input speech. In the current scenario, the machine does not identify whether the given word is in past tense or present tense. By using the algorithm, we search for a word to check if it is past or present by searching for the sub strings, as "ed", "had", "Done", etc., This paper gives us an idea on working with API's to translate the input speech to the required output speech and thus increasing the efficiency of Speech Translation in cellular devices and also a mobile application that will help us to monitor all the audios present in mobile device and translate it into required language.*

**Index Terms —** *Speech translation, Speech Recognition, Natural Language Processing, Automatic Speech Recognition, Text-To-Text Translation, Voice Synthesis.*

## 1. INTRODUCTION

A single language is not spoken by everyone in this multilingual world. There are from 6800 to 6900 distinct languages in the modern world. An individual may hardly know 4-5 languages to converse with people around him. Therefore people face a huge language barrier in their day to day life. This paper provides an idea to eliminate the language barriers among people speaking different languages and helps them to communicate in their own language. Consider a person from Chennai who knows only Tamil and wants to communicate to a government employee in New Delhi who knows only Hindi and English. Here the communication is not possible until one knows the language of the other. One cannot be a master of all languages and at such situations Speech Translation comes into act as a helping hand to resolve the communication problem.

The users can simply pick up a smart mobile phone and use voice dialing and speech commands in order to initiate a dialog translation session. It emphasizes the robust processing of spontaneous dialogues posing difficult challenges to human language technology. It deals with spontaneous one-way speech. The system is mainly intended to translate between Indian languages such as Bengali, Gujarati, Hindi, Kannada, Malayalam, Punjabi, Tamil, Telugu, and Urdu.

The main idea was derived from the preceedings of the Lok Sabha and the Rajya Sabha where Members of the Parliament from different states, speaking different languages present their opinions and proposed works in their mother tongue which is automatically



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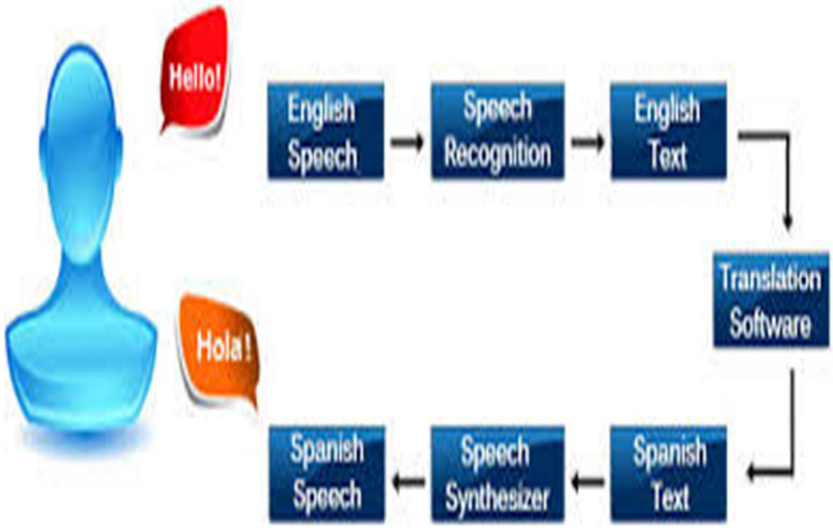
translated to every member in their own choice of language in real time.

## 2. Proposed Work

Speech Translation is a process by which conversational spoken sentences are instantly translated and spoken aloud in a second language. This differs from phrase translation, which is where the system only translates a fixed and finite set of phrases that have been manually entered into the system. Speech translation technology enables speakers of different languages to communicate.

Speech Translation system would typically integrate the following three procedures. Such as: Automatic Speech Recognition (ASR), Text-to-Text Translation (TTT) module and Voice Synthesis(TTS) module.




1. Speech Translation

The speaker of language A speaks into a microphone and the speech recognition module recognizes the utterance. The Text-to-Text translation module then translates this string to the desired language B. Instead of translating the input speech, word by word, this method translates the entire speech by identifying the "Parts of Speech" and translating them into the text format of the output language. The text instances are then processed in speech synthesis module, which identifies the text input and produces an equivalent speech of the same.

### 2.1 Automatic Speech Recognition (ASR) Module

The speech-to-text part of the input language involves implementation of Speech recognition for which a java script is written with the inbuilt function audio recorder and the recognized speech is passed to a PHP file where the "Google Speech To Text API" is called by accepting the POST requests with voice file encoded in FLAC format which is forwarded by the java script, and query parameters for control. The FLAC (Free Loss-less Audio Compression) format is an audio coding format for lossless compression of digital audio, and is also the name of the reference codec implementation. Digital audio compressed by FLAC's algorithm can typically be reduced to 50–60% of its original size and decompressed to an identical copy of the original audio data.

The Request URL should look like this: https://www.google.com/speech-api/v1/recognize.

The ASR module consists of the following Query parameters:

- **Client:** The client's name you're connecting from. For spoofing purposes, let's use chromium
- **Lang :** Speech language, for example, ar-QA for Qatari Arabic, or en-US for U.S. English
- **Maxresults:** Maximum results to return for utterance
- **Post:** body should contain FLAC formatted voice binary.

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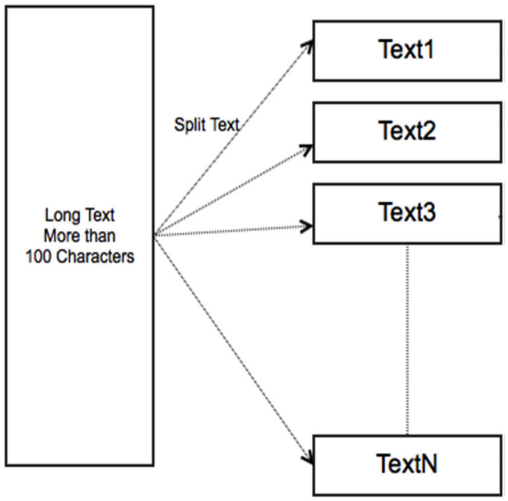


2. Speech to Text conversion

And the final output will be a text equivalent to the input speech which is forwarded to the next module Text-To-Text Translation (TTT).

## 2.2 Text-to-Text Transition (TTT) Module

The output text from the previous module is the input for this TTT module which is present in the PHP file following the previous module and it is called automatically. This input text is then converted into equivalent text of the desired speech language.

This module also uses and API called "BING TRANSLATOR" developed by MICROSOFT. Recently Microsoft announced the latest version of Bing Translator, this new version (v2) added some cool and new features, including collaborative translations, customizable widgets, powerful API, and Translate-to-Speak. In this post I will describe the simplest way to use those new APIs, provide simple example and demonstrate new features.

Bing translator APIs could be easily targeted through the various available APIs: AJAX, HTTP and SOAP. But first, you should obtain a valid Bing AppID. Sign-in using your live ID then get it from here. The AppID will be used as a validation parameter when calling any API such as Detect, Translate, and Speak.

The Translate method requires the following parameters:

**AppID:** Which is a string of a valid Bing AppId?
**From:** A code represents the language of the translated text. (You could get the available translate language using Get Languages Names Method)
**To:** Another code that represents the language to translate text into.
**Text:** And of course the text that's to be translated.
**On Complete:** The Call back function that will be called on the completion of the request.

The Request URL should look like this:

http://api.microsofttranslator.com/V2/Ajax.svc/Translate?appId=MyAppID&from=en&to=ar&text=hello&oncomplete=doneCallback

All you have to do is just replace MyAppID with your own valid Bing AppID and define the doneCallback function.The following is a full simple example that calls the Translate method passing the parameters described above.Notice that the doneCallback function receives a response parameter and simple displays it inside a div.

The output of this module will be a text, equivalent to the input text in the desired output speech language.

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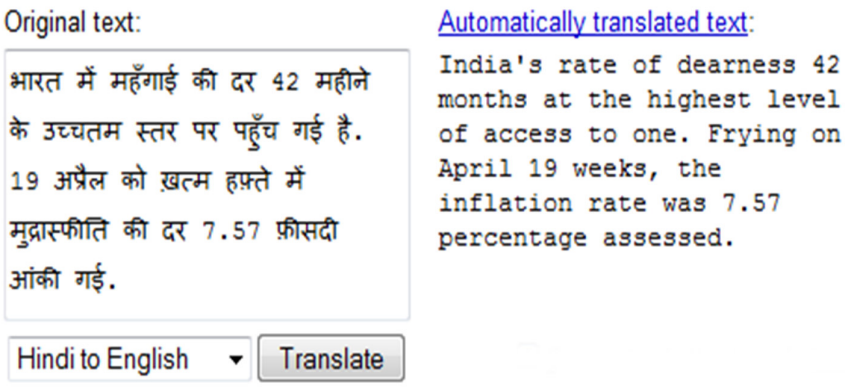
Now this output text is forwarded to the Voice Synthesis (TTS) module to obtain the equivalent speech of this text in desired language.

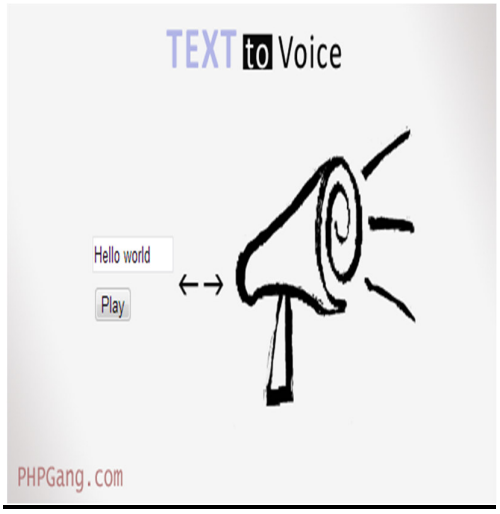



3. Text-To-Text translation

## 2.3 Voice Synthesis (TTS) Module

The output text of the previous TTT module is now the input for this TTS module which is present in that PHP file following the previous module and it is called automatically where this module is used to process the input text into the equivalent speech of the desired language.

The Request URL should look like this: http://tts-api.com




4. Text-To-Speech Synthesis

The final output of this module is nothing but the equivalent speech of the original input speech of different language and this speech is passed back to the java script written at first which automatically outputs the speech in the desired language.

## 3. Assumptions

The implementation of speech translation over cellular devices will include a talk with the top telecommunication companies such as Airtel, Vodafone, and Idea. The implementation will also include a privacy closure which would include protecting the privacy of users by not providing the recorded voice during speech translation to any unauthorized person. Speech translation systems should translate an input language to a desired output language only after identifying the completion of a sentence else the conversion would make no sense. At the same time a language conversion should also understand the noun, verb, adjective and translate the same accordingly.

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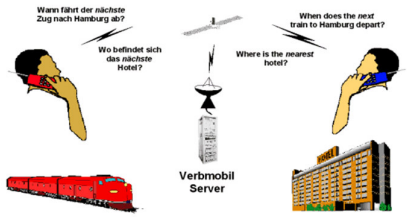


5. Working Model of Speech translation System

Speech translation can be initiated using voice dialing and speech commands. The speech API`s can be implemented using an application over the phone or as an integrated service from the telephone providers. The above discussed method is only applicable for one-way communication which allows only one person to speak at a time. The usage of such translation techniques should overcome the distortion caused by noises during the conversation and provide an error free translation.

