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Highlights

Multimedia Transmission Routing

Multipoint Virtual Private Network

Malicious Transactions in Database

Protocol with Multihop Communication

Discovering Thoughts, Inventing Future

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A Review of Security Mechanisms for Detection of Malicious Transactions in Database

By Chitanlapudi sai charan, Varada Bharat Srinivas & Dr. K. V. Daya Sagar

KL University, India

Abstract- Insider attacks formed the biggest threaten against database management systems. There are many mechanisms have been developed to detect and prevent the insider attacks called Detection of Malicious Activities in Database Systems DEMIDS. The DEMIDS consider as one of the last defenses mechanism of the database security system. There are many mechanisms that have been developed to detect and prevent the misuse activities like delete, and update data on the database systems. These mechanisms utilize auditing and profiling methods to detect and prevent the malicious activities. However these mechanisms still have problems to detect the misuse activities such as limit to detect the malicious data on authorized commands. This study will address these problems by propose a mechanism that utilizes dependency relationship among items to detect and prevent the malicious data by calculate a number of relations among data items. If the number of relations among items is not allowed any modification or deletion then the mechanism will detect activity as malicious activity. The evaluation parameters such as detect, false positive and false negative rate use to evaluate the accuracy of proposed mechanism.

Keywords: dependency relationship; detection; prevention; malicious; insider attack.

GJCST-E Classification : H.2

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A Review of Security Mechanisms for Detection of Malicious Transactions in Database

Chitanlapudi Sai Charan [α], Varada Bharat Srinivas [σ] & Dr. K. V. Daya Sagar [ρ]

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I. Introduction

Information is one of the main assets of any organization which is essential to its continuity. Therefore, information security is very important to protect the confidentiality, integrity and availability of the information. Many systems and tools are used to achieve the requirements of the information security and to prevent information systems from any possible incident. Access control systems, authentication systems, anti-virus software and firewalls are examples of such systems. According to [1] despite different protection mechanism, it is nearly impossible to have a completely secured system. Although sophisticated security systems can be used to achieve the information security requirements, those systems may be under threat due to vulnerabilities or misconfiguration of those systems. As a result, those vulnerabilities or misconfiguration may be exploited by intruders or implement their at-tacks. Therefore, Detection of Misuse Activities in Database Systems is considered as the last defense layer of the database security systems of any organization. The insider attack forms the biggest threaten on the database systems due to it has authorized access to the database systems.

II. Background

There are many types of insider attack that try to abuse the access rights and do malicious activities for example, employees, masquerading and the malicious activities such as updated and deleted approved records. A malicious activity is de-fined as a group of actions that attempts to harm the Integrity, confidentiality of database system, [3]. DEMIDS is a mechanism designed to detect and prevent the malicious activities such as malicious transactions on the database systems [4].

There are many insider attacks that may hurt the confidentiality, integrity and availability of database systems. According to [5]the database security attacks classified into two types of attack such as: outsider attacks and insider attacks. The outsider attack can defined as malicious actions that cause many problems such as delay or bugs. However, the insider attacks categorized into legitimate and illegitimate access. Legitimate access can abuse his privilege to do malicious actions, and on the other hand, the illegitimate accesses try to exploit the vulnerabilities of the system to do malicious actions. Many researchers have been conducted to investigate the insider attacks [6]. According to [2]the insider attacker's forms the biggest threat on the database security level than the outsider attacker, because two reasons, the ir knowledge about systems and their granted privileges. [7]Indicates that the insider attacks can forms the extremely dangerous on database systems. Furthermore, insider attacks use their rights to achieve the malicious action.

Malicious transaction is one of the inside attacks which harm the integrity and availability of the database [5]. There are many causes of malicious activities [5] such as bad configuration, low experiences of the Database administrator (DBA), hidden flaw and weakness of database implementation. [8]Stated that the mechanisms based on auditing log file only detect the malicious commands, and if legitimate commands contain malicious data, it will not be detected. [8]Proposed mechanism to detect the malicious activities in database sys-tem management. The mechanism used data mining approach to determine the dependency among data items. The data dependency indicates to the access relations among

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data items. These data dependency are generated in a set of rules (pre-written, read, and post-written sets). Therefore, the activities that don't follow any of rules are signed as malicious activity. The limitation of this mechanism is limited to user transactions that conform to the read-write patterns assumed by [8]. Also, the system is notable to detect malicious behavior in individual read-write commands and the false alarm rate is may be more as well as the same sensitive are given to the each items and there is no concept of attribute sensitivity [6],[3].

[9]Addressed the problem of [8]. The approach adds more rules to some attributes to become more sensitive to detect malicious modification. The limitation of this approach is identification of suitable support and confidence values, also is not suitable for the role based database access control, as well as it is not support other manipulation commands like insert and delete [11],[6].

[6]Try to address the problem of [8]. This approach use to detect the malicious behavior based on RBAC (Role Based Access Control). The technique used in this approach working as control unit on the user role profile. If the technique discover that the user use different role than the normal role of user, then the mechanism will raise notification. The approach is suitable for databases that employ role based access control mechanism. The problem of [9] also addressed in this approach. The limitation of this approach is inability to detect transaction level dependency; so some of the database attacks may be undetected [10].

[10] Addressed the problem of [6] by extracts the correlation among queries of the transaction. The proposed mechanisms called DIDS (Database Intrusion Detection System) generate the transaction profiles mechanism automatically. This mechanism has two phases: learning phase and intrusion detection phase. The learning phase generates authorized transactions profile automatically. The detection phase will check the behavior of executable transactions by compare it with authorized transaction profile. The limitation of this approach that address by this study is difficult to capture the malicious data on authorized commands. Developed mechanism to detect the malicious transaction based on predefined profile transactions called Database Malicious Transaction Detection (DBMTD). Therefore, if the enter transaction is not matching with predefined transaction in the profile will detect as misuse or malicious transaction. The limitation of this approach is limited transactions and manual generating of the predefined profile transactions and this cause consuming time as well as difficult to achieve in real and complex database installations [13],[10].

The problem of the [12] has been solved by [10] which generate the transaction profiles mechanism automatically. This approach used detection mechanism to detect the misuse activities. The limitation of this approach is inability to detect the authorized malicious activities like delete or update on approved records will address in this study by the author. The previous studies try to solve the problems of malicious activities on the relation database management system. However, the malicious data on the authorized commands can pass to the database. This study tries to address this kind of problems.

a) Problem Statement

One of the database security problems is inside malicious activities. Among them are: updating of approved records with malicious data, and deleting approved records. This study hypothesize that dependency relationship among items can be used to detect and prevent the aforementioned malicious activities. To test this hypothesis, the following questions needs to be answered:

i. How to represent the dependency relationship to detect and prevent malicious activities?
ii. How to use the dependency relationship to detect and prevent the malicious activities?

III. Methodologies

This chapter discusses the methodology used to design and develop the detection and prevention mechanism to detect the malicious activities that harm the integrity of database. Scientific research is the research which relies on the application of scientific method. So, scientific method can be defined as a set of research principles and methods that helps re-searchers obtain valid results from their research studies by providing a set of clear guidelines for gathering, evaluating, and reporting information in the context of research study [20].

a) Research Framework

A methodology is required to guide the activities conducted by the project, in order to make sure that all project activities are well-organized. However, to gather all the in-formation related to the study, the researcher have to build a methodology or research framework to make sure that all the tasks of the project have been done clearly. Figure 1 shows the project research framework.

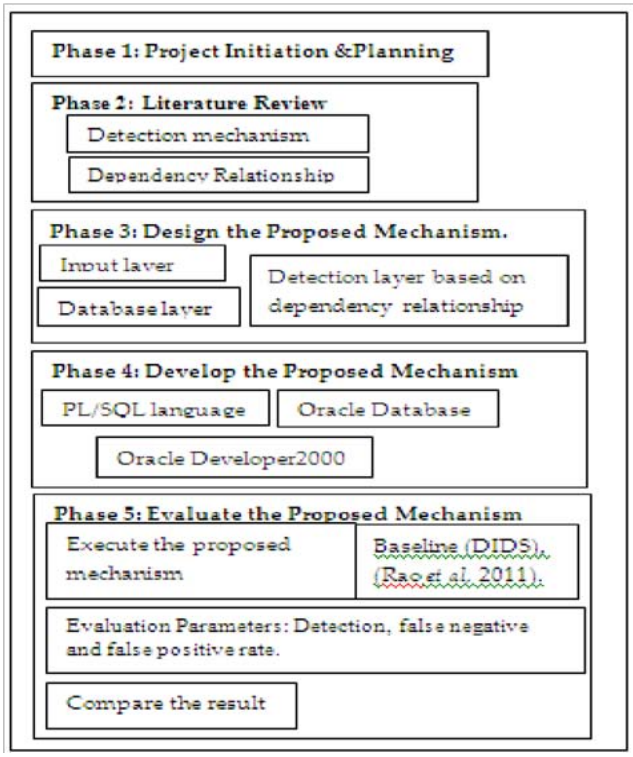

Figure 1: Research Framework

Phase 1: Initial Planning Phase

The first step in achieving this project was the initial planning phase. First of all, the title of the project was discussed with the supervisor. The objective of the project development reviewed and defined according to the problem statement. Besides that, the scope of the project identified to draw the boundary for this project. After that, some re-search on the problem background of the project was done in order to decide on the methodology of the project.

Phase 2: Literature Review

The literature review should give a theoretical base for the research and help to resolve the nature of the research. The purpose from writing the literature review is to reveal to the reader what knowledge and ideas have been established on a topic by previous studies and how similar are they to this project topic. Thus, the literature review for this study started with overview on information security in general term. Then the literature re-view focused on the components influencing on information security, such as insider attack, malicious trans-action. Moreover, continue the study by talking about importance of dependency relationship in the relational database systems. Finally, the discussion goes through related works on how to detect and prevent the misuses activities on the relational database systems. It has two parts:

i. *Dependency Relationship*

This part focus about dependency relationship concept, including the purpose of dependency relationship and how the dependency relationship among items can use to detect and prevent the malicious activities.

ii. *Detection mechanisms*

Some of the mechanisms that used to detect and prevent the malicious activities have been mentioned in this part. Also the methods used in these mechanisms such as auditing log files, profiling, data mining, and dependency relationship.

Phase 3: Design the proposed mechanism

In this phase, the design of the mechanism will be developed which will contain specification on the mechanism components. The components of the mechanism are three layers: Input layer, detection and prevention layer and database layer as follow:

i. *Input Layer*

This layer will used to input data to the mechanism. The source of input data is a dataset that constructed by this study. The dataset contains more than 20,000 records that include malicious and none malicious records.

ii. *Detection Layer Based on Dependency Relationship*

It considers the most important layer in the mechanism. It will receive the data from the input layer and check if there is malicious or not. It is collection of objects such dependency algorithm, alerter and events table. The components of this layer are:

Dependency Algorithm

The DA dependency algorithm is a set of instructions that used to calculate the total dependency relationship among date items and calculate the data items that related with, to mining the malicious data among items. Chapter 4 will ex-plain more about it.

Alerter

During the process, the malicious activities like updating or deleting commands will be detected by the mechanism. Therefore, an alert needed to be raised by the alerter and notify the DBA.

Events Table

This table used to store the misuse activities events when happened.

Database Layer

The database layer is the original database tables (schema), which store the clean data that coming from the detection and prevention layer. The database layer includes the definition and transaction tables.

1. Definition Tables: These tables store the primary and fix data of the system.
2. Transaction Table: The tables which have the transaction data those changes continuously, for example salaries tables, check tables and so on.

Phase 4: Develop the Proposed Mechanism

Three software products will used to develop the proposed mechanism:

i. *PL/SQL Language*

Procedural language/ structured query language is the best language to develop the logic of the mechanism. It has a good feature such as: flexibility, easy to use, control statement and so on. Pl/SQL will used to connect all components of the mechanism.

ii. *Oracle Database*

The oracle database will used to create target database schema such as: tables, views, triggers, procedures and functions of the mechanism.

iii. *Oracle Developer2000*

Oracle developer is one of the oracle corporation products. The oracle developer2000 will be used to build the inter-faces of the mechanism (input layer).

Evaluation of the Proposed Mechanism

This phase will evaluate the mechanism to verify it meet the project objectives or not. To evaluate the mechanism there are some steps should be executed such as execute the proposed mechanism, baseline, and evaluation measures and compare the result.

i. *Execute the Proposed Mechanism*

Execute the proposed mechanism to get the results and com-pare it with existing mechanism. The exiting mechanism is DIDS (Database Intrusion Detection system), [10].

ii. *Baseline*

The baseline of this project is used DIDS (Database Intrusion Detection System), [10].The DIDS is one of the mechanisms that used to detect and prevent the malicious activities in database.

iii. *Evaluation Parameters*

The measures that will be used in this study to evaluation the accuracy of the proposed mechanism are: detection rate, false negative and false positive rates measures.

1. *Detection Rate*

Detection rate refers to the percentage of detected malicious events, namely detection rate is equal to the product of the quotient of dividing the number of detected intrusion events by the total of malicious events and 100%.

2. *False positive Rate*

Rate of false negative refers to the probability that correct events are falsely detected as abnormal events, namely rate of false positive is equal to the product of the quotient of dividing the number of events which are falsely detected as abnormal events by the total of events and 100%.

3. *False Negative Rate*

Rate of the false negative represent the abnormal or harmful activities which are classified wrongly by detection mechanism as normal activities, namely Rate of false negative is equal to the product of the quotient of dividing the number of events which are falsely detected as normal events by the total of events and 100%.

4. *Compare the Results*

The results that have gotten will be compared with the results in the existing mechanism. These results will compare the ac-curacy of the proposed mechanism with accuracy in the existing mechanism.

IV. Conclusion

a) Entail Design of the mechanism

The initial results that have gets from this study are initial design of the mechanism, and the flowchart of the mechanism working. Figure 2: show the architect-ture design for the mechanism and the relations among the components of mechanism. Figure 3shows the mechanism flow processes of the mechanism.

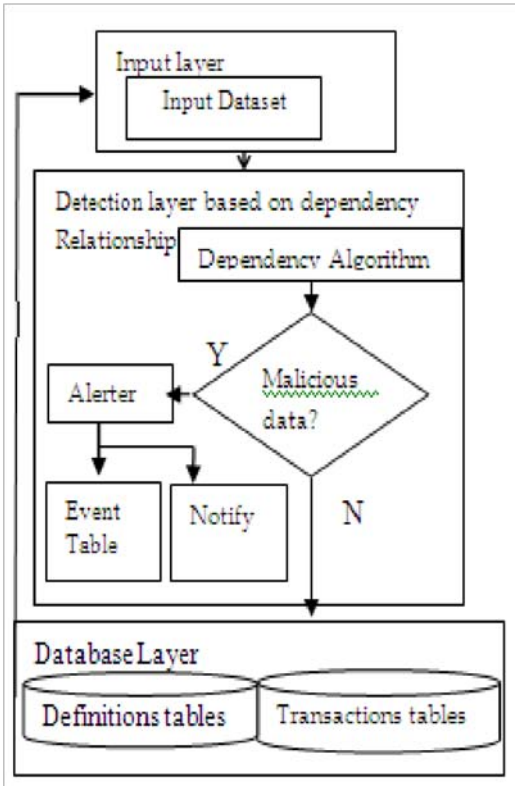

Figure 2 : Dependency Relationship Mechanism

According to the proposed dependency algorithm among items the calculate relations among items and data items that related with these relations will be accrue. For example, if the total number of relationship among items is greater than or equal three relations then the attribute is more used and high important. After, that checks the data in the items. If the

data has been written already in more than one item, then this item is used in other places by other users and the update or delete is prohibited and classified as malicious.