## 4. New Working Implementation

In the current scenario, the machine does not identify whether the given word is in past tense or present tense. By using the algorithm, we search for a word to check if it is past or present by searching for the substrings, as "ed", "had", "Done", etc., In the same manner, we search for a number to determine if a given specified number is a key or a date or a normal number. If the strings before the point of interest consist of dates, then we read the number as 'date', if the number has no reference to the speech then it is considered as a 'normal number'. If authentications are available in the part of speech, then the number is evaluated as a 'key'.

By increasing the pitch of the voice we can rectify the clock errors and incorrect recognitions.

## 5. Conclusion & Discussion

Such speech translation techniques can help the people of different languages to communicate with each other without any language barriers. By doing so it brings the people of various religions, languages together. The telecommunication companies can also find profit in this technique by providing this service at a nominal rate along with the normal call rates. There are speech translation techniques such as Skype Translate, Verbmobil which do provide language translation for a few languages but neither of them provides translation for Indian languages. Thus developing a technology for speech translation in Indian languages will not only be a great invention in the field of natural language processing but also will provide as a great tool of communication for the people of India.

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**Cite this article as:** Buela Kutti, S Hari, G Anbuselvi. "An Application for Performing Real Time Speech Translation in Mobile Environment". *International Conference on Computer Applications 2016*: 89-93. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA019 | **eAID** | ICCA.2016.019 |


# A Robust Embedded Based String Recognition for Visually Impaired People

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**Abstract:** *This paper presents the development of a camera-based assistive text reading framework to help blind persons read text labels and product packaging from hand-held objects in their daily lives. Recent developments in computer vision, digital cameras, and portable computers make it feasible to assist these individuals by developing camera-based products that combine computer vision technology with other existing commercial products such optical character recognition (OCR) systems. To automatically extract the text regions from the object, we propose a artificial neural network algorithm by learning gradient features of stroke orientations and distributions of edge pixels in an Adaboost model. Text characters in the localized text regions are binarized for processing the algorithm and the text characters are recognized by off-the-shelf OCR (Optical Character Recognition) and other process involved . Now the binarized signals are converted to audible signal. The working principle is as follows first the respected image will be captured and then it is converted to binary signals. Now the image is diagnosed to find whether the text is present in the image. Secondly, if the text is present, then the object of interest is detected. The respected text of the image is recognized and then converted to audible signals. Thus the recognized text codes are given as speech to the user.*

**Keywords:** *Edge pixel, Text region, detection, OCR*

## 1. Existing System

A Camera based Assistive text reading to read text labels to help Blind people in their daily lives. It defines region of interest by asking the user to shake the object by mixture- of- Gaussians- based background subtraction method [2]. The proposed system reads the text encountered in scene images and text boards with the aim to provide assistance to the visually challenged persons. The input image is captured from mobile camera and extracts text information from image.It detects text regions from captured image and recognizes text. [1].

It has completely revolutionaries the way we communicate, especially long distance communication. A design has been made for SMS system for them by interfacing Braille pad with the cell phone so that dual impaired person can have the access to the SMS system and through which they can take important notes[3]. A survey of navigation system of visually impaired people highlighting various technologies with their practical usefulness, design and working challenges and requirements of blind people. The aim of this paper is to provide a better understanding to identify important research directions in this increasingly important social area for future research. Visually challenged persons face constraints independent mobility and navigation. Mobility means the possibility of liberally moving, without support of any supplementary person, at home and unfamiliar scenarios [4].

A novel camera based computer vision technology to automatically recognize currency to assist visually impaired people will be enhanced. To isolate the object from cluttered backgrounds or other surroundings objects in the camera view, an efficient and effective motion based method to define a region of interest in the video by asking the user to shake the object [5]. The approach described in



**Cite this article as:** P S Suhasini, D Youbarani, C Vijayasarathi, R Vani. "A Robust Embedded Based String Recognition for Visually Impaired People". *International Conference on Computer Applications 2016*: 94-97. Print.

the paper is based on color image segmentation and segment shape analysis. Portable text reading devices are useful extensions of navigation systems as they can provide valuable pieces of information, usually not contained in the electronic databases [7].The proposed framework will capture an image of a public signage and transform it into a text file using Otsu's optical character recognition method. The text file will be read by a speech synthesizer that tells the visually impaired people what the image is[8].

## 2. Proposed System

In our paper we proposed the algorithm called Artificial Neural Network (ANN) Algorithm which is shown a below. We proposed a new framework to extract text strings with multiple sizes and colors, and arbitrary orientations from scene images with a complex and cluttered background. The figure 1 depicts the flow chart of the framework. The proposed framework is able to effectively detect text strings in arbitrary locations, sizes, orientations, colors and slight variations of illumination or shape of attachment surface. Compared with the existing methods which focus on independent analysis of single character, the text string structure is more robust to distinguish background interferences from text information.

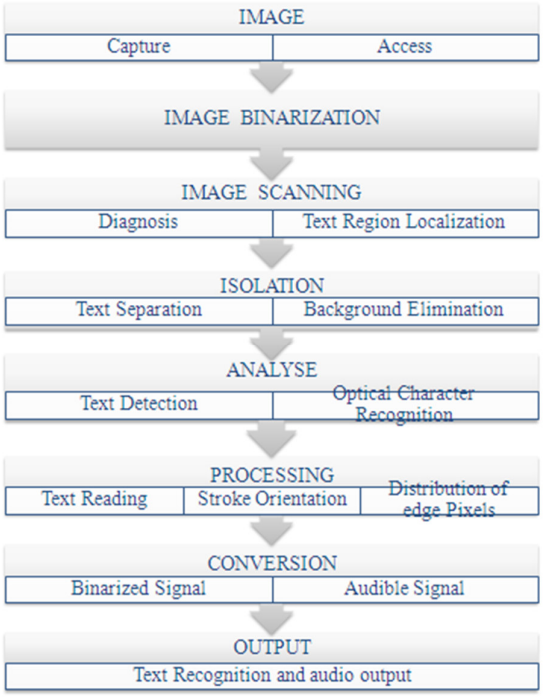


Figure1: ANN Algorithm Flow chart

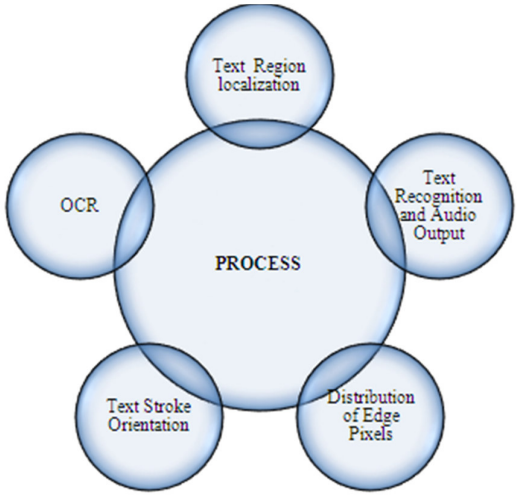


Figure 2: Process involved in Artificial Neural Network Algorithm

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As we learned in the flowchart of the artificial neural network algorithm, it involves many process. The various process are shown in the figure 2. Text Region localization is performed to diagnose whether the text is present in the captured image or not. Optical Character Recognition (OCR) plays the role of detecting the text in the image. Text Stroke Orientation and Distribution of Edge pixels are the major process of the artificial neural network algorithm, which determines each letter of the text and reads the text captured in the image. Thus finally the text is recognized and the signals are processed and converted to audible signals and the text codes are given as a speech to the user.

## 3. Hardware and Software Specification

The Hardware components used are Raspberry Pi microcontroller, 5MP logitech web camera, 16GB SD card, Personal Computer. Raspberry Pi microcontroller is where the program coding is dumped using a SD card. The Logitech camera is used to capture the images, in which the text is to be read. Personal Computer is used to access the kit and process it. The Software platform is Open Source Linux and Operating system in which the program is executed is raspbian OS. The programming language is python.

## 4. Result

The image in which the text to be studied is captured as shown in figure 3. The program is executed to get the voice output of the text in the figure 4.


Figure 3: Snapshot of the captured image

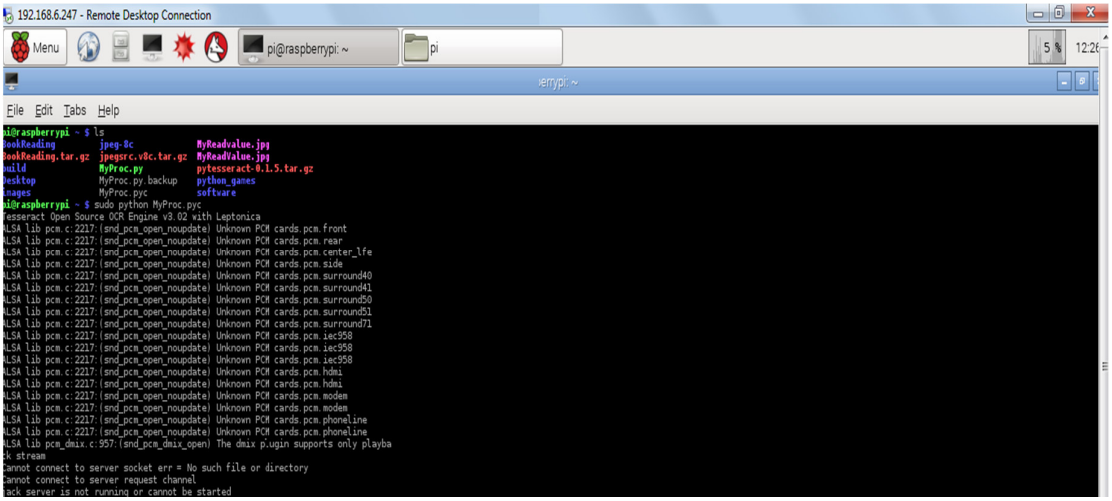


Figure 4: Snapshot of the Execution of the program

**Cite this article as:** P S Suhasini, D Youbarani, C Vijayasarathi, R Vani. "A Robust Embedded Based String Recognition for Visually Impaired People". *International Conference on Computer Applications 2016*: 94-97. Print.

## 5. Conclusion and Future Work

This system is proposed to assist the blind persons for reading the text without the guidance of other people.We have described a prototype system to read printed text on hand-held objects for assisting blind persons in their day to day life.In order to solve the common aiming problem for blind user, we have proposed a motion based method to detect the object of interest, while the blind user simply focuses the object through a camera provided. In Future, it can be developed as a product, where the camera can be fixed in the sun glass for providing flexibility in focusing the images.

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**Cite this article as:** P S Suhasini, D Youbarani, C Vijayasarathi, R Vani. "A Robust Embedded Based String Recognition for Visually Impaired People". *International Conference on Computer Applications 2016*: 94-97. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA020 | **eAID** | ICCA.2016.020 |


# Enhancing Security in Dynamic Public Cloud Data Using Encryption

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**Abstract:** *Cloud computing motivates organization and enterprise to outsource their data to third party cloud service provider. Some commercial cloud storage services are on-line data backup services of Amazon, and some practical cloud based software such as Memo pal, Mazy, Bitcasa, Drop box and Google have been built for cloud application. The data and software packages are stored in the cloud server. Multiple users in a group share the source code. The user can access, modify, compile and run that shared source code at any time and place. The collusion of revoked user, the cloud server will give chance to malicious cloud server data. Security issues would be provided in the public cloud storage server by encrypting the data by using encryption techniques. The scheme such as Key-Policy Attribute Based Encryption and Cipher Text- Policy Attribute Based Encryption provide security for the public storage cloud data. The Third Party Auditor maintains an audit log, keep track of malicious user details, and send back the details to the Data Owner are discussed.*

**Keywords—** *Cloud computing, KP-ABE, CP-ABE,Audit Log, PKI .*

## I. INTRODUCTION

Users have to entrust their data to cloud providers, there are several security and privacy concerns on outsourced data. In public cloud, service can be sold to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider) [1]. Many users share the data, software, source code from the cloud server. For protecting the confidentiality of the stored data, the data must be encrypted before uploading to the cloud by using some cryptographic algorithms [2]. Audit log entries could be annotated with attributes such as , the name of the user, the date and time of the user action, and the type of data modified or accessed by the user. Then a forensic analyst charged with some investigation would be issued a secret key associated with a particular access structure which would correspond to the key allowing for a particular kind of encrypted search; such a key, would only open audit log records whose attributes satisfied certain condition [3]. The security scheme such as CP-ABE and KP-ABE are used for encryptions. Under the construction of CP-ABE, an attribute is a descriptive string assigned to (or associated with) an entity and each entity may be tagged with multiple attributes. Many entities may share the same attributes, which allow message encryptors to specify a secure data access policy by computing multiple attributes through logical operators such as "AND" , "OR", etc. To decrypt the message, the decryption's attributes need to satisfy the access policy [4].

## II. Literature Survey

This work studies the problem of ensuring the integrity of data storage in cloud computing. In particular, they consider the task of allowing a third party auditor to verify the integrity of the dynamic data tored in the cloud. Attribute Based Encryption (ABE) was proposed as fuzzy version of IBE in [3], where an identity is viewed as a set of descriptive attributes. In the paper, the authors further



**Cite this article as:** Lita Pansy D, Pradeep S. "Enhancing Security in Dynamic Public Cloud Data Using Encryption". *International Conference on Computer Applications 2016*: 98-101. Print.

generalize the threshold-based set overlap distance metric to expressive access policies with AND and OR gates.

In this paper, encrypted data are uploaded, audit log is maintained an effective and flexible distributed scheme with dynamic data support to ensure the correctness of data [9].

## Advantages

1. Malicious data attack and server colluding attacks.
2. This system guarantees the data dependability.

## Limitation

1. This system is inconvenient.
2. The system does not provide data recovery.

## III. System Model

The system under study is a *public cloud* provider operating is a centralized data centre that is accessed by a large number of user over an unprotected public Internet network. Each data partition is made accessible to a set of authorized user. The key generation centre is responsible for granting access rights to user and the data owner.


Fig: 3.1 Architecture of data Sharing system

## A. Authentication in Cloud

Security is the most important aspect for any form of computing, making it an obvious expectation that security issues are crucial for cloud environment as well. The cloud computing approach could be associated with user's sensitive data stored both at client's end as well as in cloud servers.

## B. Key Generation Centre

It is a key authority that generates public and secret parameters for CP-ABE. It is in charge of issuing, revoking, and updating attribute keys for users. It grants differential access rights to individual users based on their attributes. The Key Generation Centre (KGC) residing in the cloud does not have access to user's private keys, but the KGC would need to ensure that partial private keys would be delivered securely to the right users using some secure, or out-of-band, transport.

## C. Data Storing Centre

Data should always be encrypted when stored and transmitted, by using a separate symmetric encryption keys. If this is implemented appropriately, even if another user can access the data, all that will appear is gibberish. Cloud providers should not have ready access to user's encryption keys.

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## IV. Proposed Approach

### A. Motivation

One of the existing solution deals with the protection of data with encryption key. But there is a chance of theft or getting the key by another person and behave like owner. In order to avoid this, the encrypted data would be stored in the cloud storage server. This completely prevent the damage of data.

### B. Method of Implementation

Encrypted data are stored in the cloud server; Public key will be provided to the data owner for accessing the data. Public key Infrastructure (PKI) is a popular encryption and authentication approach.

The PKI environment is made up of five components:

1. **Certification Authority (CA)** serves as the *root of trust* that authenticates the identity of individuals, computers and other entities in the network.
2. **Registration Authority (RA)** is certified by a root CA to issue certificates for uses permitted by the CA. In a Microsoft PKI environment, the RA is normally called a subordinate CA.
3. **Certificate Database** saves certificate requests issued and revoked certificates from the RA or CA.
4. **Certificate Store** saves issued certificates and pending or rejected certificate requests from the local computer.

### C. Attributes and Policy

In this section, we describe how to use attributes to form access policy, which is the building block of ABE scheme.

**Definition:** 1 A user's attribute list is defined as L = {A1+ /−, A2+/−,..., AK+/−k}, where Ai+/− ∈ {Ai+ ,Ai− i } and k is the number of attributes in the universe. L = L+ U L−. L+ = {Ai+ |¥i Є {1···k}} and L− = {Ai− |¥I {1···k}}. Also, we have L+∩ L− = θ.

Intuitively, Ai+ denotes the user has Ai; Ai− denotes the user does not have Ai or Ai is not a proper attribute of this user. For example, suppose U = {A1 = CS, A2 = EE, A3 = Faculty, A4 = Student}. Anand is a student in CS department; Bino is a faculty in EE department; Candy is a faculty holding a joint position in EE and CS department. Their attribute lists are illustrated in the following table:

| Attributes | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|
| Description | CS | EE | Faculty | Student |
| Anand | $A_1^+$ | $A_2^-$ | $A_3^-$ | $A_4$+ |
| Bino | $A_1^-$ | $A_2^+$ | $A_3^+$ | $A_4^-$ |
| Candy | $A_1^+$ | $A_2^+$ | $A_3^+$ | $A_4^-$ |

Table: 4.1 Example of Attribute policy

The AND-gate access policy is defined in below:

For example, to specify an access policy W1 for all CS Student and an access policy W2 for all CS people:

| Attributes | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
|---|---|---|---|---|
| Description | CS | EE | Faculty | Student |
| $W_1$ | $A_1$+ | $A_2^-$ | $A_3^-$ | $A_4$+ |
| $W_2$ | $A_1$+ | $A_2^-$ | $A_3$* | $A_4$* |

Table: 4.2 Example of Access policy

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### D. Key Generation

Each user u is tagged with the attribute list Lu = Lu+ U Lu− when joining the system. We have Lu+ C {1,⋯ ,k}, Lu− C {k+1,⋯ ,2k}. We also have L∗ = {2k+1, ⋯ , 3k}. The TA first selects k random numbers {r1, r2, ⋯, rk} from Zp and calculate r = Σk i=1 ri.

The TA computes D = gγr = vr. For every i Є Lu+, TA calculates Di = gγ(αi+ri0) where i' = i; for every i Є Lu−, TA calculates Di = gγ(αi+ri0) where i′ = i − k; for every i Є L∗, TA calculates Fi = gγ(αi+ri0) where i′ = i − 2k.

The private key for user u is computed as:

SKu = (D, {Di||¥i Lu+}, {Di|¥i Є Lu−}, {Fi|¥i Є L∗}).

## V. Conclusion

Cloud computing is as the set of resources or services offered through the internet to the users on their demand by cloud providers. As each and every organization is moving its data to the cloud, means it uses the storage service provided by the cloud provider. So there is a need to protect that data against unauthorized access, modification or denial of services etc. Cloud Computing can become more secure using cryptographic algorithms. Cyber criminals can easily cracked single level encryption. Hence we propose a system which uses cloud storage encryption and decryption to provide more security for Cloud Storage services.

As our proposed algorithm is an Encryption and Decryption algorithm. Thus, in our proposed work, only the authorized user can access the data. Even if some intruder (unauthorized user) gets the data accidentally or intentionally, he must have to decrypt the data at each level which is a very difficult task without a valid key. The Audit Log operation is provide to check the unauthorized modification of data in the cloud, it track the unauthorized person and provide intimation to the data owner.

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**Cite this article as:** Lita Pansy D, Pradeep S. "Enhancing Security in Dynamic Public Cloud Data Using Encryption". *International Conference on Computer Applications 2016*: 98-101. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA021 | **eAID** | ICCA.2016.021 |


# A Multi-Function Conversion Technique for Electric Vehicle Charging Station

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**Abstract-** *In this paper, a new method of integration between PV inverter system with utility grid for electric vehicle charging station based on the extended boost quasi-Z-source (q-ZSI) topology is proposed. The proposed system realizes a bidirectional power flow management between PV sources, energy storage unit and the utility grid. The extended boost q-ZSI is a most efficient topology that provides a single stage conversion for PV systems by providing low ratings for components, reduced number of components used, high input voltage gain, increased voltage boost property , reduced voltage stress across switches and simple control strategies .Its unique capability in single stage conversion with improved voltage gain is used for voltage buck and boost function. A simulation model of the grid connected q-ZSI for electric vehicle charging station has been built in MATLAB/ SIMULINK. The hardware setup was developed and the results are validated.*

**Keywords-** electric *vehicle charging station; battery storage; quasi ZSI; Shoot- through; extended boost*

## I. INTRODUCTION

Electric vehicles are progressively replacing traditional automobiles equipped with internal combustion engines. The continuous development of outstanding performance batteries and high-efficiency motors also has spurred dramatic interest in EVs, which are regarded as representatives of new energy vehicles [1–2]. In addition, with the emergence and development of the concept of smart grid, the reliable, economic, efficient and clean performance of smart grid and its user-friendly interaction will give EVs brighter prospects and a new round of improvements [3].

In grid connected PV systems, the power electronic converters plays a vital role in conversion of DC current of PV panels into an AC current to supply the load, with the maximum efficiency ,the lowest cost and superior performance. The two stages of DC-DC-AC power conversion may result in usage of more circuit components, lower efficiency, higher cost and larger size in comparison to single stage one.

The quasi Z source inverter has unique power conversion technology perfectly suitable for interfacing of renewable energy sources [4]. It has a single-stage boost-buck converter approach for the different renewable power applications. The efficiency and voltage gain of the q-ZSI are limited and comparable with the traditional system of a VSI inverter with the auxiliary step-up DC/DC converter in the input stage [5].

The use of photovoltaic (PV) energy for the charging operation has advantages, among others reducing the load demand on the utility grid, saving cost of energy usage to the utility provider especially for the business and contributing to the promotion of a cleaner technology. However as the harvested energy from PV is constrained by the factors such as sun irradiation availability and size and space of PV array installation, the charging station still normally need to be connected to the grid to maintain a stable power supply.



**Cite this article as:** N Hemalatha, M Arthi. "A Multi-Function Conversion Technique for Electric Vehicle Charging Station". *International Conference on Computer Applications 2016*: 102-109. Print.

In this paper multi function conversion technique for battery charging is done where DC power is directly injected to the vehicle n the off-board charger. The multi function conversion technique is done by using extended boost quasi ZSI technology which has unique single stage conversion of buck or boost function.

## II. Proposed Block Diagram

In order to investigate the feasibility of electric vehicle charging, a grid connected PV system with quasi Z source inverter and a three phase inverter is constructed. The proposed topology of grid connected q-ZSI for electric vehicle charging station was presented in Fig.1.and Fig.2.