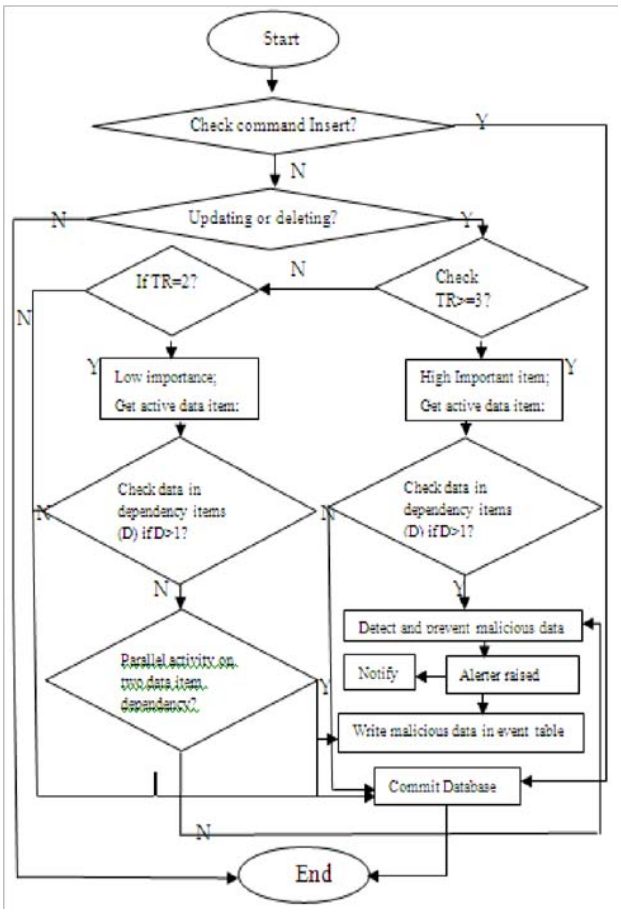

Figure 3 : Mechanism Flow processes

On the other hand,if the total relations among items equal 2 (low important), and the two data items have been used already. So, if there is up-dated or deleted command on only one data item without other item, it will determine as malicious command. However, if there is updating or deleting in parallel on these two data items, it will be determine as malicious but it will be pass and committed in database.

The proposed dependency algorithm working as:

When the authorized user send a command to the database, the algorithm checks the command type, if insert then will move directly to database. However, if the command update or delete then, the algorithm will check first the total number of the dependency relationship among items(TR) and then check the total number of data items(TD) that related by the relation dependency. Therefore, if the TR greater than or equal three relations, then check the relevant data items if data has been written already to more than one item , then the mechanism will detect the activity as malicious and prevent it and notify the DBA as well as write the events to the events table. On the other hand, if the TR equal two relations then check the TD if written in more than one item, then check the activity on two data items, if parallel activity then detect as malicious but can pass to the database, owing to the data may be correct or not, but if the activity is only on the one data item, then detect as malicious activity and prevent it, and also notify the DBA and write the event in events table. Algorithm in figure 4 will explain the proposed dependency algorithm among items.

```
Begin
    TD= data item * total target tables;
    TR=TD +1;
    TR=TD;
    Check TR>=3 then
    High Important item;
    Get active data item;
    Check active data>1 then
    Detect and prevent Malicious da-
    ta;
    Notify;
    Write events
    Check TR=2 then
    Low importance;
    Get active data item;
    Check active data>1 then
    Check parallel activity then
    Malicious;
    Database commit;
    Check TR=1 then
    Normal;
End;
```

Figure 4 : Dependency Algorithm

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A Graphical user Interface (GUI) Design of the Physical Layer to Investigate Three Different Modulators Effectiveness on the Bit Error Rasio (BER) within the Layer

By Ahmed Alahdal & Dr. G. N. Shinde

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Abstract- There is always a possibility of errors to happen into the system when we transmit data over a data link or a network which may affect the integrity of the system leading into a compromised transmission, according to this The performance of the system can be estimated by bit error rate AS (BER)provides an ideal way to achieved such transmission.

In this paper we present a graphical user interface (GUI) design of the OSI Physical layer in order to calculate the BER (bit error ratio) of three different modulators (QPSK,16QAM And 64QAM) Each modulator will individually work to achieve results in simulation with respect to the (SNR) signal to noise ratio. We will show a clean figures of the process when simulation is running and comparison of the modulators. Previous researches of (BER) have shown that there are different ways to calculate the BER in order to ensure the quality of digital transmission system.

Keywords: *BER-physical layer-QPSK-16QAM-64QAM-SNR-GUI.*

GJCST-E Classification : *H.5.2*

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Ahmed Alahdal [α] & Dr. G. N. Shinde [σ]

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Keywords: BER-physical layer-QPSK-16QAM-64QAM-SNR-GUI.

I. Introduction

Any study aims to understand the modulation and it is efficiency must take a closer look at the Bit error ratio (BER), According to this simple logic we must know how the BER works.

(BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval. BER is a unit less performance measure, often expressed as a percentage, this could be the definition of the BER but we need more than just a definition we need a simulation Process to study the behavior of the BER with multiple modulator

BER is the percentage of bits with errors divided by the total number of bits that have been transmitted, received or processed over a given time period. The rate is typically expressed as 10 to the negative power. For example, four erroneous bits out of 100,000 bits transmitted would be expressed as 4* 10-5, or the expression 3* 10-6 would indicate that three bits were in error out of 1,000,000 transmitted.BER is the digital equivalent to signal-to-noise ratio in an analog system. Basically the bit error ratio is the sum of the bits that fail to transmit or it is the data which did not transfer during the transmission. Modulators are nothing but a way of transmitting digital data in a form of a binary numbers, Generally, the modulation is the process by which a carrier wave is able to carry the message or digital signal (series of ones and zeroes). The three basic methods to perform the modulation are amplitude, frequency and phase shift keying [3]. Quadrature amplitude modulation (QAM) has been widely used in adaptive modulation because of its efficiency in power and bandwidth [2]. The QAM is one of the adaptive modulation techniques that are commonly used for wireless communications. Different order modulations allow sending more bits per symbol and thus achieving higher throughputs or better spectral efficiencies[1]. In network design it is significant that a network planer needs to optimize the various electrical and optical parameters to enhance the smooth operation of the network. However, the transmission length increases with increase in the bit rate and the parameters have the capability of absenting in the network[8]. Bit error rate BER is a parameter which gives an excellent indication of the performance of a data link such as radio or fiber optic system. As one of the main parameters of interest in any data link is the number of errors that occur, the bit error rate is a key parameter. A knowledge of the BER also enables other features of the link such as the power and bandwidth, etc. Bit error rate is a measurement of success in a digital transaction between receivers and senders, the number of errors which happen when the transmission running is considered as the bit error rate. it provides a way to find out the lost data which may not affect the package but for the sake of better services we try to avoid maximum number errors. The Error Rate Calculation block compares the input data before the signal modulator as it is generated from the signal

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generator to the output of the demodulator on the receiving end. It calculates the error rate as a running statistic, by dividing the total number of unequal pairs of data elements by the total number of input data elements from one source [9].

II. Proposed (GUI) Design of the Physical Layer

The proposed GUI Design of the physical layer represents the process of transmitting data from source to receiver with respect to its original design which can be represented in different style(design).

The figure1 and figure2 provide a view of our GUI design which we are using to investigate the Bit Error Ratio (BER).this design was programmed and coded in the Matlab software, the well known high performance language. As shown the design includes three different types of channels which we will use separately in each simulation process, so we can estimate each channel impact on the different modulators and how the channel is preferred for that specific task. We also aim to know which channel can endure more packet of data transferred and how it is going to be effected in the sense of BER TO SNR.

In the main window of our GUI design there are various functions and they are as the following:

Data generator: generates signals as a source of data

Encoded data: encodes the data provided by data generator

Digital modulator: is the process of conveying a message signal

IFFT modulator: Inverse Fast Fourier Transform which supports inputs of the data types double and single.

Channel : is the path which data is transferred through.

FFT Demodulator Fast Fourier Transform which supports the output of the data type double and single.

Digital demodulator: it is the process of conveying signal to a message.

De-interleaving a technique for making forward error correction more robust with respect to burst errors

Decoded data: is to decode the signal that was encoded by the encoder.

We must also consider that There are three channels which we will show in our next figure and they are as the following

Channel types.

AWNG channel

RAYLEIGH channel

RICIAN channel

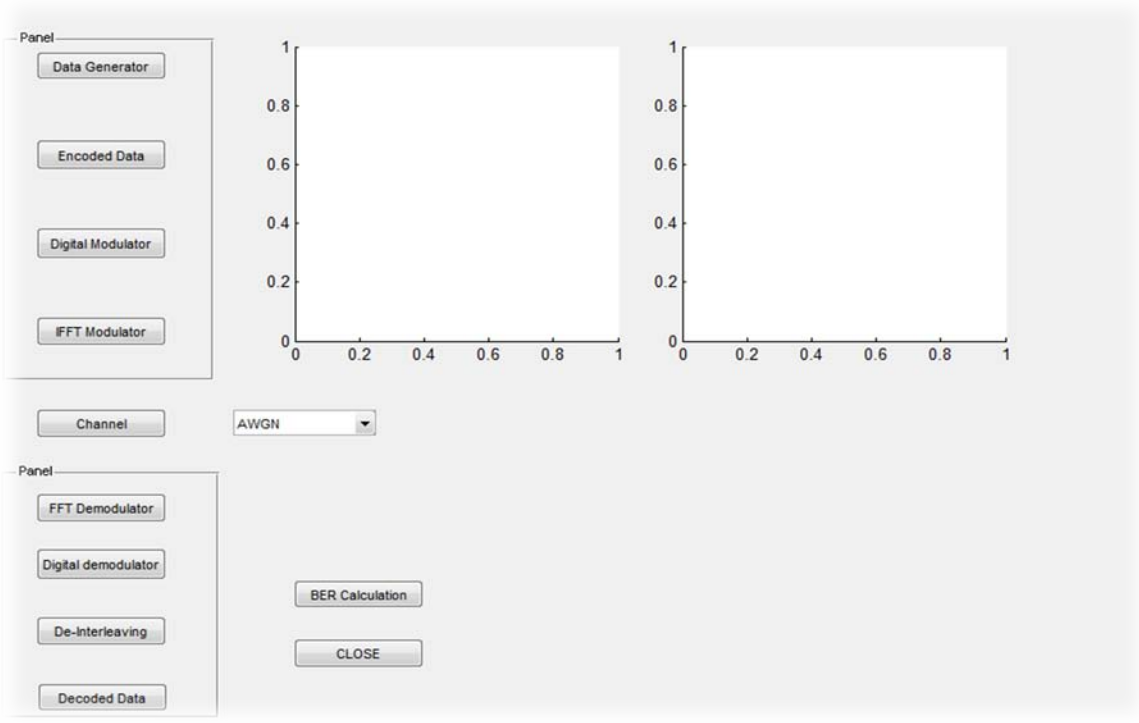

Figure 1 : GUI Design of Physical Layer

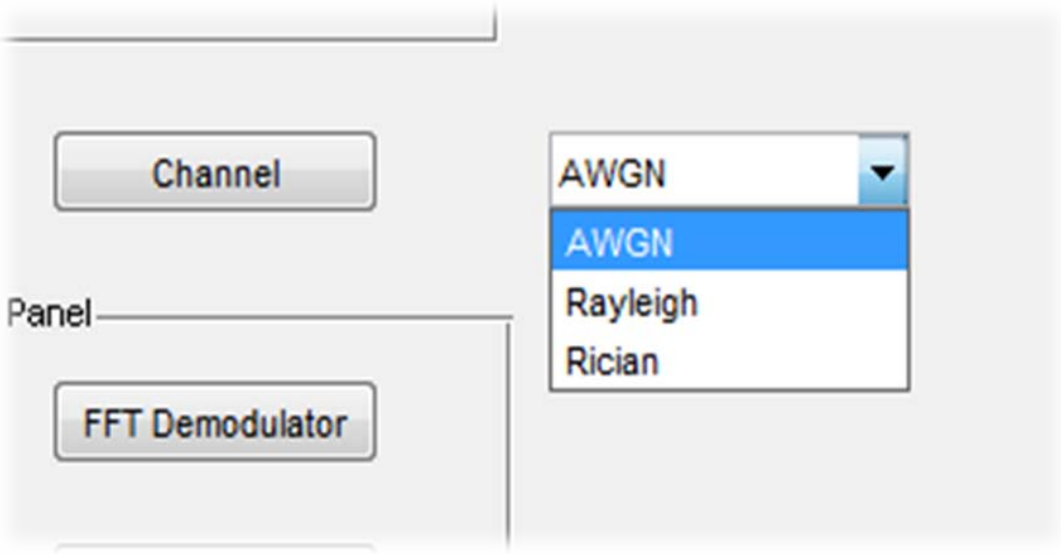

Figure 2 : Channels our Design Provides

III. Experimental Set Up

In this process we will take the Three modulators and examine them one by one as it is designed in our Physical layer design according to such design We will experiment the bit error ratio(BER) of following modulators in three different ways depending on the channel we choose out of the three channel we have(AWNG,RAYLEIGH and RICIAN .

As we all know this is a way to ensure the process and the quality of digital transmition so we will create them and display the results allowing the programer to choose what may suit one work of tramsmition.

Also this process will be in the sence of showing the results of all modulators individually at the same time it will show each channel effectiveness on the modulators.

a) (QPSK) Bit error ratio

The Quadrature Phase Shift Keying (QPSK) is the first modulator we examine in our design, QPSK uses two basic functions a sine and cosine and it is simple to optimize.

In order to modulate the data bits in QPSK it has to be grouped in a symbol each contains two bits and each of the symbol have the possibility of taking one of the following values:00,01,10,or 11 :

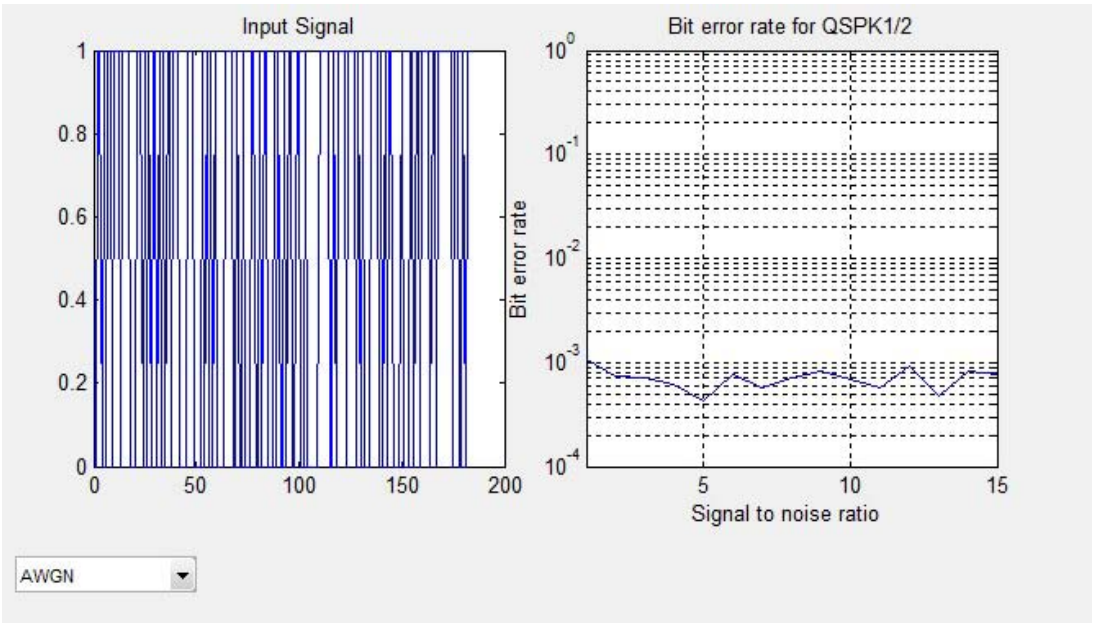

Figure 3 : (BER) of QPSK using (AWGN)channel

As it is shown in figure 3 the input signal was generated and the process of sending and receiving data in one layer(Physical layer) has completed, which allow us to calculate the BER of QPSK using the transmission data.

We can also notice that we have used the (AWGN) as our first channel to use with QPSK modulator.

b) (16-QAM) Bit error ratio

The second modulator we examine is called 16 state Quadrature amplitude modulation 16QAM,like all modulation schemes QAM conveys data by changing some aspect of a carrier signal.

The advantage of using the 16-QAM is that it is a higher form of modulation which makes it able to carry more bits of information by symbol.

In the following figure (figure 4) we will show the bit error ratio(BER) of the 16-QAM with respect to the signal to noise ratio (SNR).

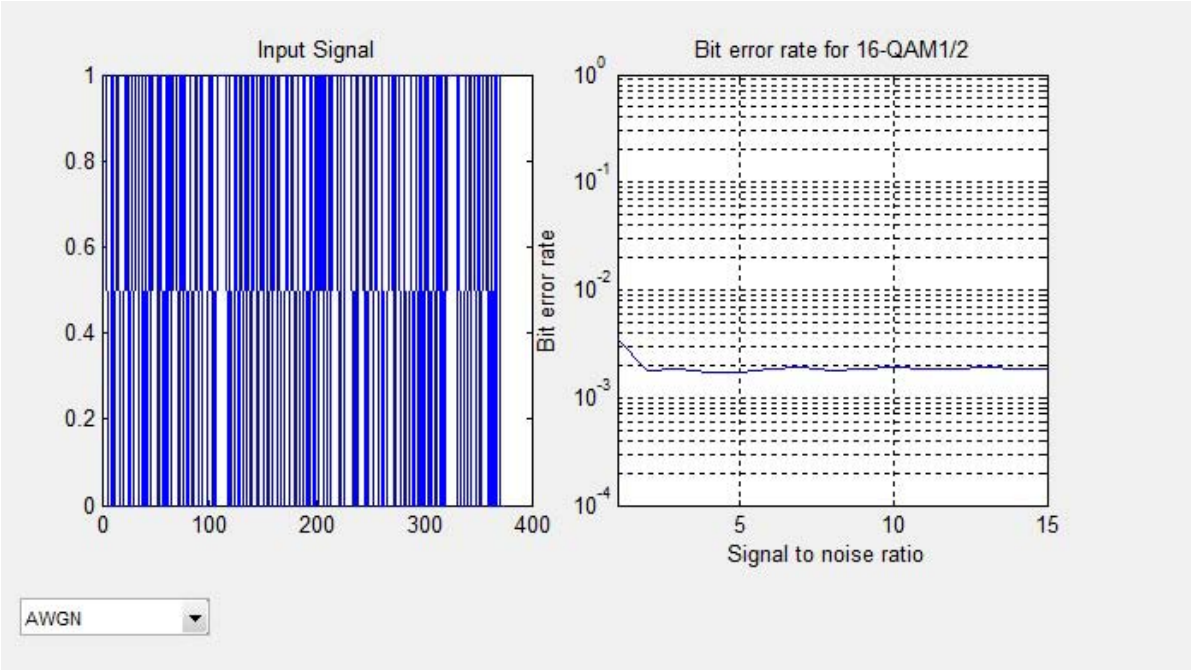

Figure 4 : (BER) of 16-QAM using (AWGN)channel

c) (64-QAM) Bit error ratio

The third modulator we examine is called 64 Quadrature amplitude modulation it is used for digital cable television and cable modem application, the mandated schemes is used for digital cables as standardized by the SCTE,64-QAM can be also used for digital video broadcasting.

But above of all that we are more concern about the bit error ratio of the 64-QAM ,as it is known the 64-QAM can take up to 8 channels some classified it as a better modulator.

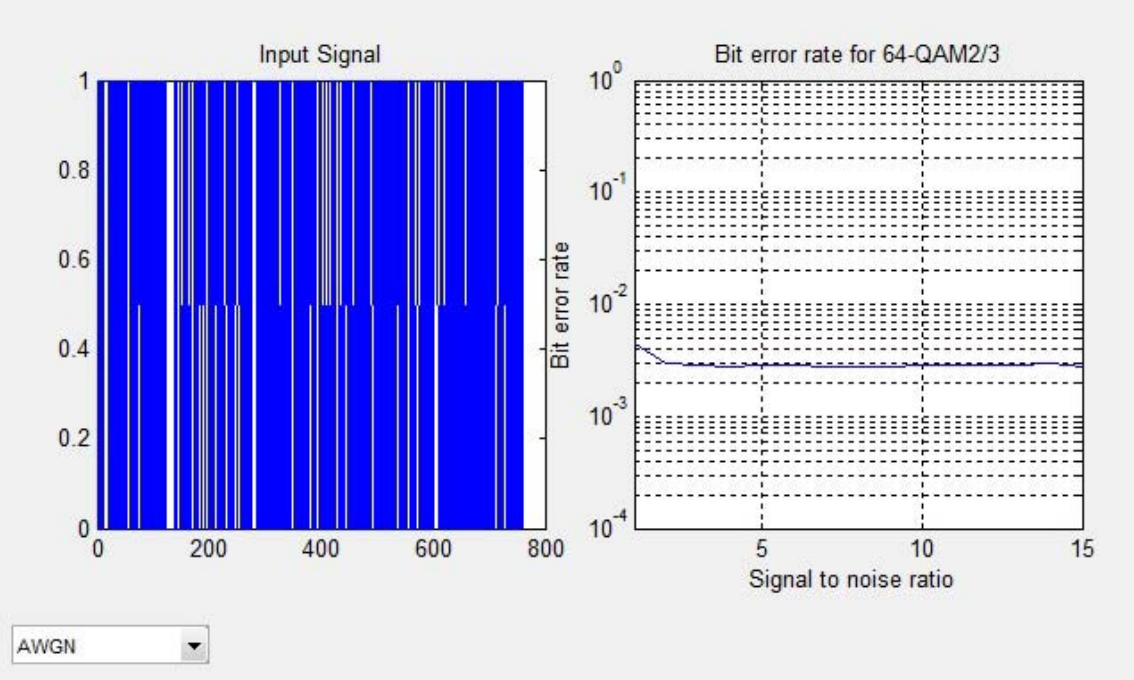

Figure 5 : (BER) of 64-QAM using (AWGN)channel

However, it must also be noted that when using a modulation technique such as 64-QAM, better signal-to-noise ratios (SNRs) are needed to overcome any interference and maintain a certain bit error ratio (BER).

A simple Table to brief the results

Modulator	Bit Error Ratio	Signal to noise ratio
QPSK	10^{-3}	10^{-4}
16 QAM	$10^{-2}.6$	10^{-4}
64 QAM	$10^{-2}.5$	10^{-4}

IV. Result and Discussion

a. QPSK shows less error rate in different channels, it is considered as less noise and interface.

Here we show the three channels and their impact on the QPSK modulator.

As we can see in figure 7,8 and 9 the AWGN in figure 7 has shown less error rate if compared to the other channels.

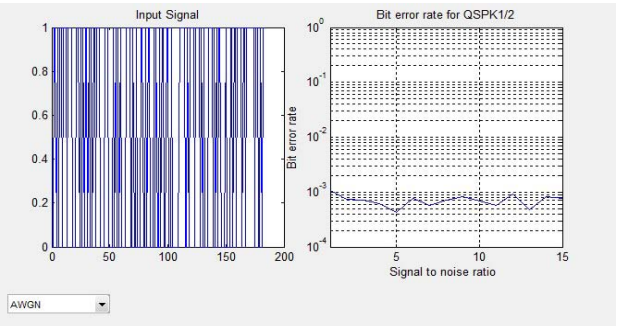

Figure 7 : QPSK using AWGN channel

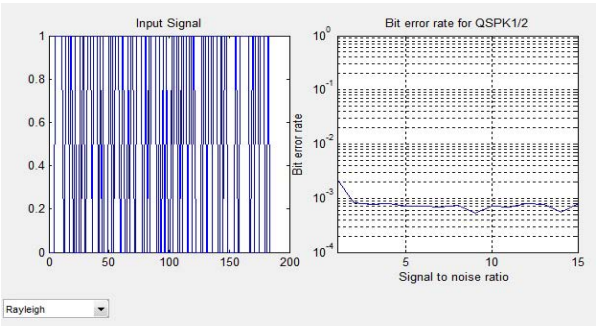

Figure 8 : QPSK using RAYLEIGH channel

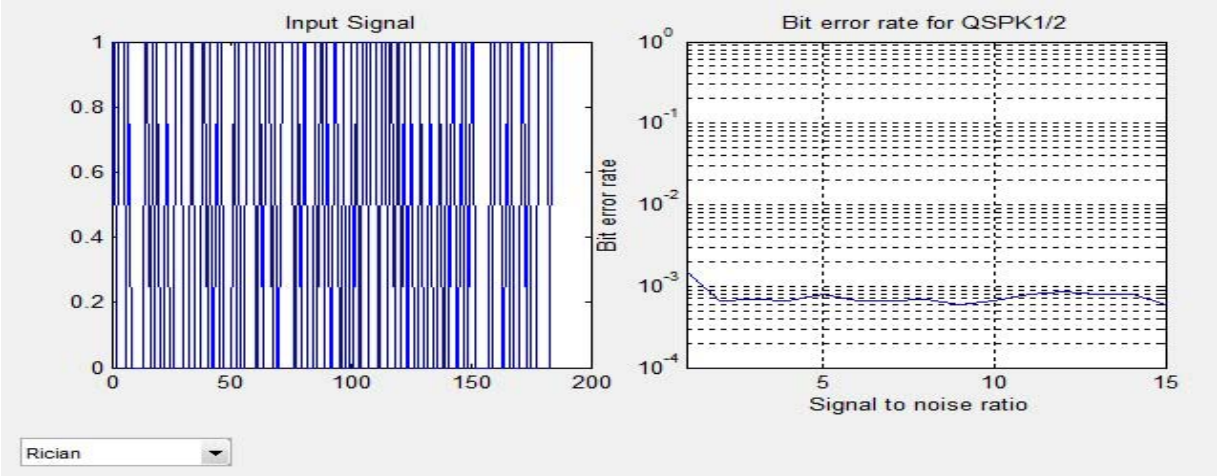

Figure 9 : QPSK using RICIAN channel

b. Here we show 16-QAM Bit error ratio with three different channel, as we can see there is a slight different among the three output which does not necessary effect in the transmission of data.

As a result of this simulation process we can see clearly that all channels can be used according to our need where our process should not be effected.

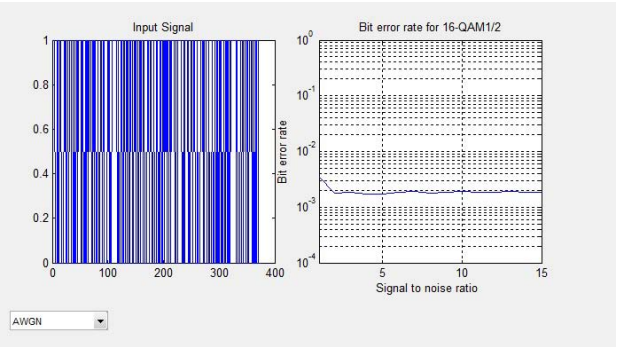

Figure 9 : 16-QAM using AWGN channel

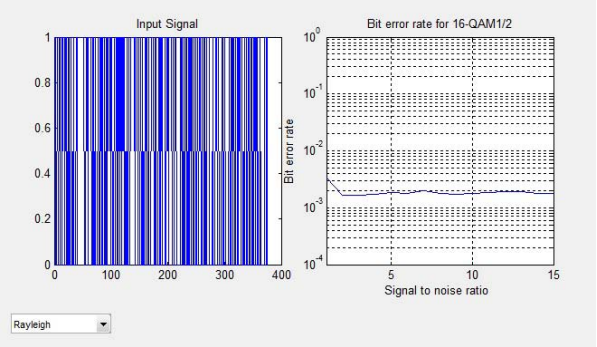

Figure 10 : 16-QAM using Rayleigh channel

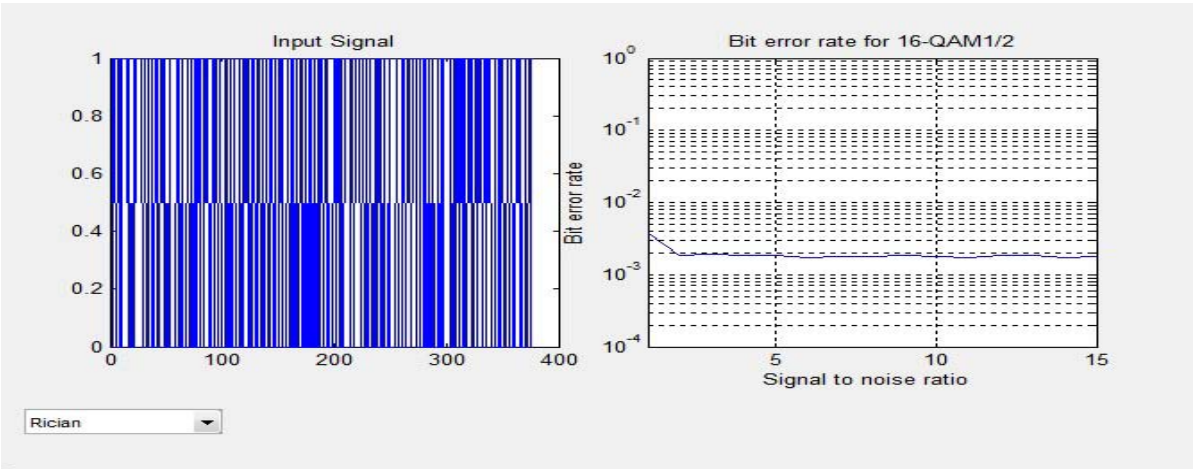

Figure 11 : *16-QAM using Rician channel*

c. 64-QAM

The 64-QAM has the ability to take up to 8channels but it gives less bandwidth comparing with the 16-QAM,but in the other hand the quality of picture for example in the 64-QAM is better than the 16-QAM.

In the following figures we can notice that no differences in any of the BER using the three channel which indicates the possibility of using any of them.

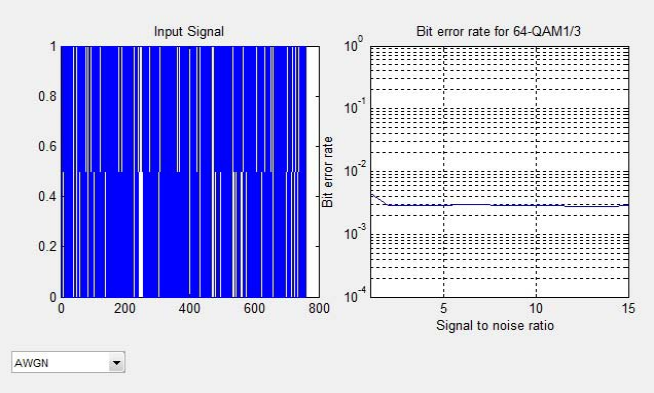

Figure 12 : QPSK using AWGN channel

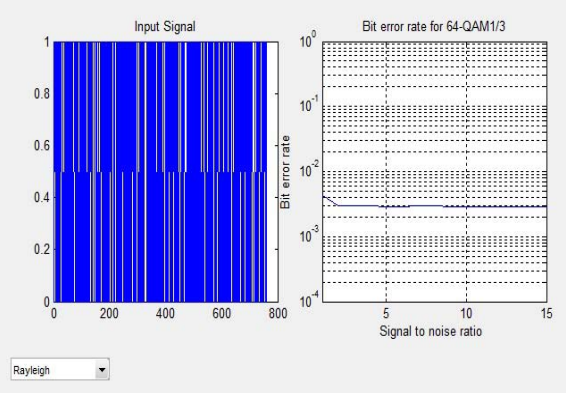

Figure 12 : QPSK using RAYLEIGH channel

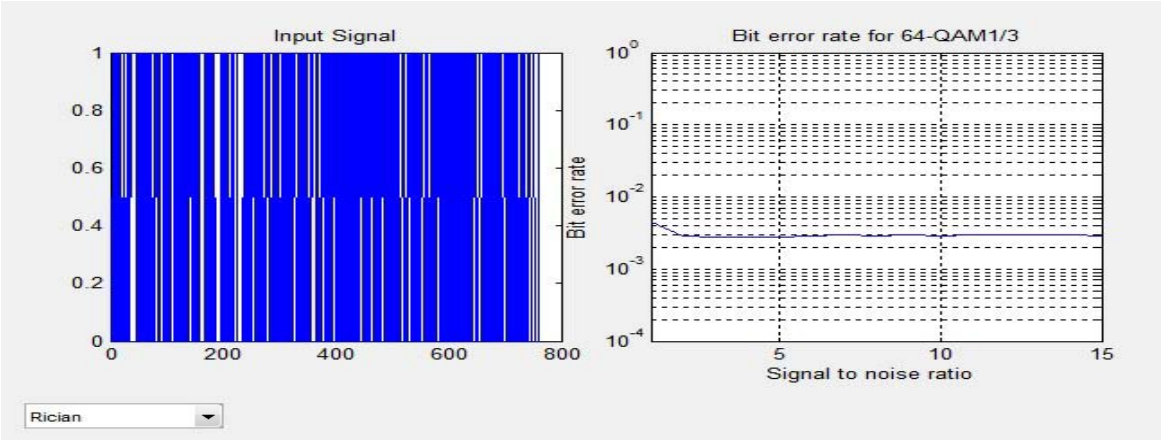

Figure 12 : QPSK using RICIAN channel

V. Conclusions

In this paper we have presented a new graphical user interface design(GUI) of the ieee 802.11 Physical layer, this design illustrate the Bit error ratio of three different modulators to show each impact on the digital data transmission with the measurement of the SNR signal to noise ratio.