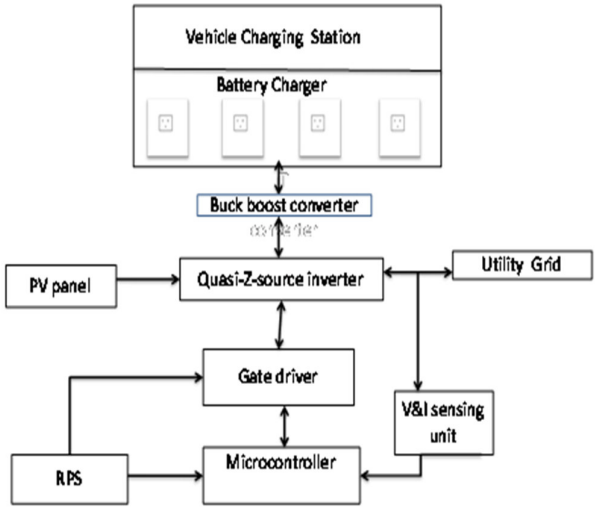



Fig.1. Proposed Block Diagram

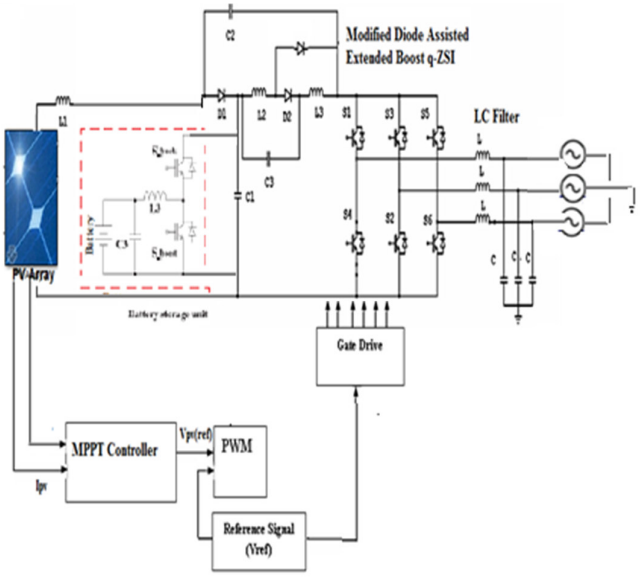


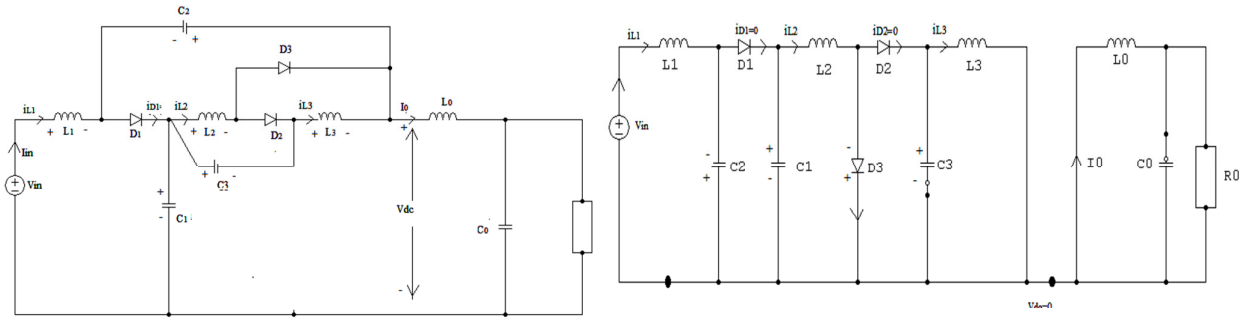

Fig.2. Grid-connected q-ZSI PV inverter system with bidirectional DCDC converter for battery storage

### 2.1 Steady State Analysis of q-ZSI

The extended boost q-ZSI has two operational states at the dc side, non-shoot-through states and the shoot-through state. [7-9].

**Cite this article as:** N Hemalatha, M Arthi. "A Multi-Function Conversion Technique for Electric Vehicle Charging Station". *International Conference on Computer Applications 2016*: 102-109. Print.

Fig. 3 (a) and 3 (b). Shows the equivalent circuits of the MCAEB q-ZSI for the shoot-through and the active states.




(a) (b)

Fig. 3. Equivalent circuits of q-ZSI: during the shoot-through state (a) and during the active state (b).

Let T = Operating period of the q-ZSI
TA= Active state
TS = Shoot through state
DA= the duty cycles of an active state
DS= the duty cycles of shoot-through state

$$T = TA + Ts \quad (1)$$
$$DA + Ds = 1 \quad (2)$$

## Shoot Through Mode

The equivalent circuit of the MDAEB q-ZSI during the shoot-through state is shown in Fig. 3a. The unique LC impedance network is interfaced between the source and the inverter to achieve voltage boost and inversion in a single stage. The voltage across the inductors can be represented as

$$VL1 = Vin - Vc1 \quad (3)$$
$$VL2 = Vc1 \quad (4)$$
$$VL3 = Vc3 + Vc1 \quad (5)$$

## Active Mode

The equivalent circuit of the MDAEB q-ZSI during the active state is shown in Fig. 3b.

The voltage of the inductors can be represented as

$$VL1 = Vin - VC1 \quad (6)$$
$$VL2 = -VC3 \quad (7)$$
$$VL3 = -VC3 - VC2 \quad (8)$$

The voltages of the capacitors can be given as

$$Vc1 = Vin \frac{Ds^2 - 2Ds + 1}{(Ds2 - 3Ds + 1)} \quad (9)$$
$$Vc2 = Vin \frac{2Ds - Ds^2}{(Ds^2 - 3Ds + 1)} \quad (10)$$
$$Vc3 = Vin \frac{Ds - Ds^2}{(Ds^2 - 3Ds + 1)} \quad (11)$$

The peak DC –link Voltage is

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$$Vdc = Vc1 + Vc2 = Vin \frac{1}{(Ds^2 - 3Ds + 1)} \quad (12)$$

The boost ratio of the input voltage is

$$B = \frac{Vdc}{Vin} = \frac{1}{(Ds2 - 3Ds + 1)} \quad (13)$$

## 2.2 Battery Storage Unit

Energy storage capability is used in the charging station infrastructure especially when PV source is used as an alternative source. Extra energy from the PV can be stored and used to reduce the reliance to the energy from the utility grid. The battery is connected directly in parallel to one of the capacitor at the impedance network as shown in Fig. 1. Direct connection to the capacitor however causes the battery terminal voltage need to be designed at higher voltage in series to match with the range of operation for the PV terminal voltage and the dc link voltage across the inverter switches.

Inside the storage unit a bidirectional DC-DC converter with the terminals across the switches are connected in parallel to capacitor C1 at point A and B. The bidirectional DC-DC converter enables the circuit to operates either as a buck converter to charge the storage battery with input voltage of 680V across C1 down to 300 V which is the optimal voltage value of the battery, or as a boost converter to supply current from the storage battery to the charging station. Value of L3 and C3 is designed based on the voltage and current ripple requirement.

## 2.3. Vehicle Charging Station

The EV charging station is consists of DC rail connected in parallel to the battery storage unit, and a charger 1 to 4, consists of DC-DC buck converter which are used to deliver the energy to the EV during charging process. Inside the DC-DC buck converter, controller is used to regulate the amount of current delivered to the car battery which can be varied depending on the time required to achieve certain level of SoC.

## 2.4. Modes of Operation

There are 3 factors used to determine mode of operation for the system; power received from the PV array (Ppv), charging power demand (Pcharge) and the SoC level of battery storage unit. Fig. 5 shows the flowchart of power management of the system which can briefly summarized as follow.

**Mode 1:** obtained PV energy is high sufficient to supply the charging demand. Energy from PV is directly used for charging and the remaining energy is stored/deliver to the grid.
**Mode 2:** obtained PV energy is low insufficient to supply the charging demand. Battery SoC in range. Battery goes to discharging operation to back up the low energy from PV.
**Mode 3:** obtained PV energy is low insufficient to supply the charging demand. Battery SoC is low. Power is drawn from the grid to support the low energy from PV.

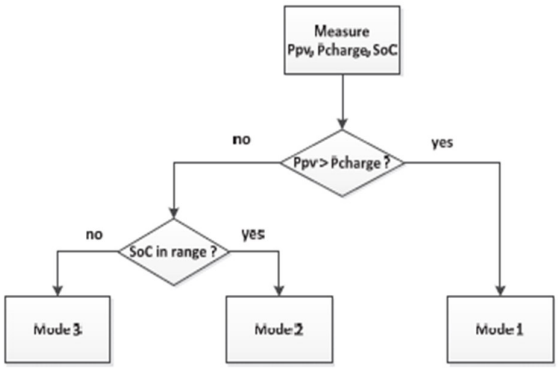


Fig.4.Flowchart of the charging management system

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## III. Simulation Results

Fig.5. shows the Matlab/ Simulink circuit of grid connected q-ZSI for electric vehicle charging station. Fig.6. shows the subsystem with battery arrangement.

Table:I shows the simulation parameters of grid connected q-ZSI for electric vehicle charging station.

| | |
|---|---|
| Input Voltage Vin | 12V |
| Inductors L1,L2, L3 & r L | 65µH, 0.005µH |
| Capacitors C1,C2, C3 & | 185µF, 0.0005µF |
| Grid Voltage Source | 230V,5Watts |
| Transformer Ratings | 230V,1A |
| DC Motor Ratings | 12V,30watts |
| Battery | 24V |
| Filter Inductance | 20mH |
| Filter Capacitance | 220µF |

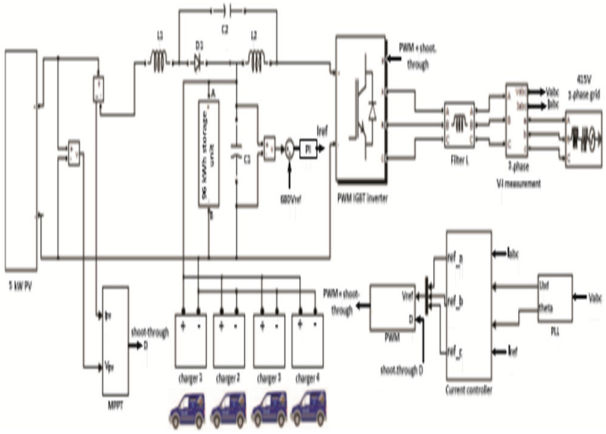

Fig.5.Matlab/Simulink circuit of proposed system

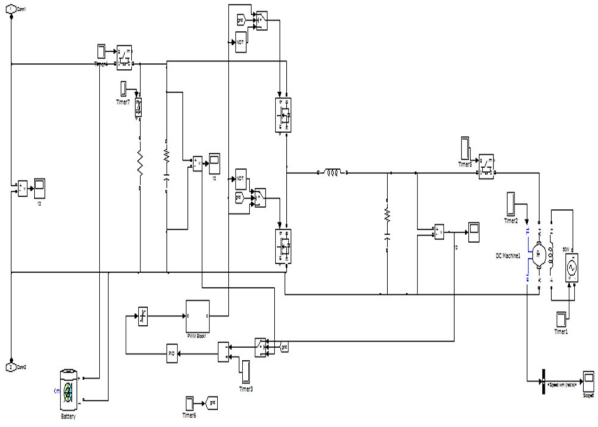

Fig.6.Matlab/ Simulink Circuit of battery storage

### 3.1. Gating Pattern

The gating pattern of the pulse generation using the simple boost control technique is shown in Fig.7.