We have used the Matlab tool GUI to build the physical layer and simulate the three modulators.

The 16-QAM has shown quite bit different from the 64-QAM in the sense of BER to SNR where QPSK has shown better quality and improvement in the number of the bit error ratio.

We have also discussed and shown the results of the 16-QAM,64-QAM and QPSK using three different channels AWNG,RAYLEIGH and RICIAN each one operated separately in order to see how the channel will effect on the BER of the modulator used in the transmitter.

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A Study on Pollution Monitoring System in Wireless Sensor Networks

By D. Yaswanth & B. Bhanu Satwik
KL University, India

Abstract- Air pollution is one of environmental issues that cannot be ignored. The heavy transportation and urbanization result in the air pollutants concentrated in certain areas. Inhaling pollutants for a long time causes damages in human health. Traditional air quality monitoring methods, such as building air quality monitoring stations, are typically expensive. In addition, monitoring stations are generally less densely deployed and provide low resolution sensing data. This paper proposes an urban air quality monitoring system based on the technology of wireless sensor networks (WSNs). It also integrates with the global system for mobile communications (GSM). The system consists of sensor nodes, a gateway, and a control center managed by the Lab VIEW program through which sensing data can be stored in a database. This system is deployed to the main roads in the Taipei city to monitor the carbon monoxide (CO) concentration caused by vehicle emissions. The experimental results show that the proposed system is suitable for micro-scale air quality monitoring in real-time through the WSN technology.

Keywords: *air quality monitoring; wireless sensor networks; real-time monitoring.*

GJCST-E Classification : *C.2.1 I.2.9*

Strictly as per the compliance and regulations of:

A Study on Pollution Monitoring system in Wireless Sensor Networks

D. Yaswanth[α] & B. Bhanu Satwik[σ]

Abstract- Air pollution is one of environmental issues that cannot be ignored. The heavy transportation and urbanization result in the air pollutants concentrated in certain areas. Inhaling pollutants for a long time causes damages in human health. Traditional air quality monitoring methods, such as building air quality monitoring stations, are typically expensive. In addition, monitoring stations are generally less densely deployed and provide low resolution sensing data. This paper proposes an urban air quality monitoring system based on the technology of wireless sensor networks (WSNs). It also integrates with the global system for mobile communications (GSM). The system consists of sensor nodes, a gateway, and a control center managed by the Lab VIEW program through which sensing data can be stored in a database. This system is deployed to the main roads in the Taipei city to monitor the carbon monoxide (CO) concentration caused by vehicle emissions. The experimental results show that the proposed system is suitable for micro-scale air quality monitoring in real-time through the WSN technology.

Keywords: air quality monitoring; wireless sensor networks; real-time monitoring.

I. Introduction

Drawn from industrial and commercial activities, the world's human population concentrates on specific regions. Such a phenomenon is known as 'urbanization'. Although the urbanization brings a higher economic development, the excessive population concentration will cause environmental damage and pollution like air pollution, noise pollution, water pollution, etc. Among various kinds of pollution, air pollution has a direct impact on our lives, because of the rapid emission of pollutants. Over the past decades, governments of many countries have imposed different regulations on air pollutants, so the severe damage brought to human health is reduced considerably. Although there may be no the immediate damage to human lives, however, air pollution still causes some chronic diseases. According to epidemiological studies [1], for example, the long-term exposure to pollutants may result in the harm to respiratory, nervous and cardiovascular systems. Therefore, the real-time monitoring of the air quality is particularly important and necessary. High urbanization in an area may lead to the absence of vegetation in that area. Air cleaning and temperature cooling become more difficult because of the lack of vegetation, and the area will be inevitably influenced by the urban heat island effect [2]. Moreover, the crowded tall buildings and heavy transportation also prevent air pollutants from dispersing. Thus, the government in Taiwan built many air quality monitoring stations to monitor the air quality in urban areas. However, the cost of building the stations is very expensive, so the deployment density is rather low. Let's take the Taipei city as an example. There are approximately 2.6 million people living in an area of 271.8 square kilometer, but only eight air quality monitoring stations are deployed in the area. The distance between the monitoring stations is more than dozens of kilometers. Such a strategy for air quality monitoring does not provide a higher spatiotemporal resolution. This paper proposes an automatic micro-scaled air quality monitoring system for areas with a high density of population and vehicles as shown in Figure 1. The system is based on the wireless sensor network technology and integrates with the global system for mobile communications (GSM) employed for data transmission. The monitoring system consists of a gateway and sensor nodes equipped with the air quality detection sensors. The gateway collects the data received from the sensor nodes and transmits the data to the control center with a database by the GSM network. The high-resolution meteorological data and concentrations of air pollutants can be provided in a real-time manner, including rainfall, wind speed, wind direction, temperature, humidity and the concentration of carbon monoxide (CO). For a preliminary research result, we only target the concentration of CO. In the future, however, a variety of pollutants will be considered by equipping the sensor nodes with corresponding gas sensors. CO is toxic to humans and animals. The National Fire Protection Association (NFPA) in the United States indicates that the main way that CO enters human body is through breathing. The symptoms of CO poisoning are very similar to the symptoms of getting the flu and food poisoning. The symptoms include shortness of breath, nausea, dizziness, and headaches. A high level of CO concentration is fatal, causing death within minutes if not treated [3]. Thus, in our research, a real-time monitoring system is proposed and implemented in the real environment. This system not only overcomes the problem that many monitoring systems cannot immediately send sensing data back but also provides a good way to monitor air pollution parameters such as CO concentration. This paper is

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organized as follows. Section II provides the related works. Section III outlines the architecture of the WSN and introduces our monitoring system. The section IV shows the experimental results. The final section concludes the paper.

Figure 1: The architecture of the proposed automatic micro-scaled air quality monitoring system

II. Materials for Experiment and System Mapping

In this study, the micro-scale air quality monitoring system is mainly composed of two parts, including a front-end automatic monitoring system and a control center, as shown in Figure 2. The front-end automatic monitoring system uses the WSN as its core technology, accompanied by the technology of Global System for Mobile Communications (GSM). This monitoring system could provide meteorological parameters and air pollution data from a small time scale. It includes a gateway and wireless sensor nodes. The gateway is used to control sensor nodes, collect the sensing data from the sensor nodes, and transmit the data to the control center through the short message service (SMS) provided by GSM. The gateway, on the other hand, is equipped with a weather station module, which provides various meteorological parameters, including temperature, relative humidity, barometric pressure, rainfall, wind speed, and wind direction. Through the Lab VIEW program [9], the sensing data can be stored and integrated into the database. In addition, users can make inquiries to the historical data and the latest updated data through the web page provided by the database.

a) Sensor Nodes

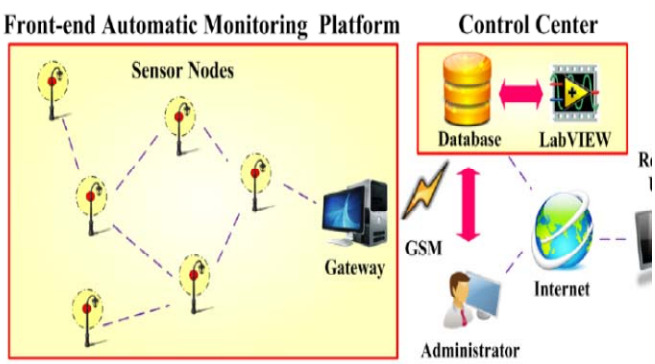

Figure 2 : The architecture of the micro-scale air quality monitoring system

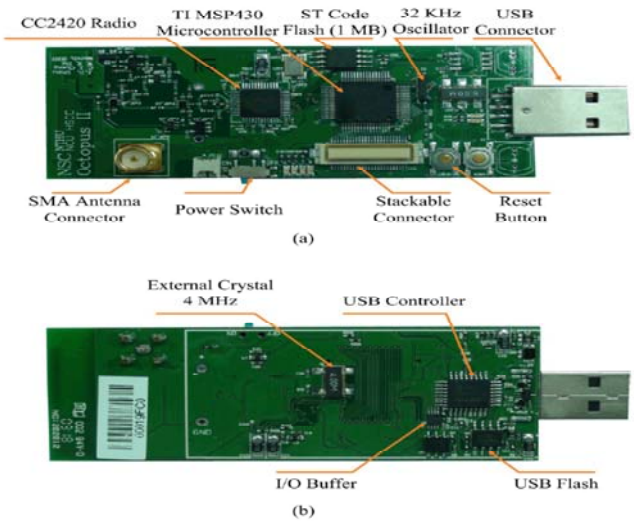

Figure 3 : Octopus II wireless communication module utilized in this study. (a) The front of the Octopus II; (b) The back of the Octopus II

i. *Wireless Communication Module*

The micro-scale air quality monitoring system employs the Octopus II, developed by the Department of Computer Science at National Tsing Hua University in Taiwan, as its wireless sensor nodes. The configuration of the Octopus II [10] is shown in Figure 3. The Octopus II is based upon the Texas Instruments MSP430F1611 architecture [11]. Fifty pins are available for general purpose input/output and dual 12-bit digital-to-analog (D/A) converters with synchronization. The Octopus II contains a light sensor (Hamamatsu S1087) [12] and a temperature-humidity sensor (Sensirion SHT11) [13] for environmental information acquisition. The memory (10 KB RAM, 48 KB ROM flash, 1 MB extend flash memory) provided by the Octopus II is rather large, so it might serve as a buffer to temporarily store sensing data when the network connection fails. In addition, the Octopus II uses a low-power CC2420 wireless transceiver adopting IEEE 802.15.4 and the Zig Bee specification [14] for wireless communication.

ii. *Gaseous Pollution Sensors*

In this paper, CO derived from the vehicle emissions is selected as the research target, since it is one of the main sources of air pollution and highly toxic to human beings. We use MiCS-5525 [15] to monitor the CO concentration. MiCS-5525 is a semiconductor-based sensor produced by the e2v Company as a miniature carbon monoxide gas sensor (CO sensor). MiCS-5525 has the merits of short warm-up time, a smaller size and high sensitivity. Figure 4 shows the conversion of CO concentration and the resistance value. R0 is a benchmark resistance of MiCS- 5525 under a relative humidity of 40 % and a temperature of 25 °C. Rscan be used to estimate the CO concentration under the same environmental conditions. In general, the across voltage of Rsis measured to estimate the concentration of CO in practical applications.

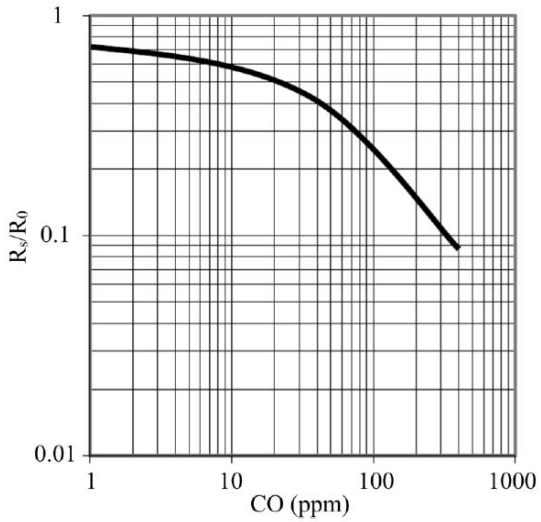

Figure 4 : Conversion of the CO gas concentration and the ratio of Rsto R0

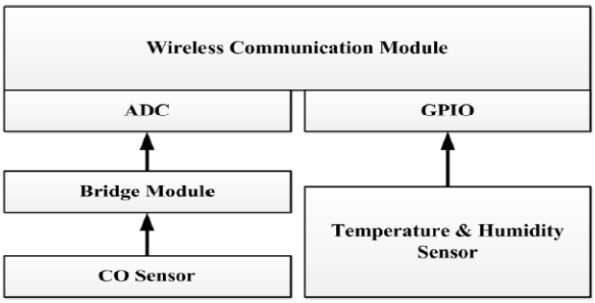

Figure 5 : The structure of the sensor node

The architecture of the sensor node in our system is shown in Figure 5. The sensor node includes a bridge module, a wireless communication module (Octopus II), a temperature/humidity sensor, and a CO sensor. We use a 12 V/ 9 Ah battery as the power supply for the node. The CO sensor is also driven by the bridge module. The sensor device is placed inside a waterproof box with two hole affixed with a breathable waterproof membrane as shown in Figure 6.

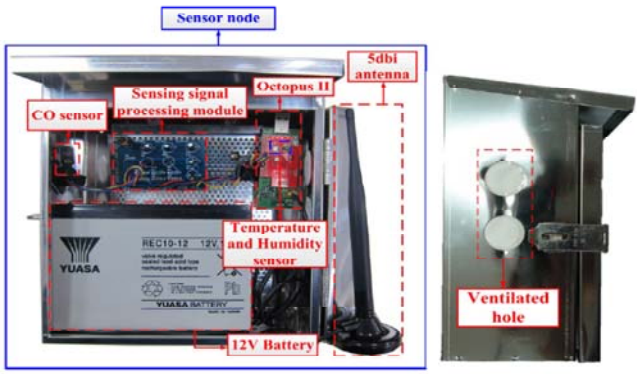

Figure 6 : The designed sensor node (a) The front of the sensor node; (b) The lateral of the sensor node

iii. *Bridge Module*

The bridge module is composed of voltage regulation circuits, signal modulation circuits and power switch circuits, as shown in Figure 7. The voltage regulation circuits are mainly used to regulate the voltage fed into the wireless communication module and the CO gas sensor. The signal modulation circuits are utilized to modulate the sensing signal generated from the CO sensor, and the power switch circuits are used to turn on/off the CO sensor in order to conserve energy. Figure 8 shows the bridge module.

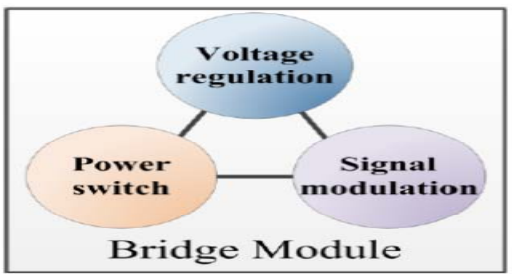

Figure 7 : The three sub-circuits of the bridge module

Figure 8 ; The sensing signal processing module

III. Experimental Results

In order to accurately obtain the CO concentration, we conducted a linear regression analysis on the monitoring data provided by the Environmental Protection Administration (EPA) monitoring station and our sensing data generated by the MCS-5521. Based on the linear regression result, we created a calibration equation that can be used to correct the readings of CO concentration from the CO sensor. In the calibration experiment, we set up 9 sensor nodes next to the sensors from the EPA monitoring station at Yong he in New Taipei City, as shown in Figure 9. Figure 16 demonstrates that our sensor nodes and the sensors from the Yong he monitoring station were located at the same height. The experiment was

conducted from April 22 to May 3, 2011. The sensor nodes sent the sensing data back every two minutes.

Figure 17 shows the linear regression results based on the 9 sensor nodes, and the points represent the averages of 30 sets of sensing data collected every hour. The horizontal axis represents the readings (V) from the MiCS-5525, and the vertical-axis represents the readings from the Yong he monitoring sensor (ppm) that measures environmental CO concentration. Table II shows the results of the linear regression. The ID denotes the sensor nodes number, and the C (v) denotes the calibration equations. Hence, the real CO concentration can be acquired through the voltage readings provided by the MiCS-5525.

Figure 9 : The location of the Yong he monitoring station

This study focuses on air pollution in the urban areas. The intersection circle of Keelung Road and Roosevelt Road (hereinafter referred to as the Gong Guan roundabout) in the Taipei city has witnessed heavy traffic during the rush hours, and this area urgently requires an air quality monitoring system. We set up a test bed in the Gong Guan roundabout. As shown in Figure 10, the urban air quality monitoring system located in the Gong Guan roundabout includes a gateway and 9 sensor nodes. Figure 11 shows the deployment of the proposed system.