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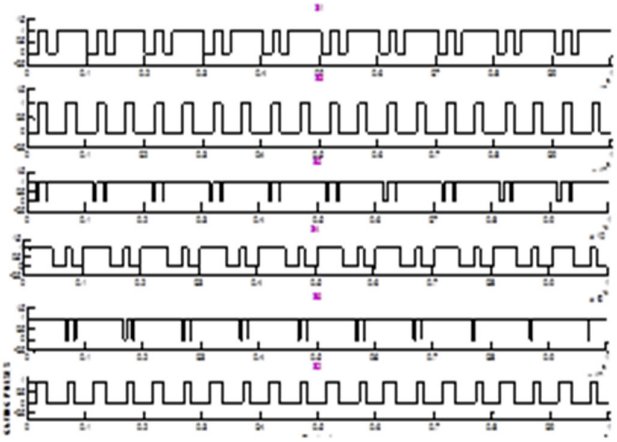

Fig.7.Gating Pattern for Simple Boost Control

Fig.7. shows the active state and shoot through pulse generation for simple boost control technique.

### 3.2. Input Power Waveform

The input power waveform is shown in Fig.8.

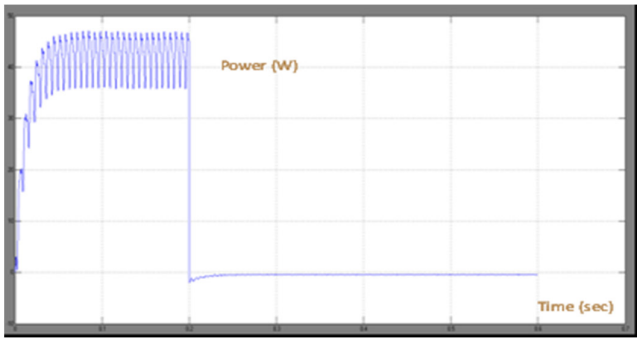


Fig.8.Input Power Waveform

### 3.3 Electric Vehicle Motor Speed Waveform

The motor speed waveform is shown in Fig.9.

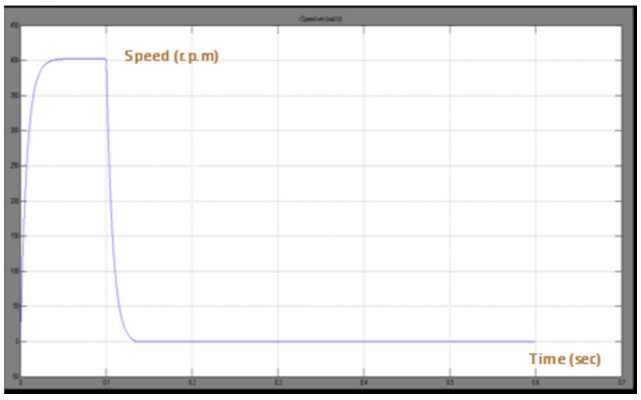


Fig.9. Motor Speed Waveform

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### 3.4. Regenerative Mode Voltage Waveform

The regenerative mode voltage waveform is shown in Fig.10.

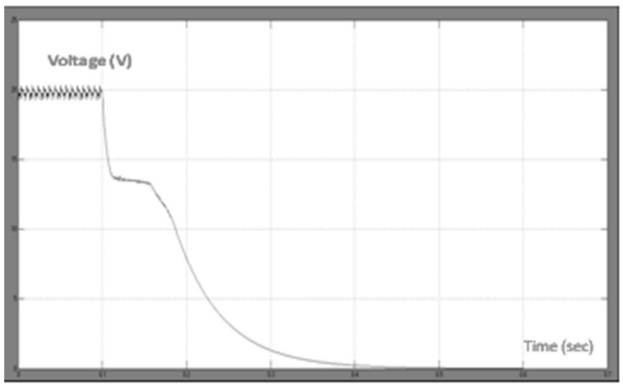


Fig.10.Regenerative Mode Voltage Waveform

### 3.5. Voltage and Current Waveform

The output load voltage and load current are shown in Fig.11.

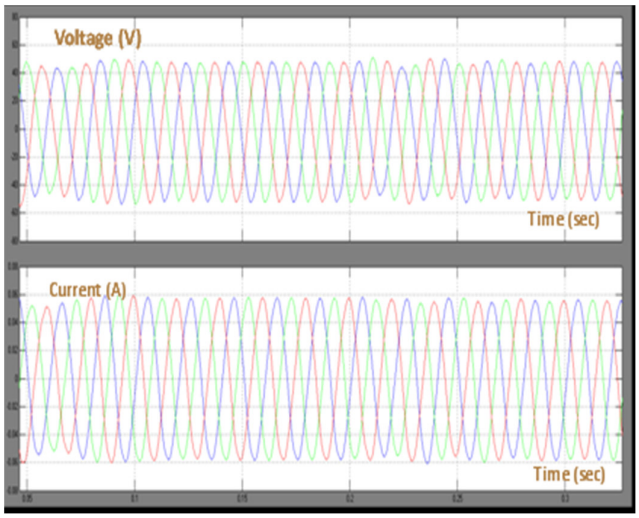


Fig.11.V & I Measurement waveform

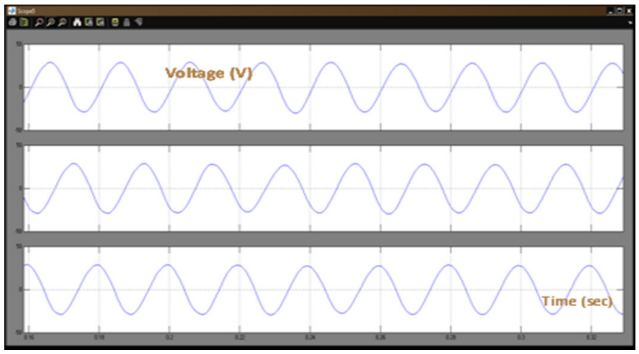


Fig.12.Load Voltage Waveform

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## IV. Conclusion

In this paper, the novel topology of modified diode assisted extended boost quasi ZSI is used in EV charging station based on grid connected PV system. The proposed topology of q-ZSI ensures the continuous input current and have increased boost factor of the input voltage and bidirectional power flow management system. From the simulation results, it is observed that the bidirectional power flow management between the PV source, charging station and the grid works well with the q-ZSI.

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International Conference on Computer Applications 2016 [ICCA 2016]

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|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA022 | **eAID** | ICCA.2016.022 |


# Palmprint Recognition using Multimodal Biometrics and Generation of One Time Password

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**Abstract—** *Biometrics was developed with the aim of improving the overall security level in all society contexts. A biometric system describes a set of techniques to analyze certain individual's biometric features, store and then using those patterns to identify or verify the identity of a person. The palmprint contains not only principal curves and wrinkles but also rich texture and miniscule points, so the palmprint identification is able to achieve a high accuracy because of available rich information in palmprint. Various palmprint identification methods, such as coding based methods and principal curve methods have been proposed in past decades. In addition to these methods, subspace based methods can also perform well for palmprint identification. Combining the left and right palmprint images to perform multibiometrics is easy to implement and can obtain better results.*

*Multimodal biometrics can provide higher identification accuracy than single or unimodal biometrics, so it is more suitable for some real-world personal identification applications that need high-standard security. A onetime password is included for higher security and accuracy.*

*One time passwords generally expire after using once. They are generated for using it within a certain time period after which it is useless. These passwords are set as a secondary security measure for the primary palmprint recognition.*

**Keywords—***palmprints, biometrics, multimodal biometrics, One Time Password, matching score, feature extraction*

## I. INTRODUCTION

Palmprint Identification technique is a growing biometric security method in the technology market. The palmprint contains principal curves, wrinkles, rich texture, depth and miniscule points. Using these biometric features, the palmprint is identified and the personal identification is verified. In spite of these verifications, there is a possibility of an error. In order to make this technique more secure and more stable, the method also includes the generation of an OTP (One Time Password). The OTP is used for making the system more reliable more efficient and trustworthy.

Various palmprint identification methods are used in previous works. All those works use unimodal biometrics which has certain limitations such as low performance. To overcome those limitations of unimodal biometrics, multimodal biometrics are used in this system. In general the multimodal biometric system uses more than one biometric input or feature of same individual for identification. Combining more than one biometric trait of the same individual increases the accuracy and reduces the error rate considerably which makes the system more secure and increases the performance.

In addition to the multimodal biometrics, an OTP (One Time Password) is also included. This OTP further increases the performance and accuracy of the system by reducing the identification errors. Since, these one-time passwords are valid only for a period, the



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passwords cannot be forged by the individuals which increases the security of the system.

## II. Proposed Framework

In this system, a novel framework of combining the left palmprint with the right palmprint at the matching score level is provided. In this framework, four types of matching scores are obtained by the left palmprint matching, right palmprint matching, cross matching between the left query palmprint and right training palmprint and cross matching between the right query palmprint and the left training palmprint respectively. These four matching scores are then fused together to make the final decision. This method uses the similarity between the left palmprint and the right palmprint of the same subject and then generates an OTP (One Time Password) for more accurate personal identification. Extensive experiments show that the proposed framework can integrate most conventional palmprint identification methods for performing identification and can achieve higher accuracy than conventional methods.

The proposed system uses five levels of framework for working at five different stages in the entire process. These levels are: the image (sensor) level, the feature level, the matching score level, the decision level and the OTP (One Time Password) generation level.

### Image (Sensor) Level

The image sensor level uses touchless method for obtaining the image of the palmprint. Generally, scanners are used for detecting minute minuscule in the palmprint. However, the touchless method uses a high resolution camera for capturing the image and processing it. The image is then processed based on the requirements of the system.

### Feature Level

The feature level involves extracting the miniscule points and principal lines from the obtained input image. The features include the principal lines, the rich texture and other miniscule points that play a major part in identifying an individual. The features are then processed and prepared for the next level.

### Matching Score Level

The matching score is calculated in this level by using the features that has been extracted in the previous level. The matching score level uses the matching score algorithm. This algorithm is used for determining the right palmprint matching score, the left palmprint matching score and the cross matching scores. Finally, the matching scores are fused together to form the fused matching score.

### Decision Level

Based on the final fused matching score value, the decision is made on whether the palmprints match any of the existing palmprints in the database. If there is a match, then the next level is executed. If not a match, then the recognition is denied and authentication is failed.

### OTP (One Time Password) Generation Level

The One Time Password is generated based on the random permutation algorithm. The one time password is valid only for a certain period of time. Once the password is used, it expires and hence cannot be reused again.

## A. Procedure of the Proposed Framework

Initially, two query palmprint images are given: left query palmprint and right query palmprint image. The training palmprint from the database are accessed and the principal lines are extracted. Now the matching score for left palmprint, right palmprint and cross matching scores are determined. The obtained matching scores are fused together and the final matching score is acquired. Based on this score, the best match is found. Then, a One Time Password (OTP) is generated. Once the correct password is typed, the person is recognized and access is granted.

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Fig.1 Architecture of the entire palmprint recognition process

In fig.1, query indicates the input images obtained by the system and the training palmprint denotes the images stored in the database. The left query palmprint image is verified with the left training palmprint image from the database to determine the left matching score. Then the right query palmprint image is verified with the right training palmprint image from the database to determine the right matching score. Then the left query palmprint image is combined with the right training palmprint image from the database to determine the cross matching score 1. Finally, the right query palmprint image is combined with the left training palmprint image from the database to determine the cross matching score 2. The above four matching scores are fused to determine the final matching score. Based on the obtained matching score, the one-time password is generated and accuracy is maintained.

## B. Preprocessing

In this section, if the input images are color images, they are converted to their respective gray scale images from their corresponding color images. This is done because a matrix cannot store more than one value at a given position. Hence the Red Green Blue (RGB) values in each pixel is converted to a single grayscale value by processing the red, blue and green values of each pixel to a grayscale pixel and averaging them. Now, the obtained grayscale image matrix is complemented. In the complement of an image, black and white colors are reversed (i.e.) the intensity of the grayscale image is swapped. In the output image, dark areas become lighter and light areas become darker. For a method to enhance the contrast of digital image, modified histogram equalization technique is proposed.

## C. Principal Line Extraction

This subsection describes the steps to extract the principal line from the palmprint image. The principal lines of the left palmprint and the reverse right palmprint of the same individual have similar shapes and positions. But the principal lines of the left and right palmprint of different individuals have very different shapes and positions. The principal line based methods have been widely used in palmprint identification. Top-hat filtering computes the opening of the image and then subtracts the result from the original image. Here, a value from zero to 255 is selected and assigned as the threshold value. The output image BW replaces all pixels in the input image with luminance greater than the threshold level with the value 1 (white) and replaces all other pixels with the value 0 (black). However, this binary black and white image might contain several distortions and noises. In order to avoid such discrepancies, filtering is done to remove the noise. Finally, principal line images are extracted. The principal line based method is able to provide stable performance for palmprint verification.

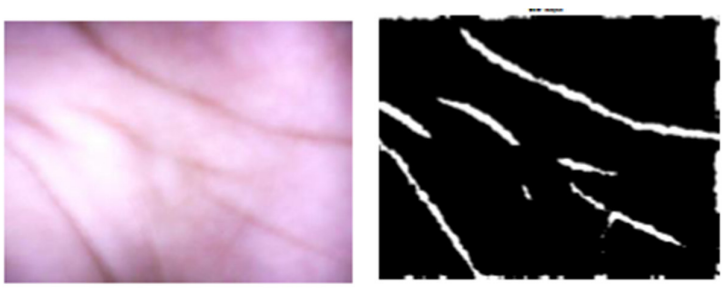

Fig.2.a Sample Left Palmprint Image Fig.2.b Extracted Principal line Image

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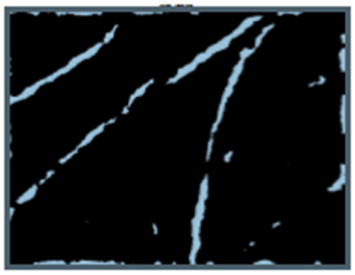

Fig. 3.a Sample Right Palmprint Image Fig. 3.b Extracted Principal line Image

The figure 2.a shows the left palmprint input image and figure 2.b represents the extracted and filtered image of the principal lines. The figure 3.a similarly shows the right palmprint input image and figure 3.b gives the extracted and filtered image of the principal lines of the corresponding image.

## D. Matching Score Level

The framework first works for the left palmprint images and uses a palmprint identification method to calculate the scores of the test sample with respect to each class. Then it applies the palmprint identification method to the right palmprint images to calculate the score of the test sample with respect to each class. After the crossing matching score of the left palmprint image for testing with respect to the reverse right palmprint images and right palmprint image with respect to left palmprint images of each class is obtained, the proposed framework performs matching score level fusion to integrate these four scores to obtain the identification result. The method has the following logic:

$S(A, B) = \text{sum}(\text{sum}(A(i, j) \& \bar{B}(i, j)))/NA$ (1)

where A and B are two palmprint principal lines images, "&" represents the logical "AND" operation, NA is the number of pixel points of A, and $\bar{B}(i, j)$ represents a neighbor area of B(i, j ).

The value of $A(i, j) \& \bar{B}(i, j)$ will be 1 if A (i, j) and at least one of $\bar{B}(i, j)$ are simultaneously principal lines points, otherwise, the value of $A(i, j) \& \bar{B}(i, j)$ is 0.

S(A, B) is between 0 and 1, and the larger the matching score is, the more similar A and B are.

The steps are presented in detail below:

Step 1: Find the matrix B~ (i,j) by adding zeros along the rows and columns of the matrix and comparing A(i,j) and B(i,j). Denote the matrix values of B~(i,j) as 1 if any one value of B(i+1,j), B(i-1,j), B(I,j+1) or B(I,j-1) are equal to A(i,j).
Step 2: Perform AND operation for A(I,j) and B~(I,j).
Step 3: Add the row values and column values of the obtained matrix separately.
Step 4: Average both the values to get the matching score value for the right palmprint.
Step 5: Similarly, perform the same method for the left palmprint images.
Step 6: For finding the matching score of the right training palmprint and the left query palmprint, generate the reverse images ˜ B(i,j) of the right palm- print image. Both B(i,j) and B~(i,j) will be used as training samples.
Step 7: The maximum matching score denotes the most closest and accurate match for the given inputs.

## E. One Time Password

A One Time Password (OTP) is included for higher security and accuracy. One Time Passwords generally expire after using once and are more secure to use than normal passwords. They are useless if not used within the given time duration. Only if the palmprint matches, the One Time Password is generated. One Time Password is generated using the random permutation method. The algorithm uses three random variables xx=1, a=1, b=2 to compute a four digit random password.

The random password is obtained using the logic,

$x = r(i) * r(i) * r(i)$, (2)
$k = x + (a*r(i)) + b$, (3)
$y(i) = \text{sqrt}(k)$ (4)
$OTP = \text{round}(xx * y)$ (5)

where OTP is the final password that has been generated.

## F. Complexity

In this method, the reverse of left and right training palmprint is processed before performing the identification which increases the complexity of the system with respect to time. The proposed system requires extra time for computation of matching score when

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compared to other conventional methods. Further, it requires an extra time for computing the One Time Password which increases the computational complexity of the system.

## III. Conclusion

This study shows that the left and the right palmprint images of the same subject are somewhat similar. The use of this kind of similarity for the performance improvement of palmprint identification has been explored. The proposed method carefully takes the nature of the left and right palmprint images into account, and designs an algorithm to evaluate the similarity between them. Moreover, by employing this similarity, the proposed weighted fusion scheme uses a method to integrate the three kinds of scores generated from the left and right palmprint imaged. Extensive experiments demonstrate that the proposed framework obtains very high accuracy and the use of the similarity score between the left and right palmprint leads to important improvement in the accuracy.

## IV. Future Enhancement

The technique implemented should be improved by creating a database all over India for security purposes. The detection technique in an image should be improved by using a camera with high resolution. The technique should be taken ahead by all the organizations for accurate personal identification and security reasons.

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**Cite this article as:** S Pravarthika, S Babitha Rani, K Induja. "Palmprint Recognition using Multimodal Biometrics and Generation of One Time Password". *International Conference on Computer Applications 2016*: 110-114. Print.

International Conference on Computer Applications 2016 [ICCA 2016]

| | | | |
|---|---|---|---|
| **ISBN** | 978-81-929866-5-4 | **VOL** | 05 |
| **Website** | icca.co.in | **eMail** | icca@asdf.res.in |
| **Received** | 14 – March– 2016 | **Accepted** | 02 - April – 2016 |
| **Article ID** | ICCA023 | **eAID** | ICCA.2016.023 |


# Robustness Analysis of Buffer Based Routing Algorithms in Wireless Mesh Network

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**Abstract:** *Wireless Mesh Network rose as a promising innovation for providing quick and productive communication for which numerous algorithms have been proposed in networking infrastructure. For routing there are various performance parameters such as throughput, network congestion, resiliency, fairness, robustness, network jitter, delay, stability, optimality, simplicity, completeness etc. Robustness provides the capability to deal with all the failures that come across during the connection in the network to increase the network performance. In this paper we have studied and analyzed three algorithms namely on robustness parameter Resilient multicasting [2], Resilient Opportunistic Mesh Routing for Wireless Mesh Network (ROMER) [3], and Buffer Based Routing (BBR) [4], in Wireless Mesh Networks. Analysis through various parameters such as network congestion, network throughput and resiliency [5], shows network performance of BBR is better.*

**Keywords:** *Resilient Multicasting, ROMER, Buffer Based Routing, WMN, Robustness.*

## INTRODUCTION

Wireless Mesh Networks propose a decentralized structural engineering for setting multi-hop wireless communications. The decentralized structural planning brings advantages such as ease of deployment, maintenance, scalability and consistency. However, WMN is deficient in high level services such as handoff and mobility management [1]. Routing is process of transferring information across a network from source to destination. It can also be referred to as the process of selecting a path over to send the packet. To provide routing services efficiently and appropriately there are many characteristics that need to be analyzed in a routing algorithm which could help in packet transmission in a network. In context to computer network, robustness is the capability of the network to deal with all the failures that occurs during the transmission of message or packet that take place between source and destination. The most appropriate application for robustness is to make routing algorithm so resistant that if error occurs it should not affect the normal functioning of the network.

The issue that exists during communication is management of bundle transmission from source to destination efficiently and demonstrating the calculation/algorithm that it is powerful in nature. In our previous work [5] Buffer based routing was analyzed on three parameters i.e. system throughput, network congestion and resiliency and it was demonstrated in comparison with Resiliency Multicasting and ROMER that BBR lives up to expectations all the more proficiently because of the way that it has some buffered nodes that help in travelling the packet to its destination. In this paper we consider another critical parameter to further upgrade the power of BBR methodology.

The paper is divided in five sections. In section first we have introduced the problem. Second section discusses the related work in the



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field of routing protocols. The third section introduced the proposed work by comparing the algorithms on the basis of cost. In section fourth the results and analysis is presented. Section fifth concluded the manuscript, which is followed be references of the manuscript.