Table II. The calibration equation for each sensor node

ID	C (v)	R^2
2	- 0.8+20.676v	0.7649
3	- 0.9+16.35352v	0.7082
4	- 0.7+72.18853v	0.7793
5	- 0.9+42.64811v	0.7185
6	- 1.4+27.98008v	0.7353
7	- 2.7+26.49416v	0.7173
8	- 2.0+31.07793v	0.8139
9	- 2.8+54.29874v	0.8567
10	- 2.0+39.79569v	0.674

In this study, the sensor nodes were used to collect air pollution and meteorological data every ten minutes, including temperature, relative humidity, CO sensor voltage, wind speed, wind direction, and atmospheric pressure. The CO concentration detected by the nine sensor nodes are shown in Figure 12.

Figure 10 : Locations of sensor nodes of the proposed system

Figure 11: Deployment of the air quality monitoring system. A sensor node was attached to the traffic signal pole

There were 24 data sets per day, coming from the hourly averaged data. Two peaks were found at 7 a.m. and 7 p.m., which echoed the rush hours during the daytime. Especially, in rush hours, there were significant changes in the data collected by sensor nodes 3, 4, 5, 7 and 9, because the sensor nodes were mounted on the traffic signals near the intersection. A high concentration of pollutions was detected and continuously accumulating when motor vehicles waited for green lights.

As a result, the CO concentration detected by sensor nodes 3 and 9 was up to 9 parts per million (ppm). According to the definition of air pollution indicators [20], human body will be harmed when the CO concentration reaches 9 ppm. If so, people should avoid the area or wear masks. Thus, the proposed real-time urban air quality monitoring system can provide warnings to the public by showing a red light to further traffic planning.

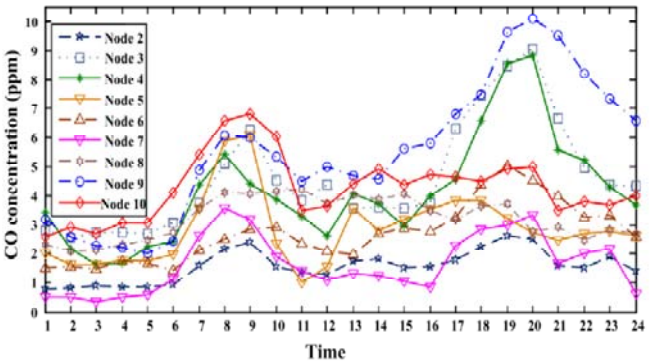

Figure 12 : CO concentrations on September 6, 2010, detected by each sensor node

In Figure 12, we made a comparison of the CO concentration during rush hours in the morning and afternoon (7 a.m. to 9 a.m. and 5 p.m. to 7 p.m.). The CO concentration detected by sensor nodes 5, 8 and 10 at the rush hours in the morning were higher than that in the afternoon. As mentioned earlier, the Gong Guan roundabout is an important transportation hub in the Taipei city for people who live in the Zhonghe, Yong he and Xindian Dist. and have to commute to the city through the roundabout. The readings of the CO concentration in the morning indicated that the traffic flow from Zhong he and Yong he (Zhong-Yong he Dist.) to the Taipei city through the Keelung Road was heavier than that from Xindian Dist. to Taipei. In other words, the traffic flow from Zhong- Yong he Dist. to the Taipei city generates more serious air pollution than that from Xindian Dist. to the city during morning rush hours. On the other hand, Figure 12 shows that the sensor nodes 3, 4, 6, and 9 detected higher CO concentrations during the rush hours in the afternoon compared with the morning hours, because the heavy traffic flow during the rush hours was from the city to Xindian Dist. and Zhong-Yonghe Dist. Moreover, sensor nodes 3 and 9 were located at a corner of the intersection next to the traffic signal. Comparing with the sensor nodes 4 and 6, sensor nodes 3 and 9 detected that CO concentrations were higher than 9 ppm. Based on the findings, the CO concentration was largely influenced by the direction of the traffic flow and how long cars stopped in front of the traffic signal.

IV. Conclusion

This study uses wireless sensor network technologies to acquire and record monitoring data for the goal of completely automatic air-quality monitoring. On the hardware side, we integrate sensor nodes with the CO sensors to perform air-quality-monitoring tasks. The sensor nodes are able to communicate with each other based on the Zig Bee protocol. The control center, controlled by the Lab VIEW program, successfully communicates with users through sending them SMS messages. It also stores a large amount of data into the database via the My SQL program, so that experts can establish a prediction model of pollution diffusion based on the data. In addition, the monitoring data reveals high-resolution pollution conditions near the Gong Guan roundabout in the Taipei city of Taiwan. The data can be an important source when addressing the issue of the impacts of motorcycles at idles (e.g. waiting for a green light) on air quality. Moreover, to achieve real-time monitoring, the data of CO concentration in a particular place could be reviewed from mobile communication devices, such as PDAs, smart phones, and tablet PCs to help keep air quality in check.

V. Acknowledgment

This work was financially supported in part by the National Science Council, Taiwan, under contract no. NSC 100-2118-E-002-005 and NSC 100-2218-E-002-006. This work was also supported by the National Science Council, National Taiwan University and Intel Corporation under Grants NSC99-2911-I-002-201, NSC100-2911-I-002-001, and 10R70501.The authors would also like to thank the Council of Agriculture of the Executive Yuan, Taiwan, for its financial support under contracts no. 100AS-6.1.2-BQB1, and 100AS-6.1.2-BQ-B2.

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Adaptive Multicast Multimedia Transmission Routing Protocol System (ACMMR) for Congestion Control and load Balancing Techniques in Mobile ADHOC Networks

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Abstract- A MANET is a probable solution for this need to quickly establish interactions in a mobile and transient environment. Proposed congestion controlled adaptive multicasting routing protocol to achieve load balancing and avoid congestion in MANETs. The existing algorithm for finding multicasting routes computes fail-safe multiple paths, which provide all the intermediate nodes on the primary path with multiple routes to target node. Routing may let a congestion happen, which is detected by congestion control, but dealing with congestion in this reactive manner results in longer delay and redundant packet loss and requires significant overhead if a new route is needed. Transmission of real-time video typically has bandwidth, delay, and loss requirements. Video transmission over wireless network poses many challenges. To overcome these challenges, extensive research has been conducted in the various areas of video application.

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GJCST-E Classification : C.2.2 C.1.3

Strictly as per the compliance and regulations of:

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R. Rajesh Kanna[α] & Dr. A. Saradha[σ]

Abstract- A MANET is a probable solution for this need to quickly establish interactions in a mobile and transient environment. Proposed congestion controlled adaptive multicasting routing protocol to achieve load balancing and avoid congestion in MANETs. The existing algorithm for finding multicasting routes computes fail-safe multiple paths, which provide all the intermediate nodes on the primary path with multiple routes to target node. Routing may let a congestion happen, which is detected by congestion control, but dealing with congestion in this reactive manner results in longer delay and redundant packet loss and requires significant overhead if a new route is needed. Transmission of real-time video typically has bandwidth, delay, and loss requirements. Video transmission over wireless network poses many challenges. To overcome these challenges, extensive research has been conducted in the various areas of video application. This paper is designed at dissemination of the contributions a simulation environment for video transmission over the adaptive multicast transmission routing protocol in mobile adhoc network.

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I. Introduction

A mobile ad-hoc network (MANET) is composed of mobile nodes without any infrastructure. Mobile nodes self-organize to form a network over radio links. The goal of MANETs is to extend mobility into the realm of autonomous, mobile and wireless domains, where a set of nodes form the network routing infrastructure in an ad-hoc fashion. The majority of applications of MANETs are in areas where rapid deployment and dynamic reconfiguration are necessary and wired network is not available. These include military battlefields, emergency search, rescue sites, classrooms and conventions, where participants share information dynamically using their mobile devices. These applications lend themselves well to multicast operations [1]. Multicasting can be used to improve the efficiency of the wireless link when sending multiple copies of messages to exploit the inherent broadcast nature of wireless transmission. So multicast plays an important role in MANETs Unlike typical wired multicast routing protocols, multicast routing for MANETs must address a diverse range of issues due to the characteristics of MANETs, such as low bandwidth, mobility and low power. MANETs deliver lower bandwidth than wired networks; therefore, the information collection during the formation of a routing table is expensive.

One of the challenges faced by multimedia is the limited capacity offered by many wide-area wireless technologies[2]. In general these networks offer less capacity than available in wired networks, and typically utilize sophisticated Radio Resource Management (RRM) methods to dynamically share the available radio bandwidth between a population of users. This can result in networks with limited capacity, and appreciable delay[3].

II. Related Work

Shruti Sangwan et al [7] have proposed adaptive and efficient load balancing schemes to get fair routing in mobile ad hoc networks (MANETs). They explain various load balancing mechanisms that controls congestion. Also their efficient optimization techniques help in deciding best route in the ad hoc networks. They mainly focused on presenting a better performance in terms of the processing time of the loads, nodes stability, throughput and lifetime of the network.

Multipath Routing with Load Balancing QoS in Ad hoc Network [8] gives novel protocol for AdHoc routing. It deals with only delay that does not fulfill the bandwidth and energy constraint. But in our paper we take into account bandwidth and energy constraints for selecting best path from source to destination node.

Wu et al. [8] proposed the power-aware method in dominating set-based routing. Their idea is to use rules based on energy level to extend the lifetime of a node in the refining process of reducing the number of nodes in the dominating set.

P. P. Tandon et al [9] have proposed a novel load balanced routing method that can efficiently reduce

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the data collision or route coupling. By this method they reduced the packet loss because of to collision and interference. Next the mechanism requires additional improvement to reduce the amount of flooding as more successive flooding can result in performance degradation. They targeted the route adaptation and maintenance as their future work.

Kawak and Song [9] investigate the inherent scalability problem of ad hoc networks which originate from their multi hop nature. They accomplished that the packet traffic at the center of a network is linearly related with radius of the network.

Vinh Dien HOANG et al [10] have proposed a new load balancing solution in MANET. The major idea in this solution is the probe packets used for bandwidth estimation are sent by the destination node. By doing so, these packets only have to go one time on the path, which will minimize consumed network resource and increase the accuracy of the estimation. A new formula for available bandwidth judgment in IEEE 802.11 network based on the gaps between probe packets is also presented.

Asis Nasipuri et al [11] illustrate how intelligent use of multi-path technique in DSR protocol can reduce the frequency of query floods. They also developed an analytic modeling framework to find out the relative frequency of query floods for various techniques.

III. Proposed Solution

Most of the protocols give solutions to load balancing or congestion or fault-tolerance, alone. So a joint protocol is essential, in order to present solutions for all the problems. In this paper, Proposed adaptive congestion controlled multicast multimedia routing protocol (ACMMR) to achieve load balance and avoid congestion in mobile adhoc networks. The average load of an link increases beyond a threshold and residual battery power of a node decreases below a threshold, it distributes the traffic over disjoint multicast routes to reduce the traffic load on a congested link. This proposed method for finding multi-path routes computes fail-safe multiple paths, which present all the intermediate nodes on the primary path with multiple routes to target node. The fail-safe multiple paths include the nodes with least load and residual power.

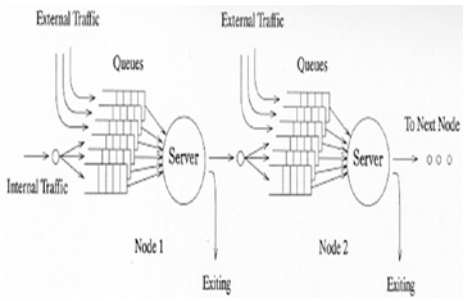


Figure 1 : A queuing perspective of the proposed congestion control technique.

IV. Methodology

A congestion, bandwidth and maximum node delay are crucial parameters used for setting up connections. Bandwidth is pre-allocated for real-time traffic based on prescribed mean bit rates. Available buffers are the control parameter for admitting non-real-time cell transfers on a link-by-link basis. Details are shown below [4].

1. Two types of traffic are defined in the model: a) Real-time Traffic (RT): Cells of this type are delay-sensitive. They must be delivered to the destination within a predefined time frame. b) Data Traffic (DT): Cells of this type are delay-insensitive, but they are loss-sensitive. All cells must be delivered.
2. EB (Effective Bandwidth) is the criterion used for call acceptance. There exists a separate EB for each type of traffic and for each node. EB is a two-element vector with the format of EB = (x, y).

The EB of a node is defined as follows:

$$EB_i = (C_{AVAIL_i}, M_i) \quad (1)$$

Where

EB_i = the EB of node i

C_{AVAIL_i} = the available (unallocated) channel capacity at node i

M_i = the maximum node delay at node i

The EB of a RT traffic is defined as:

$$EB_{RT_{i,j}} = (B_{RT_i}, D_{RT_{i,j}}) \quad (2)$$

Where

$EB_{RT_{i,j}}$ = the EB of the i^{th} RT traffic at node j

B_{RT_i} = the pre-specified mean bit rate of the i^{th} RT traffic

$D_{RT_{i,j}}$ = the allowable maximum node delay of the i^{th} RT traffic at node j, and

$$D_{RT_{i,j}} = D_{RT_{i,pred(i,j)}} - M_{pred(i,j)}$$

Where pred(i,j) = the predecesor of the j^{th} node of the i^{th} traffic

The EB of a DT traffic is defined as:

$$EB_{DT_{i,j}} = (0_{DT_i}, D^{+}_{DT_{i,j}}) \quad (3)$$

Where

$EB_{DT_{i,j}}$ = the EB of the i^{th} DT traffic at node j

0_{DT_i} = the prescribed mean bit rate of the i^{th} RT traffic is zero

$D^{+}_{DT_{i,j}}$ = a quantity that is larger than the allowable maximum node delay for the i^{th} RT traffic at node j

The operation of EBs is defined as follows:

$$O(EB_1, EB_2) = \begin{cases} 1 & if\ x_1 \geq x_2\ and\ y_1 \geq y_2 \\ 0 & otherwise \end{cases}$$

where

$$EB_1 = (x_1, y_1)\ \text{and}\ EB_2 = (x_2, y_2) \quad (4)$$

ART connection request is granted only if its EB can be satisfied by all intermediate nodes on the route; i.e., RT_i can be granted its connection request only if $O(EB_j, EB_{RT_{i,j}}) = 1$ is true for all j's on the routes. A DT traffic is also connection-oriented. However, a DT connection request is always granted. From the EB definition for DT traffic (Definition 3) we know that acceptance is instantaneous. In this case, a route can be selected randomly by the entrance node.

EF is the major criterion used to grant cell transfer requests for DT traffic from node to node. There exists a separate EF for each DT cell transfer request and for each node. EF is a scalar quantity.

The EF of a node i is defined as follows:

EF_i = the available (unallocated) buffer at node i (5)

The EF of a DT cell transfer request is defined as follows:

EF_{DT_i} = the buffer requirement of the current DT cell transfer request

at node i (6)

The operation of EFs is defined as follows:

$$O(EF_1, EF_2) = \begin{cases} 1 & if\ EF_1 \geq EF_2 \\ 0 & otherwise \end{cases} \quad (7)$$

A transfer request to node j from node i is granted only if $O(EF_j, EF_{DT_j}) = 1$. We assume that there exists at the entrance node a device that can mark all cells of this traffic before they enter the input buffer. It is obvious that DT transfer requests are done on a node-by-node basis, subject to the availability of EF at the next node. More precisely, this is a receiver credit-based windowing mechanism – it is up to the receiver to decide the number of cells allowable for transfer dynamically.

V. Simulation

Figure 2 shows the packet delivery fractions for variations of the pause time for ACMMR, AODV, and OLSR. Note that the packet delivery fractions for ACMMRR, AODV, and OLSR are very similar for both 10 and 25 sources. With 50 and 100 sources, however, ACMMR outperforms AODV and OLSR.

In fact, ACMMR achieves the highest packet delivery fraction all pause time values. For 50 sources, ACMMR achieves up to 20% higher packet delivery fractions than both AODV and DSR. This is mainly because of redundant route information that is stored in destination node to provide aid in routing, which eliminates the necessity of source reinitiating of route discovery. Similarly, ACMMR has superior performance to both AODV and OLSR in the case of 100 sources, in terms of the packet delivery fraction.

a) Performance Evaluation

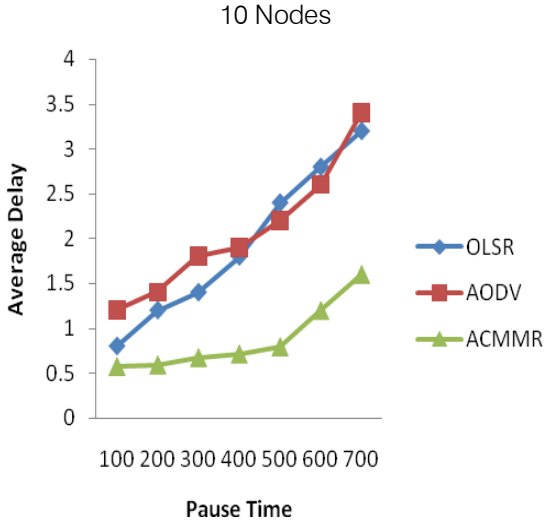
There are number of qualitative and quantitative metrics that can be used to evaluate in these protocol. These are comparing with use of NS-2 simulator.