## Related Work

Xin Zhao et al. in [2] presented an approach called Resilient Multicasting requiring two node disjoint path for every pair of source to destination. These disjoint paths are such as, link disjoint and node disjoint. Link disjoint do not have any link in common and node disjoint do not have any node in common except the source and destination. Yuan [3] et al. proposed Resilient Opportunistic Mesh Routing for mesh Network as a solution and provides with the balance between long term and short term performance. It works on R (credit ratio) and T (threshold) value. This mechanism was used to provide differentiated robustness for various categories of data packets. Rathee et al. in [4] projected a approach as Buffer based Routing Algorithm as to overcome resilient multicasting and ROMER. This algorithm is used to maintain buffer at every alternative nodes in the network. These buffered nodes are half to the number of nodes present in the network. This approach maintains a routing table keeping all information of the node. Sangman Cho et al. in [7] developed an independent directed acyclic graph for resilient multipath routing which follows a path from source to root. This graph is link disjoint in nature. They also develop an algorithm for computation of link-independent and node-independent graphs. Zeng [8] et al. proposed a protocol named as opportunistic multicast protocol for improving throughput of the network. This protocol helped to enhance the unicast throughput in the network. Main concept of the protocol is its tree backbone. The protocol presents the tradeoff between traditional multicast protocol and unstructured protocols. Xin [9] studied the multipoint multicasting for distributed environment in the mesh network targeting to minimize the time slots for exchanging messages among many nodes in the network. The paper presented an algorithm for multicasting algorithm and analyzes its time complexity. The time taken by the algorithm is O(d log n + k). Bruno et al. [10] proposed a routing algorithm called as MaxOPP. It takes a localized routing decision for selection of forwarding nodes. The selection of the nodes is on per packet basis and at run time. Xi Fang [11] proposed an opportunistic algorithm for improving the performance of the network. Various problems have been studied for choosing the route for every user so that they can optimize the total profit of various users in the network concerning node constraint. The paper formulated two problems for programming system. By two methods i.e. primaldual and subgradient, an iterative approach named Consort: node constraint opportunistic routing. For every iteration it updates the lagrange multiplier in distributed environment according to user and node. Zhang [12] et al. presented an overview of opportunistic routing, the challenges faced in implementing the routing. The paper presented various routing protocol such as ExOR, ROMER, SROR etc for achieving increased throughput in comparison with traditional routing Aajami [13] et al. studied various approaches such as wireless interflow network and opportunistic routing for enhancing the throughput. A solution have been proposed by combining these approaches. The paper suggested a technique abbreviated as MRORNC as an integrated cross layer approach for determining packet, next hop and transmission rate.

## Proposed Work

### Robustness Analysis of Resilient Multicasting

Zhao et.al in [5] proposed that the algorithm works on disjoint paths having no node as common except the source and destination. We will be demonstrating the path traversed from source to destination for network with varying number of nodes.

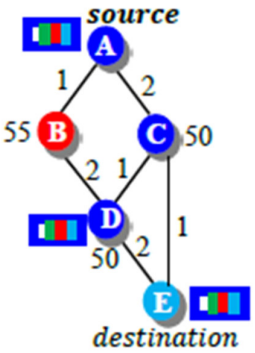


Fig.1. Network showing 5 nodes [5].

For example in the network [5], Fig 1 when there are 5 nodes, the algorithm chooses two nodes disjoint paths to send the packet from source (node A) to destination (node E) are: and A-B-D-E and A-C-E. Choosing first path as A-B-D-E having its cost as 1+2+2 = 5 units, and in A-C-E as 2+1 = 3 units, leads to total of 8 units for the packet to travel.

In Fig 2, for a network with 10 nodes,

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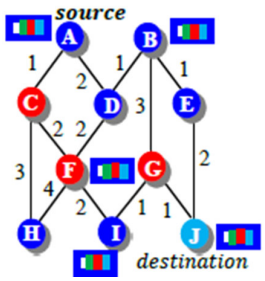


Fig. 2. Network showing 10 nodes [5].

Taking two disjoint paths from source (node A) to destination (node J) are: and A-C-H-F-I-G-J and A-D-B-E-J. Choosing first path as A-C-H-F-I-G-J having its cost as 1+3+4+2+1+1 = 12 units and A-D-B-E-J as 2+1+1+2 = 6 units, leads to total of 18 units for the packet to travel.

In Fig 3, for a network with 15 nodes,

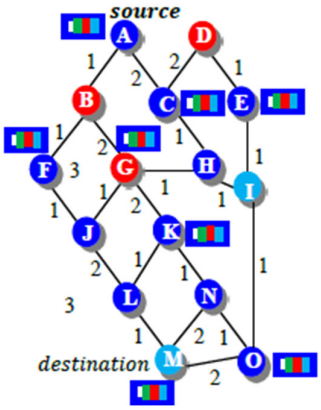


Fig. 3. Network showing 15 nodes [5].

The two disjoint paths from from source (node A) to destination (node M) are: A-C-H-I-O-M and A-B-G-K-N-M. Choosing first path as A-C-H-I-O-M having its cost as 2+1+1+12 = 7 and A-B-G-K-N-M as 1+2+2+1+2 = 8 units, leads to total of 15 units for the packet to travel.

In Fig 4, for a network with 20 nodes,

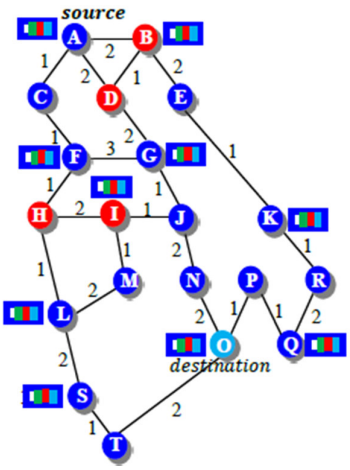


Fig. 4. Network showing 20 nodes [5].

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Taking two disjoint paths from which packet can travel from source (node A) to destination (node O) are: A-C-F-H-L-S-T-O and A-B-E-K-R-Q-O. Choosing first path as A-C-F-H-L-S-T-O having its cost as 1+1+1+1+2+1+2 = 9 units and A-B-E-K-R-Q-O as 2+2+1+1+2+1+1 = 10 units, leads to total of 19 units for the packet to travel.

In Fig 5, for a network with 25 nodes,

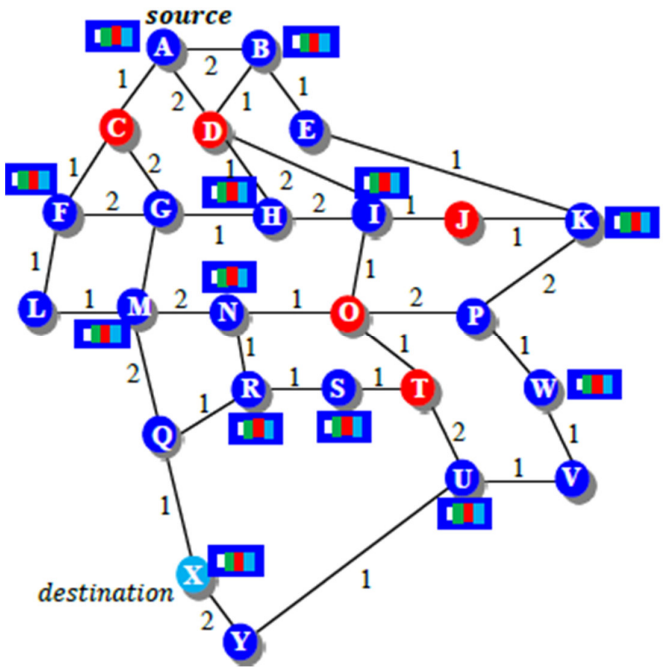


Fig. 5. Network showing 25 nodes [5].

The two disjoint paths from source (node A) to destination (node X) are: A-C-G-M-O-X and A-D-H-I-O-T-U-Y-X Choosing first path as having its cost A-C-G-M-O-X as 1+2+1+2+1 = 7 units and A-D-H-I-O-T-U-Y-X as 2+1+2+1+1+2+1+2 = 12 units, leads to total of 19 units for the packet to travel.

In multicasting algorithm whenever failure occurs in the network the source can prefer another path to route the packet in order to reach to its destination, but when all the routes fail then no packet will travel in the network. Therefore through all this study we can conclude that multicasting algorithm could not pass this robustness parameter as it is unable to route the packet at the time of node failure.

## Robustness Analysis of Romer

Due to node failure possibility in Resilient Multicasting another algorithm was developed that overcome all its disadvantages i.e. ROMER. Yuan et.al [3] proposed that the algorithm works on the value of R(credit ratio) and T(threshold) on every node that has its value of R greater than its value of T can forward the packet to the possible route. We will be demonstrating the path traversed from source to destination for network with varying number of nodes for ROMER, cost is written along.

| NODE | CREDIT UNIT | NODE UNIT |
|---|---|---|
| A | 100 | 100 |
| B | 120.5 | 55 |
| C | 120.5 | 50 |

Table 1. Credit unit and Node unit of network of 5 nodes as in fig 1.

**At node B:**

$$R = \frac{(100-(120.5+55-100)}{100}$$

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Where (120.5 + 55 -100) 77.5 is the credit required, (100 - (77.5)) = 22.5 is the remaining credit for node B and 22.5/100 is the ratio of remaining credit to initial credit.
Therefore the value of R = 0.245.

Further threshold value is calculated as $T = \left(\frac{cost\ of\ node\ B}{cost\ of\ source}\right)^2$.

T= (55/100) = 0.3025.
R<T which depicts that node B will discard the packet.

**At node C:**

R = (100 - (120.5 + 50 - 100)/100 )
=0.295.
T = (50/100)2
=0.2500.
R>T which depicts that node C will forward the packet.

| NODE | R | T | COMPARISON | FUNCTION |
|---|---|---|---|---|
| B | 0.245 | 0.3025 | $R < T$ | Discard the packet |
| C | 0.295 | 0.2500 | $R > T$ | Forward the packet |

Table 2. Showing the value of R (credit ratio) and T (through put) in network of 5 nodes as in fig 1.

Table 1 and 2 are representation of fig 1 in which there are 5 nodes, the two possible paths (out of three available options) from which packet can travel from source (node A) to destination (node E) are: and and nodes B is having the value of R less than the value of T which shows that this node fails to transmit the packet. Choosing first path as having its cost as 1 units, and in as units, leads to total of 4 units for the packet to travel.

| NODE | CREDIT UNIT | NODE UNIT |
|---|---|---|
| A | 100 | 100 |
| B | 120.5 | 50 |
| C | 120.5 | 50 |
| D | 120.5 | 55 |
| E | 120.5 | 50 |
| F | 121.5 | 55 |
| H | 122.5 | 51 |

Table 3. Credit unit and Node's unit of network of 10 nodes as in fig 2.

| NODE | R | T | COMPARISON | FUNCTION |
|---|---|---|---|---|
| B | R=(100 − (122.5 + 50 − 100)/100) =0.275 | T= (50/100)2 =.2500 | R>T | forward the packet |
| C | R=(100 − (120.5 + 50 − 100))/100 = 0.295 | T= (50/100)2 =.2500 | R>T | forward the packet |
| E | R=(100 − (120.5 + 50 − 100)/100) =0.295 | T= (50/100)2 =.2500 | R>T | forward the packet |
| F | R=(100 − (122.5 + 51 − 100))/100 =0.265 | T= (51/100)2 = 0.2601 | R>T | forward the packet |
| H | R=(100 − (121.5 + 55 − 100)/100) =0.235 | T=(55/100)2 =0.3025 | R<T | discard the packet |

Table 4. Showing value of R and T in network of 10 nodes as in fig 2.

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Similarly, table 3 and 4 are representation of fig 2 in which there are 10 nodes, the two possible paths (out of all available options) from which packet can travel from source (node A) to destination (node J) are: A-C-F-I-G-J and A-C-F-I-G-B-E-J. Choosing first path as having its cost A-C-F-I-G-J as 1+2+2+1+1 = 7 units and A-C-F-I-G-B-E-J as 1+2+2+1+3+1+2 = 12 units, leads to total of 19 units for the packet to travel.

| NODE | CREDIT UNIT | NODE UNIT |
|---|---|---|
| A | 100 | 100 |
| B | 120.5 | 51 |
| C | 121.5 | 50 |
| D | 121.5 | 51 |
| E | 122.5 | 50 |
| F | 120.5 | 50 |
| G | 122.5 | 55 |
| H | 121.5 | 51 |

Table 5. Credit unit and Node's unit of network of 15 nodes as in fig 3.