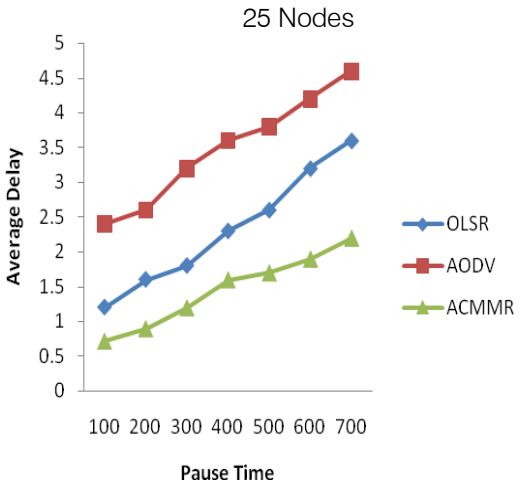
b) Routing overhead

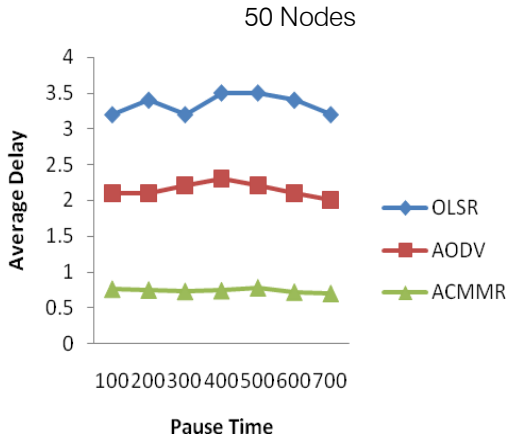
This metric describes how many routing packets for route discovery and route maintenance need to be sent so to as propagate the data packet.

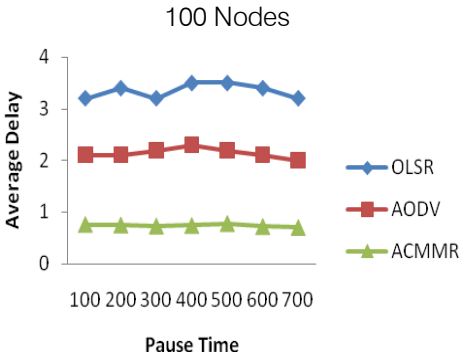
c) End-to-End delay

It is the ration of time difference between every continuous bit rate (CBR) packet sent and received to the total time difference over the total number of CBR packets received.

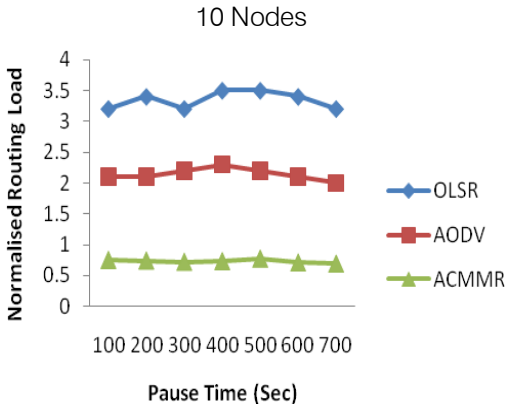


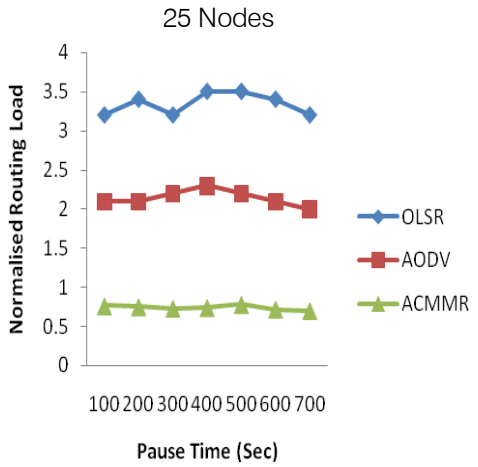


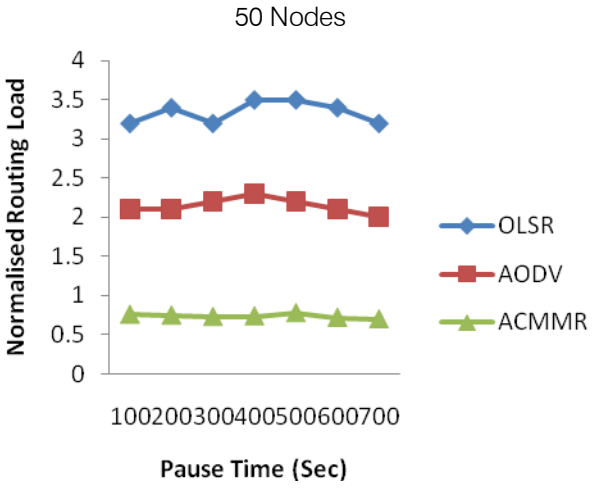


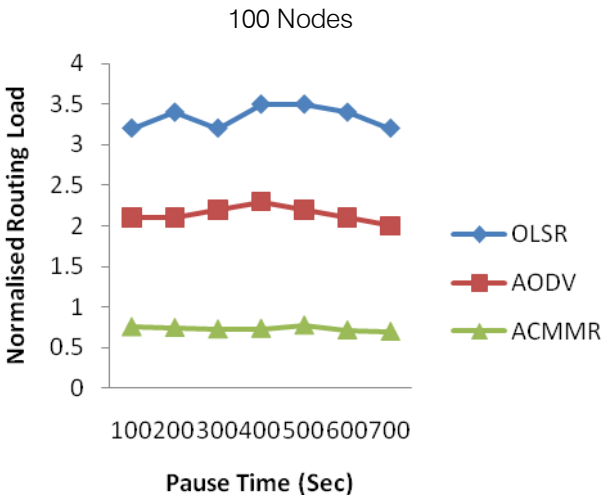


Normalized Routing Load









VI. Conclusion

Multimedia applications have enjoyed the global interest over the last few years. The multimedia transmission over MANETs facing many challenges mainly due to the following characteristics of the MANETs: Dynamic topology, transmission errors, node failures, link quality variations and link failures etc. This paper presents in detail and analyzes the current state

of the art in the area of multimedia transmission over MANETs which is a promising application area.

In this paper, a proposed new multipath ACMMR routing protocol for MANET with load balancing mechanism. There are two main contributions in this work. One is load balancing mechanism to honestly distribute the traffic on different active routes; the other is the route discovery mechanism parameters such as. Delivery Rate and Packet lost Rate. First, we have proposed a new multipath routing protocol called ACMMR with a new metric which is the buffer size to select the less congested routes. The goal of our scheme to find a congestion less path. Performance evaluation has been done using NS2 simulator tool and comparison with AODV,OLSR, ACMMR shows that our protocol can effectively reduce end to end delay while maintaining a good packet delivery ratio.

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Energy Consumption of TCP in Ad Hoc Networks

By K. Bhavana & M. Himaja
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Abstract- In this paper we study the energy cost (protocol processing and communication cost) and goodput of different flavors of TCP (Transmission Control Protocol) in ad hoc networks.We implemented a tes tbed and measured the actual energy cost as well as goodput of running TCP Reno, Newreno, SACK (Selective ACKnowledgement) and a version that combines Explicit Link Failure Noti_cation (ELFN)and Explicit Congestion Noti_cation (ECN) in Newreno. We see that the use of ECN & ELFN does yield higher good put in most cases with a corresponding lower total energy cost. We see an energy savings of between 20% and 500% depending on the network conditions.

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I. Introduction

Communication plays a major role in the ad-hoc networks and is used many applications. It account for a large proportion of energy usage. Energy is an important factor in the ad-hoc networks. It is very essential to lower the energy consumption in the adhoc networks. There are many techniques for reducing energy consumption and energy cost in ad-hoc networks. MAC protocols and routing protocols use energy based metrics.

These approaches reduces the energy cost. Aditionally the energy of the TCP also can be reduced as well. There are four variants in saving the energy. The four variants in saving the TCP energy are: Reno ,New Reno ,SACK ,and TCP-ECN-ELFN. SACK means selective acknowledgement. TCP-ECN-ELFN is a combination of ECN AND ELFN. ECN means Explicit Congestion Notification. ELFN is Explicit Link Failure Notification. ECN is a mechanism that enables the senders to respond quickly to the beginning congestion in the network. When the energy cost is measured there is a good throughput for this mechanism. There is a good total energy and idealized energy for this mechanism. The idealized energy is defined as the energy consumed by the sender for transmitting or sending or receiving. The other variant TCP-ECN-ELFN mechanism results in the lower energy consumption when compared to the SACK. The other variants of TCP that is Reno and New Reno also had a good throughput. In this paper we discuss about the energy model and summary of the various TCP variant mechanisms.

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II. Related Work

The link is an approach it includes the effect of ARQ AND FEC and the combination of the two in the ad-hoc networks. There are some link layer schemas to improve the energy behavior. The key idea is to discard the packet transmission when channel conditions are worsen. When the channel conditions is good then the packet transmission is resumed. The three implementations of TCP theno ,Reno, New Reno. This mainly focuses on the wired and the wireless environment.

III. Over View of TCP Variants

At present all the TCP implementations depands on tahoe. Various algorithms are incorporated on TCP for slow start ,fast avoidance and fast retransmit and modifications in the formulas for estimation the RTT. RTT means round trip time. The TCP RENO is very much similar to the tahoe but there is a slight difference that is the fast retransmit algorithm this fast retransmit algorithm includes the fast recovery. When a sender receives three duplicate acknowledgment signals then it reduces by half. But as not like a tahoe it becomes the slow start. Thus the RENO increases the congestion rapidly by setting it to the minimum. Here the retransmit timer will turn off and this leads to the congestion and the low throughput.

TCP New Reno overcome the disadvantages of the RENO. A partial acknowledgments infers that there are some unacked packets in the senders window. In RENO a partial acknowledgment gives the sender the fast recovery in a view of the multiple packet losses. When ever the receiver gets a data is out of sequence then that unsequences data creates a hole in the buffer that is present at the receivers end. This is the reason why the reciver generates a duplicate acknowledgment. The receiver includes the starting and ending sequence addresses that is the sequence numbers. These sequence numbers are present in the SACK. The first block in the SACK represents the recently transmitted segment to the reciever. The remaining SACK blocks represents the recently reported blocks. This algorithm is helpful for TCP to recover from multiple segment losses of data with in one round trip time.

When the sender comes to know that there is a loss of the packet then it retransmits and reduces the congestion to half and does fast recovery in RENO and

New RENO. SACK has a variable named pipe it gives the number of packets in the flight. This pipe variable is increased by one that is incremented for the transmission and it is decreased by one that is decremented when it receives a duplicate zed energy cost is high for SACK.

a) TCP-ECN-ELFN

It summarizes the changes made to the operation of TCP to include ECN and ELFN. We note that our implementation goes beyond simply adding ELFN and ECN to TCP - we no longer treat timeouts and triple duplicate ACKs as indications of congestion. Rather, we rely exclusively on ECN to ag network congestion. The table also describes the intuition behind these changes.

i. *Routing Failure*

It describes the interplay between routing failure (due to link outage or propagation of stale routes) and TCP throughput, in detail. Briey, successive route failures (due to link failure) lead to timeouts hence resulting in a small congestion window.. Hence, the throughput of the connection is small. The proposed in and used by us is as follows. A route failure message is propagated back to the TCP sender from the intermediate node that detects the route failure. This message has the effect of freezing TCP's state and initiating the transmission of probe packets. When there is a response to the probe packet (i.e., the route is up), TCP's state is unfrozen and transmission resumes. This solution ensures that there are no timeouts(and hence no unnecessary retransmissions), and that the TCP sender begins sending packets soon after the route is up.

ii. *Out of Order Packets*

Mobility of nodes can cause packets belonging to the same connection to be routed along different routes. This can result in the receiver getting out-of-order packets which causes duplicate ACKs to arrive at the sender. Likewise, packet loss due to link-layer errors can result in triple duplicate ACKs or timeouts. On receiving three duplicate ACKs, the sender reduces its congestion window by a half and retransmits the out-of-sequence packet while in the case of timeouts, the window is reduced to one or two segments. This congestion avoidance behavior has the net e_ect of reducing the throughput of the connection (due to the smaller congestion window) and thus increasing overall energy consumption. We believe that the appropriate _x for this problem is for the TCP sender to retransmit the sending packet but not adjust its congestion window. We made this modification to TCP-ECN-ELFN in our implementation.

iii. *Network Congestion*

A problem with our approach above is that if the triple duplicates (or timeout) were generated as a result of packet drops due to congestion, then the solution of simply retransmitting the packet without reducing the congestion window will have negative consequences (this is the reason why TCP reduces its congestion window). In our design, we rely on explicit congestion notification to signal imminent congestion along a route2. Here, a node whose buffer occupancy. crosses some threshold, sets a bit (the CE bit) in all data packets it sees. Receivers reect this ag back in the ACKs they generate by setting the ECN-ECHO bit. Upon receiving an ACK with the ECN-ECHO bit set, TCP senders enter a recovery phase in which they reduce the congestion win down by a half. The sender sets a CWR (Congestion Window Reduced) bit in new data packets. If the receiver sees an other CE bit set in a future packet and sees that the sender had sent a CWR bit, this indicates that there is still congestion in the network. The receiver again sets the ECN-ECHO bit in new ACKs thus forcing the sender to enter another recovery phase. This can go on until the sender's window has shrunk to one or two segments.

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Fast Dictionary Learning for Sparse Representations of Speech Signals

By Maria G. Jafari & Mark D. Plumbley
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Abstract- For dictionary-based decompositions of certain types, it has been observed that there might be a link between sparsity in the dictionary and sparsity in the decomposition. Sparsity in the dictionary has also been associated with the derivation of fast and efficient dictionary learning algorithms. Therefore, in this paper we present a greedy adaptive dictionary learning algorithm that sets out to find sparse atoms for speech signals. The algorithm learns the dictionary atoms on data frames taken from a speech signal. It iteratively extracts the data frame with minimum sparsity index, and adds this to the dictionary matrix. The contribution of this atom to the data frames is then removed, and the process is repeated. The algorithm is found to yield a sparse signal decomposition, supporting the hypothesis of a link between sparsity in the decomposition and dictionary. The algorithm is applied to the problem of speech representation and speech denoising, and its performance is compared to other existing methods.

Keywords: *adaptive dictionary, dictionary learning, sparse decomposition, sparse dictionary, speech analysis, speech denoising.*

GJCST-E Classification : *I.2.6*

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Index-terms: adaptive dictionary, dictionary learning, sparse decomposition, sparse dictionary, speech analysis, speech denoising.

I. Introduction

SPARSE signal representations allow the salient information within a signal to be conveyed with only a few elementary components, called atoms. For this reason, they have acquired great popularity over the years, and they have been successfully applied to a variety of problems, including the study of the human sensory system [1]–[3], blind source separation [4]–[6], and signal denoising [7]. Successful application of a sparse decomposition depends on the dictionary used, and whether it matches the signal features [8].

Two main methods have emerged to determine a dictionary within a sparse decomposition: dictionary selection and dictionary learning. Dictionary selection entails choosing a pre-existing dictionary, such as the Fourier basis, wavelet basis or modified discrete cosine basis, or constructing a redundant or overcomplete dictionary by forming a union of bases (for example the Fourier and wavelet bases) so that different properties of the signal can be represented [9]. Dictionary learning, on the other hand, aims at deducing the dictionary from the training data, so that the atoms directly capture the specific features of the signal or set of signals [7]. Dictionary learning methods are often based on an alternating optimization strategy, in which the dictionary is fixed, and a sparse signal decomposition is found; then the dictionary elements are learned, while the signal representation is fixed.

Early dictionary learning methods by Olshausen and Field [2] and Lewicki and Sejnowski [10] were based on a probabilistic model of the observed data. Lewicki and Sejnowski [10] clarify the relation between sparse coding methods and independent component analysis (ICA), while the connection between dictionary learning in sparse coding, and the vector quantization problem was pointed out by Kreutz–Delgado et al. [11]. The authors also proposed finding sparse representations using variants of the focal underdetermined system solver (FOCUSS) [12], and then updating the dictionary based on these representations. Aharon, Elad, and Bruckstein [13] proposed the K-SVD algorithm. It involves a sparse coding stage, based on a pursuit method, followed by an update step, where the dictionary matrix is updated one column at the time, while allowing the expansion coefficients to change [13]. More recently, dictionary learning methods for exact sparse representation based on ℓ_1 minimization [8], [14], and online learning algorithms [15], have been proposed.

Generally, the methods described above are computationally expensive algorithms that look for a sparse decomposition, for a variety of signal processing applications. In this paper, we are interested in targeting speech signals, and deriving a dictionary learning algorithm that is computationally fast. The algorithm should be able to learn a dictionary from a short speech signal, so that it can potentially be used in real-time processing applications.

a) Motivation

The aim of this work is to find a dictionary learning method that is fast and efficient. Rubinstein et al. have shown that this can be achieved by means of "double sparsity" [16]. Double sparsity refers to seeking a sparse decomposition and a dictionary $\mathbf{D} = \mathbf{AB}$ such that the atoms in $\mathbf{A}$ are sparse over the fixed dictionary $\mathbf{B}$, such as Wavelets or the discrete cosine transform (DCT). Also, in previous results in [17], it was

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found that dictionary atoms learned from speech signals with a sparse coding method based on ICA (SC-ICA) [18], are localized in time and frequency. This appears to suggest that for certain types of signals (e.g., speech and music) there might be a link between sparsity in decomposition and sparsity in dictionary.

This is further supported by the success of transforms such as the Wavelet transform whose basis functions are localized, and are well-suited to the analysis of natural signals (audio, images, biomedical signals), often yielding a sparse representation.

Thus, in this paper we propose to learn sparse atoms as in [16], but rather than learning atoms that are sparse over a fixed base dictionary, we directly learn sparse atoms from a speech signal. In order to build a fast transform, the proposed algorithm seeks to learn an orthogonal dictionary from a set of local frames that are obtained by segmenting the speech signal. Over several iterations, the algorithm "grabs" the sparsest data frame, and uses a Gram–Schmidt-like step to orthogonalize the signal away from this frame.

The advantage of this approach is its computational speed and simplicity, and because of the connection that we have observed between sparsity in the dictionary and in the representation, we expect that the signal representation that is obtained with the learned dictionary will be also sparse.

b) Contributions

In this paper, we consider the formulation of our algorithm from the point of view of minimizing the sparsity index on atoms.We seek the sparsity of the dictionary atoms alone rather than of the decomposition, and to the authors' knowledge this perspective has not been considered elsewhere.[1] Further, we propose a stopping rule that automatically selects only a subset of the atoms. This has the potential of making the algorithm even faster, and to aid in denoising applications by using a subset of the atoms within the signal reconstruction.

c) Organization of the Paper

The structure of the paper is as follows: the problem that we seek to address is outlined in Section II, and our sparse adaptive dictionary algorithm is introduced in Section III, along with the stopping rule. Experimental results are presented in Section IV, including the investigation of the sparsity of the atoms and speech representation, and speech denoising. Conclusions are drawn in Section VII.

II. Problem Statement

Given a one-dimensional speech signal $x(t)$, we divide this into overlapping frames $\mathbf{x}_k$, each of L length samples, with an overlap of M samples. Hence, the kth frame $\mathbf{x}_k$ is given by

$$\mathbf{x}_k = [x((k-1)(L-M)+1), \ldots, x(kL-(k-1)M)]^T \quad (1)$$

where $k \in \{1, \ldots, K\}$. Then we construct a new matrix $\mathbf{X} \in \mathbb{R}^{L \times K}$ whose k th column corresponds to the signal block $\mathbf{x}_k$, and whose (l,k) th element is given by

$$[\mathbf{X}]_{l,k} = x(l + (k-1)(L-M)) \quad (2)$$

where $l \in \{1, \ldots, L\}$, and $K > L$.

The task is to learn a dictionary $\mathbf{D}$ consisting of L atoms $\boldsymbol{\psi}^l$, that is $\mathbf{D} = \{\boldsymbol{\psi}^l\}_{l=1}^{L}$, providing a sparse representation for the signal blocks $\mathbf{x}_k$. We seek a dictionary and a decomposition of $\mathbf{x}_k$, such that [19]

$$\mathbf{x}_k = \sum_{l=1}^{L} \alpha_k^l \boldsymbol{\psi}^l \quad (3)$$

where α_k^l are the expansion coefficients, and

$$||\boldsymbol{\alpha}_k||_0 \ll L. \quad (4)$$

The ℓ_0-norm $||\boldsymbol{\alpha}_k||_0$ counts the number of non–zero entries in the vector $\boldsymbol{\alpha}_k$, and therefore the expression in (4) defines the decomposition as "sparse," if $||\boldsymbol{\alpha}_k||_0$ is small. In the remainder of this paper, we use the definition of sparsity given later in (5).

The dictionary is learned from the newly constructed matrix $\mathbf{X}$. In the case of our algorithm, we begin with a matrix containing K columns, and we extract the first L columns according to the criterion discussed in the next section.

III. Greedy Adaptive Dictionary Algorithm (GAD)

To find a set of sparse dictionary *atoms* we consider the sparsity index ξ [20] for each column $\mathbf{x}_k$, of $\mathbf{X}$, defined as

$$\xi = \frac{||\mathbf{x}||_1}{||\mathbf{x}||_2} \quad (5)$$

where $||\cdot||_1$ and $||\cdot||_2$ denote the ℓ_1-and ℓ_2 -norm, respectively. The sparsity index measures the sparsity of a signal, and is such that the smaller ξ, the sparser the vector $\mathbf{x}$. Our aim is to sequentially extract new atoms from $\mathbf{X}$ to populate the dictionary matrix $\mathbf{D}$, and we do this by finding, at each iteration, the column of $\mathbf{X}$ with minimum sparsity index

$$\min_k \xi_k. \quad (6)$$

Practical implementation of the algorithm begins with the definition of a residual matrix $\mathbf{R}^l = [\mathbf{r}_1^l, \ldots, \mathbf{r}_K^l]$, where $\mathbf{r}_k^l \in \mathbb{R}^K$ is a residual column

[1] The approach proposed in\[16]looks for as parse dictionary over a base dictionary, as well as as parse decomposition, and there for eisquite different to them ethod proposed here.

vector corresponding to the th column of $\mathbf{R}^l$. The residual matrix changes at each iteration l, and is initialized to $\mathbf{X}$. The dictionary is then built by selecting the residual vector $\mathbf{r}_k^l$ that has lowest sparsity index, as indicated in Algorithm 1.

Algorithm 1 Greedy adaptive dictionary (GAD) algorithm

1. Initialize: $l = 0$, $\mathbf{D}^0 = [\,]$ {empty matrix}, $\mathbf{R}^0 = \mathbf{X}$, $\mathcal{I} = \emptyset$
2. **repeat**
3. Find residual column of $\mathbf{R}^l$ with lowest ℓ_1 - to ℓ_2 -norm ratio:
$$k^l = \arg\min_{k \notin \mathcal{I}^l} \{\|\mathbf{r}_k^l\|_1 / \|\mathbf{r}_k^l\|_2\}$$
4. Set the th atom equal to normalized $\hat{\mathbf{r}}_{k^l}^l$:
$$\boldsymbol{\psi}^l = \hat{\mathbf{r}}_{k^l}^l / \|\hat{\mathbf{r}}_{k^l}^l\|_2$$
5. Add to the dictionary:
$$\mathbf{D}^l = [\mathbf{D}^{l-1} \,|\, \boldsymbol{\psi}^l], \quad \mathcal{I}^l = \mathcal{I}^{l-1} \cup \{k^l\}$$
6. Compute the new residual $\mathbf{r}_k^{l+1} = \mathbf{r}_k^l - \boldsymbol{\psi}^l \langle \boldsymbol{\psi}^l, \mathbf{r}_k^l \rangle$ for all columns k
7. **until** "termination" (see Section III-A)

We call our method the greedy adaptive dictionary (GAD) algorithm [21].

Aside from the advantage of producing atoms that are directly relevant to the data, the GAD algorithm results in an orthogonal transform. To see this, consider rewriting the update equation in step 6 in Algorithm 1 as the projection of the current residual $\mathbf{r}_k^l$ onto the atom space, in the style of Matching Pursuit [22], [23]:

$$\mathbf{r}_k^{l+1} = \mathbf{P}_{\boldsymbol{\psi}^l} \mathbf{r}_k^l = \left(\mathbf{I} - \frac{\boldsymbol{\psi}^l \boldsymbol{\psi}^l}{\boldsymbol{\psi}^{l^T} \boldsymbol{\psi}^l} \right) \mathbf{r}_k^l = \mathbf{r}_k^l - \frac{\boldsymbol{\psi}^l \langle \boldsymbol{\psi}^l, \mathbf{r}_k^l \rangle}{\boldsymbol{\psi}^{l^T} \boldsymbol{\psi}^l}. \quad (7)$$

It follows from step 4 in Algorithm 1, that the denominator in the right-hand-side of (7) is equal to 1, and therefore the equation corresponds to the residual update in step 6. Orthogonal dictionaries have the advantage being easily invertible, since if the matrix $\mathbf{B}$ is orthogonal, then $\mathbf{B}\mathbf{B}^T = \mathbf{I}$, and evaluation of the inverse simply requires the use of the matrix transpose.

a) Termination Rules

We consider two possible termination rules:

1. The number of atoms l to be extracted is pre-determined, so that up to L atoms are learned. Then, the termination rule is:
   - Repeat from step 2, until $l = N$, where $N \leq L$.
2. The reconstruction error at the current iteration ϵ^l is defined, and the rule is:
   - Repeat from step 2 until
$$\epsilon^l = \|\hat{x}^l(t) - x(t)\|_2 \leq \sigma \quad (8)$$

Where $\hat{x}^l(t)$ is the approximation of the speech signal $x(t)$, obtained at the l th iteration from $\hat{\mathbf{X}}^l = \mathbf{D}^l (\mathbf{D}^l)^T \mathbf{X}$ by reversing the framing process; $\mathbf{D}^l$ is the dictionary learned so far, as defined in step 5 of Algorithm 1.

IV. Experiments

We compared theGADmethod to PCA [24] and K-SVD [13]. K-SVD was chosen because it learns data-determined dictionaries, and looks for a sparse representation. PCA was chosen because it is a well-established technique, commonly used in speech coding and therefore it sets the benchmark for the speech denoising application.

We used the three algorithms to learn 512 dictionary atoms from a segment of speech lasting 1.25 s. A short data segment was used because this way the algorithm can be used within real-time speech processing applications. The data was taken from the female speech signal "supernova.wav" by "Corsica S," downloaded from The Freesound Project database [25], and downsampled to 16 kHz. We also used the male speech signal "Henry5.mp3" by "acclivity," downloaded from the same database, and downsampled to 16 kHz.

The K-SVD Matlab Toolbox [26] was used to implement the K-SVD algorithm. K-SVD requires the selection of several parameters. We set the number of iterations to 50, as recommended in [13], and the number of nonzero entries in the coefficient update stage to 10, which we found empirically to give

Table1: Comparing The Computational Complexity For The Pca, K-Svd, And Gad Algorithms. The Table Shows The Average Computational Time For Each Algorithm, Obtained Over 100 Trials

Method	Average Computation Time (sec)
PCA	7
K-SVD (Matlab only)	6710
K-SVD (v2)	163
GAD	167

a more accurate, although not as sparse, signal representation than $T_0 = 3$, as used in [13]. The dictionary size was set to 512 and the memory usage to "high."

a) Computational Complexity

In Table I, we report the computational times of the algorithms, when learning a dictionary from speech segment of 1.25s, and averaged over 100 trials. Two versions of the K-SVD were also compared: the original version which is fully based on Matlab M-code, and the second version, which combines M-code with optimized MEX functions written in C. The experiments were conducted on a Quad-Core Intel Xeon Mac at 2.66 GHz, using Matlab Version 7.6.0.324 (R2008a) and under the Mac OS X Version 10.5.8 operating system.

GAD and K-SVD (v2) only need about 2 minutes, and PCA needs as little as 7sec. However, note how the K-SVD version based exclusively on M-code requires around 1 hour and 45 minutes to learn the dictionary. Therefore, we expect that optimizing the code for GAD will lead to even faster computational complexity.

b) Learned Atoms

We begin by visually inspecting some examples of the atoms learned with the three algorithms, and then considering the sparsity of the atoms and signal representation.

Fig. 1(a) shows examples of the overlapping data blocks found in the columns of the matrix $\mathbf{X}$, from which each dictionary is learned, while the remaining plots in the figure show examples of the atoms learned with PCA, K-SVD and GAD. The sparsity index relating to each atom is also given.

The atoms extracted with PCA [Fig. 1(b)] are not localized. Comparing them with Fig. 1(a), they do not appear to be capturing any particular features of the speech signal.

The K-SVD atoms [Fig. 1(c)] exhibit some structure that generally seems to correspond to that of the original data blocks. The atoms obtained with the GAD algorithm are illustrated in Fig. 1(d). Those atoms extracted earlier, shown on the first two lines, are quite similar to the original data, and are also the sparsest atoms, as indicated by the low sparsity index. Atoms extracted later, shown on the last two lines in the figure, capture mostly "noise"-like characteristics, or less meaningful features of the signal.

c) Sparsity of Atoms and Representation

We have seen in Fig. 1 how the GAD algorithm yields atoms that are initially quite sparse and then become more "noise"-

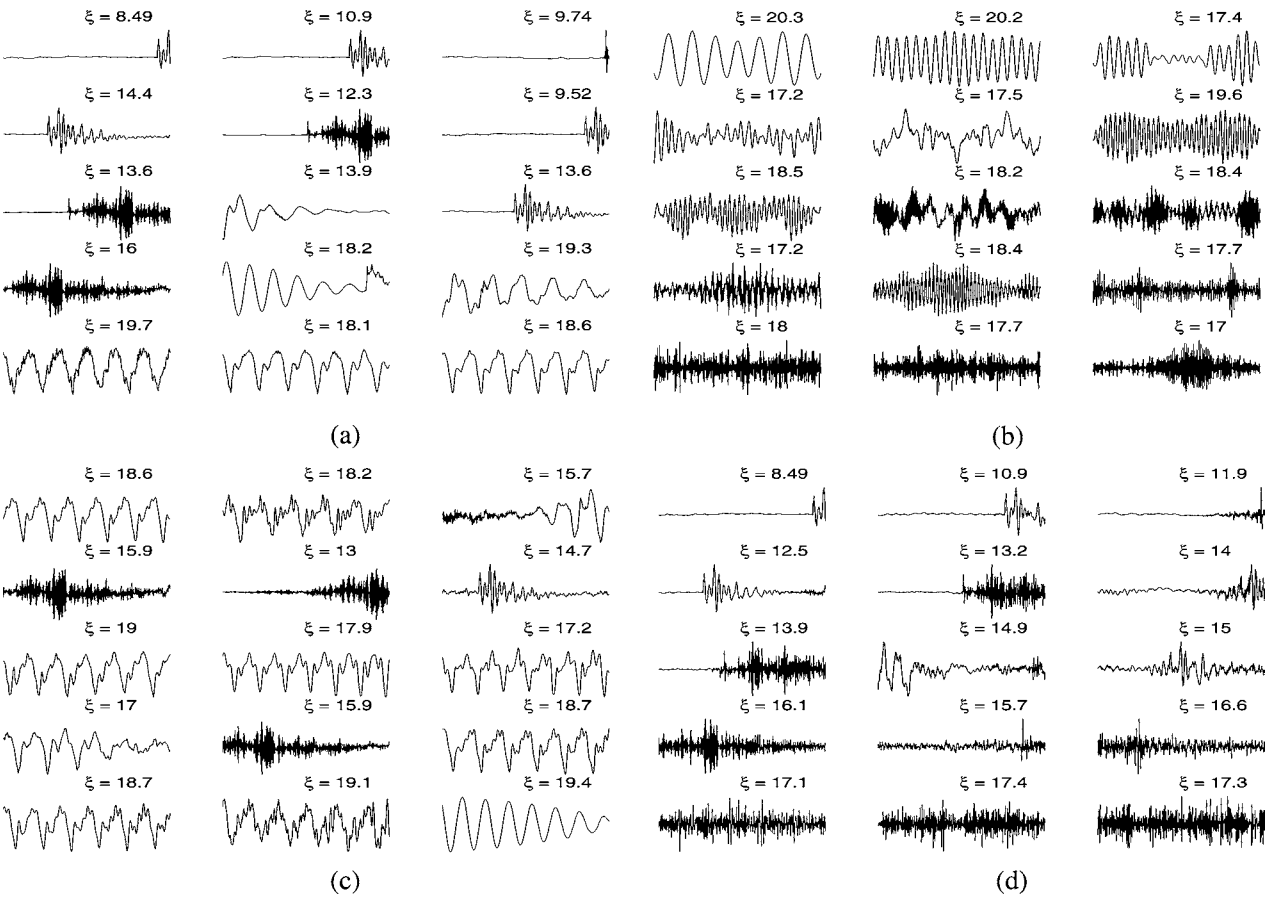

Figure 1: Examples of the frames of the original speech signals, and of the atoms learned with the PCA, K-SVD, and GAD algorithms

like. To investigate this further, 100 segments were taken from the original speech data, each lasting 1.25 s. PCA, K-SVD and GAD were used to learn dictionaries from each segment. The sparsity index ξ_k for each atom was then evaluated, and the average across the 100 trials was taken.