The units are assumed for explanation.

| NODE | R | T | COMPARISON | FUNCTION |
|---|---|---|---|---|
| B | 0.295 | 0.2500 | $R > T$ | forward the packet |
| C | 0.285 | 0.25 | $R > T$ | forward the packet |
| E | 0.275 | 0.25 | $R > T$ | forward the packet |
| F | 0.295 | 0.25 | $R > T$ | forward the packet |
| G | 0.225 | 0.3025 | $R < T$ | discard the packet |
| H | 0.275 | 0.2601 | $R > T$ | forward the packet |

Table 6. Showing value of R and T in network of 15 nodes as in fig 3.

As previously performed for 5 and 10 nodes, table 5 and 6 are representation of fig 3 in which there are 15 nodes, the two possible paths (out of all available options) from which packet can travel from source (node A) to destination (node M) are: A-B-F-J-G-K-N-M and A-C-F-J-L-K-N-O-M. Choosing first path as A-B-F-J-G-K-N-M having its cost as 1+1+1+1 = 4 units (till node G) and A-C-F-J-L-K-N-O-M as 1+1+1+2+1+1+1+2 = 10 units, leads to total of 14 units for the packet to travel.

| NODE | CREDIT UNIT | NODE UNIT |
|---|---|---|
| A | 100 | 100 |
| B | 121.5 | 50 |
| C | 120.5 | 51 |
| D | 120.5 | 50 |
| E | 120.5 | 55 |
| F | 121.5 | 55 |
| G | 121.5 | 51 |
| H | 122.5 | 50 |
| I | 122.5 | 51 |
| J | 122.5 | 55 |
| L | 123.5 | 50 |
| M | 123.5 | 51 |
| N | 123.5 | 55 |
| O | 124.5 | 55 |
| S | 124.5 | 50 |
| T | 124.5 | 51 |

Table 7. Credit unit and Node's unit of network of 20 nodes as in fig 4.

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| NODE | R | T | COMPARISON | FUNCTION |
|---|---|---|---|---|
| B | 0.285 | 0.25 | $R > T$ | forward the packet |
| C | 0.285 | 0.2601 | $R > T$ | forward the packet |
| D | 0.295 | 0.25 | $R > T$ | forward the packet |
| E | 0.245 | 0.3025 | $R < T$ | discard the packet |
| F | 0.295 | 0.2500 | $R > T$ | forward the packet |
| G | 0.285 | 0.2500 | $R > T$ | forward the packet |
| H | 0.275 | 0.25 | $R > T$ | forward the packet |
| I | 0.265 | 0.2601 | $R > T$ | forward the packet |
| J | 0.225 | 0.3020 | $R < T$ | discard the packet |
| L | 0.265 | 0.25 | $R > T$ | forward the packet |
| M | 0.255 | 0.2601 | $R < T$ | discard the packet |

Table 8. Showing value of R and T in network of 20 nodes as in fig 4.

As per table 7 and 8 for 20 nodes there are two possible paths (out of all available options) from which packet can travel from source (node A) to destination (node O) are: A-B-D-G-F-H-L-S-T-O and A-D-G-J-N-O. Choosing first path as A-B-D-G-F-H-L-S-T-O having its cost as 2+1+2+3+1+1+2+1+2 = 15 units and A-D-G-J-N-O as 2+2+1 = 5 units, leads to total of 20 units for the packet to travel.

Therefore this same calculation can be done in the case of 25 nodes and the paths will be discard are according to incapable nodes.

## Robustness Analysis of Buffer Based Routing

Rathee et.al proposed in [4] that the algorithm works on two conditions i.e. the packet travels through the route that must contain minimum number of buffered node and if more than one path has same number of buffered node than it will select the least cost path from source to destination. We will be demonstrating the path traversed from source to destination for network with varying number of nodes.

| PATHS | COST | BUFFERED NODES |
|---|---|---|
| A-B-D-E | 5 | 3 |
| A-C-D-E | 5 | 3 |
| A-C-E | 3 | 2 |

Table 9 . Network of 5 nodes.

Table 9 represents fig 1 in which there are 5 nodes, having two possible paths (out of three available options) from which packet can travel from source (node A) to destination (node E) are: A-C-E and A-B-D-E. Choosing first path as A-C-E having its cost as 2+1 = 3 units, and in A-B-D-E as 1+2+2 = 5 units, leads to total of 8 units for the packet to travel.

| PATHS | COST | BUFFERED NODES |
|---|---|---|
| A-D-B-E-J | 6 | 3 |
| A-D-F-I-G-J | 8 | 4 |
| A-C-H-F-I-G-J | 12 | 3 |
| A-C-F-I-G-J | 7 | 4 |
| A-D-B-G-J | 7 | 3 |

Table 10. Network of 10 nodes.

Similarly, table 10 represents (fig 2) two possible paths (out of all available options) from which packet can travel from source (node A) to destination (node J) are: A-D-B-E-J and A-D-F-I-G-J Choosing first path as A-D-B-E-J having its cost as 2+1+1+2 = 6 units and A-D-F-I-G-J as 1+2+2+1+1+1 = 7 units, leads to total of 13 units for the packet to travel.

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| PATHS | COST | BUFFERED NODES |
|---|---|---|
| A-B-F-J-L-M | 6 | 3 |
| A-B-G-K-N-M | 7 | 3 |
| A-B-G-K-L-M | 7 | 4 |
| A-B-G-J-L-M | 7 | 3 |
| A-B-G-K-N-O-M | 9 | 5 |
| A-C-H-I-O-M | 7 | 3 |

Table 11. Network of 15 nodes.

Table 11 represents two possible paths (out of all available options) for 15 nodes from which packet can travel from source (node A) to destination (node M) are A-B-F-J-L-M and A-C-H-I-O-M. Choosing first path as A-B-F-J-L-M having its cost as 1+1+1+2+1 = 6 units and A-C-H-I-O-M as 2+1+1+1+2 = 7 units, leads to total of 13 units for the packet to travel.

| PATHS | COST | BUFFERED NODES |
|---|---|---|
| A-B-E-K-R-Q-P-O | 10 | 5 |
| A-C-F-H-I-J-N-O | 11 | 4 |
| A-B-D-G-J-N-O | 10 | 4 |
| A-C-F-G-J-N-O | 10 | 4 |

Table 12. Network of 20 nodes.

Table 12 (represents fig 4) where there are 20 nodes, the two possible paths (out of all available options) from which packet can travel from source (node A) to destination (node M) are: A-C-F-H-I-J-N-O and A-B-D-G-J-N-O. Choosing first path as A-C-F-G-J-N-O having its cost as 1+1+31+2+2 = 10 units and A-B-D-G-J-N-O as 2+1+2+1+2+2 = 10 units, leads to total of 20 units for the packet to travel.

| PATHS | COST | BUFFERED NODES |
|---|---|---|
| A-C-F-L-M-Q-X | 7 | 4 |
| A-C-G-M-Q-X | 7 | 3 |
| A-D-H-G-M-Q-X | 8 | 4 |
| A-B-E-K-P-W-V-U-Y-X | 12 | 6 |
| A-B-D-I-O-T-U-Y-X | 12 | 5 |

Table 13. Network of 25 nodes.

Fig 5 (as detailed in table 13) when there are 25 nodes, the two possible paths (out of all available options) from which packet can travel from source (node A) to destination (node M) are: A-C-G-M-Q-X and A-B-D-I-O-T-U-Y-X. Choosing first path as A-C-G-M-Q-X having its cost as 1+2+1+2+1 = 7 units and A-B-D-I-O-T-U-Y-X as 2+1+2+1+1+2+1+2 = 12 units, leads to total of 19 units for the packet to travel.

## 4. Result and Analysis

We are evaluating the robustness of the three algorithms (in terms of cost units).As we can see that robustness is inversely proportional to the cost. Lesser the cost of the packet higher will be the robustness. Cost evaluated on robustness parameter for packet to reach from source to destination in network of different sizes is shown in table 14 with respect to the three algorithms. In case of multicasting, the cost will be according to two disjoint paths taken in the network. In case of ROMER, the source choose two paths, if in any path there is a node which is unable to forward the packet further in the network then the cost will be considered up to the node causing failure in the network, in addition to the cost of next path (shown in fig 6). In Buffer Based Routing, the cost depends on the path containing least buffered nodes.

| ALGORITHMS | 5 NODES | 10 NODES | 15 NODES | 20 NODES | 25 NODES |
|---|---|---|---|---|---|
| RESILIENT MULTICASTING | 8 | 18 | 15 | 19 | 19 |
| ROMER | 4 | 19 | 14 | 20 | 18 |
| BBR | 8 | 13 | 13 | 20 | /19 |

Table 14. Table showing the units consumed by the packet from source to destination.

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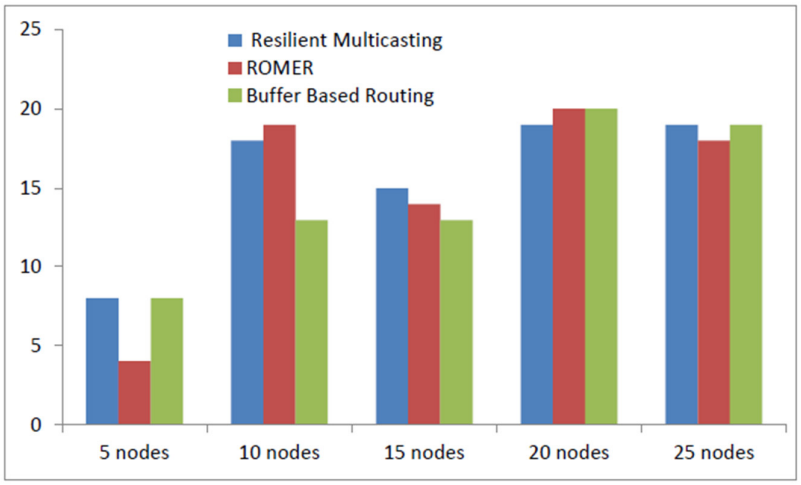


Fig 6. Showing the graphical representation of values Table 14.

## 5. conclusions And Future Work

This paper explores the robustness parameter in diverse sizes of network that how it deals with errors or failures during the transmission of the packet in all three algorithms. We began our study with resilient multicasting algorithm, then ROMER and finally Buffer based resilient routing approach. We assessed and Compared robustness on the basis of cost consumed while transmitting every packet in the network. By assessing the cost evaluated in distinctive size of the networks, we can conclude that BBR shows better result when contrasted with resilient multicasting and ROMER. As Resilient Multicasting and ROMER algorithm has more likelihood of failures whereas in BBR the failure handling capability is more because buffered nodes are present in the network, which are half of the number of nodes present, which serves to choose another path taken by the previously buffered node whenever the failure occurs.

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**Cite this article as:** Long CAI, Rajkumar Sugumaran, Kokula Krishna Hari Kunasekaran. "Robustness Analysis of Buffer Based Routing Algorithms in Wireless Mesh Network". *International Conference on Computer Applications 2016*: 115-123. Print.