Fig. 2 shows the atom sparsity index for the framed speech data in the columns of $\mathbf{X}$, and for the atoms learned with PCA, K-SVD and GAD. Recall that a sparse atom is characterized by a low sparsity index. The plot shows that the atoms learned by GAD in the beginning are the sparsest, and after around 200 atoms have been extracted, the sparsity index is close to its maximum value. The behavior observed here is in agreement with what was observed in Fig. 1. It also shows that the atoms obtained with the other algorithms are not as sparse as those extracted by GAD. The original data blocks that are considered in the figure correspond to the columns in $\mathbf{X}$ that are extracted by GAD, and therefore they are the sparsest within the speech segment.

The results are shown in the first column of Table II, and they validate our expectations: GAD yields atoms that are sparser than the original signal blocks, and than all the algorithms. However, when we used the termination rule in (8) (shown in Table II as GAD-TR), with $\sigma = 5 \times 10^{-3}$, the average sparsity index for the GAD atoms decreased from 16.2 to 12.6. On average, GAD-TR was found to learn less than 110 atoms, which from Fig. 2 can be seen to correspond to those atoms that are sparsest. The algorithms perform in a similar way on the male speech.

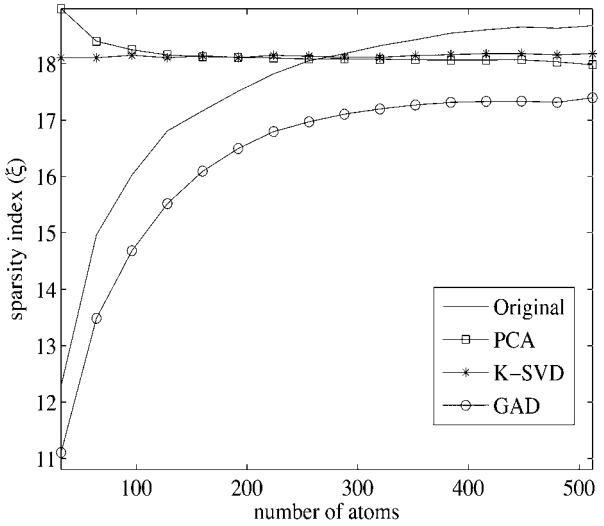

Figure 2 : Sparsity index for atoms GAD, PCA, and K-SVD algorithms, learned from a female speech signal, and averaged over 100 trials

Next, we seek to determine how sparse is the representation obtained with the GAD method. We do this by considering the transform coefficients obtained with all methods, for each block, and across the 100 speech segments taken from the speech signal, each lasting 1.25s. The sparsity index of the transform coefficients is found each time. We then average across the 100 segments and across all blocks to obtain a single

Table 2 : Mean Value And Standard Deviation (Std) For The Sparsity Index Of The Atoms And The Signal Representation Obtained With The Pca, K-Svd, And Gad Algorithms Compared To That Of The Original Signal Blocks. The Values For The Original Data Blocks And For Pca, K-Svd, And Gad Were Averaged Across 100 Trials, And 512 Atoms

Method	Mean and Standard Deviation of Sparsity Index							
	Atom Sparsity Index				Representation Sparsity Index			
	Female		Male		Female		Male	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Original	17.5	0.44	17.1	0.48	17.5	0.44	17.1	0.48
PCA	18.2	0.18	18.1	0.23	16.0	0.15	15.5	0.19
K-SVD	18.1	0.04	17.9	0.09	2.1	0.20	2.6	0.18
GAD-FULL	16.2	0.29	16.8	0.29	10.5	0.62	12.3	0.51
GAD-TR	12.6	0.64	14.9	0.70	6.0	0.43	6.9	0.48

figure for each method, and for both the female and male speech signals, as shown in the second column of Table II. This also includes values for the sparsity index for the original signal blocks in $\mathbf{X}$. The lowest representation sparsity index value is obtained with K-SVD, thanks to the strong sparsity constraint imposed by the algorithm on the signal decomposition. This entails limiting the number of nonzero elements in the signal representation to a small number (we use $T_0 = 10$). The signal transformed with the GAD algorithm is sparser than in the time domain, and than the coefficients obtained with PCA when all atoms are used in the signal reconstruction, for both signals. Moreover, the representation becomes even sparser when GAD is used with the termination rule.

Thus, as well as a dictionary whose atoms are sparse GAD leads to a sparse decomposition. This confirms the concepts discussed in Section I-A.

d) Representation Accuracy

The accuracy of the signal approximation given by each algorithm can be assessed with the reconstruction error , as defined in (8), after the dictionary has been learned

$$\epsilon = \|\hat{x}(t) - x(t)\|_2 \qquad (9)$$

Where $x(t)$ is the signal approximation obtained from $\hat{\mathbf{X}} = \mathbf{D}^l(\mathbf{D}^l)^\dagger\mathbf{X}$, and $(\mathbf{D}^l)^\dagger$ is the right pseudo-inverse of $\mathbf{D}^l$. This is plotted in Fig. 3 for each algorithm, as the number of atoms omitted in the signal reconstruction goes from 0 to 462 (or, the total number of atoms used goes from 512 down to 50). K-SVD has a nonzero reconstruction error even when all atoms are included in the signal approximation, because the transform is not complete, and therefore it does not result in an exact reconstruction.

In general, the results show that all algorithms perform quite well when few atoms are omitted in the reconstruction. As more and more atoms are omitted,

the reconstruction error increases. PCA performs best, because the transform arranges the signal components so that most energy is concentrated in a small number of components, corresponding to those extracted earlier. The GAD transform also gives good signal approximations as more atoms are excluded from the reconstruction, although its performance seems to worsen as the number of omitted atoms becomes more than 300 (or less than 200 atoms

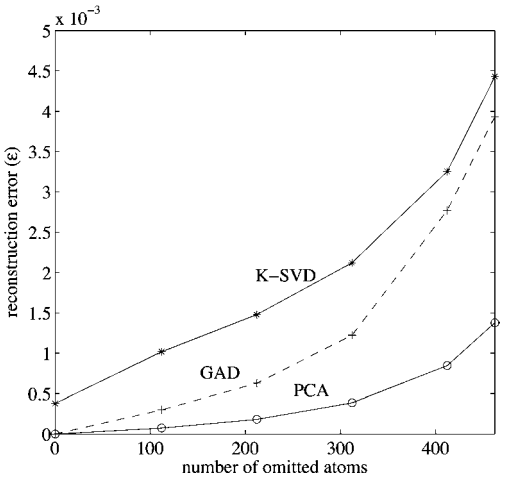

Figure 3: Reconstruction error for the GAD, PCA, and K-SVD algorithms, averaged over 100 trials

are used in the reconstruction). This corresponds to the number, identified in Fig. 2, below which the GAD atoms are sparsest, and above which the sparsity index reaches its maximum value. K-SVD yields signal approximations that suffer most from the reduction in the number of atoms.

The dictionary constructed by GAD separates the coherent components from the incoherent components. The latter can be discarded from the representation to reduce incoherent background noise. This suggests that the GAD algorithm might be suitable for denoising applications. Hence, we will consider this problem in the following section.

V. Application to Speech Denoising

The term denoising refers to the removal of noise from a signal. Sparse transforms have been found to be among the most successful methods for denoising [27], and dictionary learning methods have been used for this application [13].

Table III shows the tolerance of the PCA, K-SVD, and GAD algorithms to a noise level changing from 10 dB to 10 dB, as the number of atoms in the reconstruction is reduced from 512 to 50. This is evaluated with the improvement in signal-to-noise ratio (ISNR):

$$\mathrm{ISNR} = 10\log\frac{E\{(x(t)-x_n(t))^2\}}{E\{x(t)\quad\hat{x}(t))^2\}} \qquad (10)$$

Where $x(t)$ is the original signal, $x_n(t)$ is the observed distorted (noisy) signal, and $\hat{x}(t)$ is the source approximated by the transform. As the signal approximation becomes closer to the original source, ISNR increases.

When all atoms are used in the reconstruction, the complete transforms PCA and GAD, yield an ISNR of 0 dB, while K-SVD gives a nonzero ISNR, since the approximation is not exact. Generally, K-SVD has been shown to perform well for tasks such as image denoising [7], and the results in Table III show that this is also true for speech: the algorithm yields the highest ISNR values across all experiments. For the remaining algorithms, when the noise is low (10 dB), reducing the number of atoms in the reconstruction leads to distortion in the signal approximation. As the level of noise increases, the high ISNR

Table 3 : ISNR For The Gad, Pca, And K-Svd Algorithms. All Isnr Values Are Expressed In Decibels (Db)

Noise Level	Method	Number of Atoms					
		512	400	300	200	100	50
10 dB	PCA	0.00	0.52	1.32	2.61	4.74	5.69
	K-SVD	5.10	6.01	6.83	7.45	7.00	5.85
	GAD	0.00	1.40	2.97	4.71	5.10	2.53
0 dB	PCA	0.00	0.50	1.30	2.69	5.42	8.33
	K-SVD	4.89	5.98	7.10	8.52	10.17	10.97
	GAD	0.00	1.50	3.29	5.65	7.20	7.27
-10 dB	PCA	0.00	0.49	1.28	2.65	5.34	8.28
	K-SVD	4.70	5.75	6.96	8.53	10.64	12.07
	GAD	0.00	1.47	3.27	5.80	8.86	10.21

values for PCA and GAD indicate that there are benefits in reducing the number of atoms used in the signal approximation. It is well-known that PCA can reduce the level of noise present, because it decomposes the space into signal and noise subspaces [28], and the results in Table III show that the performance of GAD is similar.

It should be emphasized that the advantage of using the GAD algorithm over PCA is that methods based on sparse representations do not enforce decorrelation on the data. This results in greater flexibility in adapting the representation to the data, and uncovering previously unobserved structure in the data. Moreover, sparse representations allow the use of powerful and efficient tools for signal analysis.

VI. Discussion

GAD is a computationally fast algorithm that finds atoms that are sparse. It is motivated by the observation that sparsity in the dictionary and sparsity in the decomposition appear to be linked, for certain types of signals. This notion is supported by the results in this paper: whilst looking for sparse atoms and making no assumptions on the decomposition, the GAD algorithm yields a signal decomposition that is sparse.

Although the only sparsity measure considered here is the sparsity index, we have compared the results to other measures of sparsity including the Gini index, which was found to outperform several other sparsity measures [29]. Our experimental results indicated that the performance of the algorithm is not noticeably different. However, we are considering to study this further in future work.

In its present form, the GAD method looks for onsets, and it might be argued that it does not take advantage of all the possible redundancy in the speech signal, by not exploiting the pitch structure of the signal. In future work we are considering searching for sparsity in the frequency domain, and perhaps in prototype waveform domain [30]. On the other hand, in its present form GAD is a general algorithm that can be used with a variety of data because it does not make any assumptions on its characteristics.

Although the GAD algorithm is currently at the theoretical stage, it is a fast method that might in future be used in real practical applications such as speech coding. In this case, like with PCA, this method would require the transmission of the signal adaptive dictionary. Other applications to which we are particularly interested in applying the GAD method include image processing and biomedical signal processing. Biomedical applications typically give rise to large data sets, for instance, in microarray experiments the expression values of thousands of genes are generated. Therefore, in this case the algorithm would have to be extended to deal with large data sets. We are also considering the application of this approach to the problem of source separation.

VII. Conclusion

In this paper, we have presented a greedy adaptive dictionary learning algorithm, that finds new dictionary elements that are sparse. The algorithm constructs a signal-adaptive orthogonal dictionary, whose atoms encode local properties of the signal. The algorithm has been shown to yield sparse atoms and a sparse signal representation. Its performance was compared to that of PCA and K-SVD methods, and it was found to give good signal approximations, even as the number of atoms in the reconstructions decreases considerably.

It results in better signal reconstruction than K-SVD and it has good tolerance to noise and does not exhibit distortion when noise reduction is performed at low noise levels.

VIII. Acknowledgment

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Blind Video Watermarking Scheme For Mpeg-4 Videos With Parity Sequences In Transform Domain

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Keywords: *video watermarking, parity check codes, spreading sequences, DCT.*

GJCST-E Classification : *H.5.1*

Strictly as per the compliance and regulations of:

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S. Janardhana Rao [α] & Dr. O. Naga Raju [σ]

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I. Introduction

With the advent of digital video broadcasting over the internet and DTH (Direct to Home) /DVB (digital video Broadcasting) many issues of copy right protection is of great importance [3] [4]. Since the duplication of digital video signals does not result in the inherent decrease in quality of the suffered analog video signals. Invisible watermarking is one of the solutions for the protection of the digital data. A water mark is a digital code that is embedded in the video sequence which can be used to transmit that video to the copyright owner in others terms this can be used to send the copy of digital data only to the legal user. This allows illegally reproduced copies to be traced back to the receiver from which they are originated. A simple diagram used to depict the scenario.

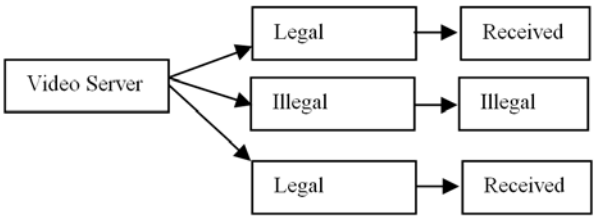

Figure 1: Block diagram of Copyright protection

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The digital video watermarking is regarded as a complete cryptogram communication system in which the watermark is regarded as the transmitted message and the video frame as the channel or carrier for the watermark and the pixels that are encountering attacks as the noise in the channel [1]. Based on this concept we can use parity check codes for error correction codes. In this paper we use LDPC codes for error correction.

Error correction codes are commonly used to protect memories from so-called soft errors, which change the logical value of memory cells without damaging the circuit. As technology scales, memory devices become larger and more powerful error correction codes are needed. To this end, the use of more advanced codes has been recently proposed. These codes can correct a larger number of errors, but generally require complex decoders. To avoid a high decoding complexity, the use of one step majority logic decoding codes was first proposed in for memory applications

LDPC code was first presented by Gallager [2], these codes have many advantages like stronger ability to correct errors and have the lower error floor, it's a parallel algorithm which is very much suitable for hard ware implementation, lower delay in decoding process, lastly it uses the length of the watermark and the value of the transformed coefficients for adaptive embedding.
In [5], XU Ba et al proposed a blind video watermarking algorithm based on LDPC, improving the robustness of video watermarking algorithm in the original domain. In [6], Hsu et al proposed a video watermarking scheme based on DCT, using the DCT coefficients to embed watermark. In [7], Hartung et al proposed a scheme that the watermark is added in the MPEG-4 facial motion parameters. The disadvantage of the method is that extracting the watermarking requires the original host signal and the rate of extracting is unbalance. In [8], Chen Chao et al proposed a video watermarking algorithm in compressed domain, using the intermediate frequency coefficient of the luminance to embed watermark. Also, in [9], Li Jing et al proposed a robust blind video watermarking algorithm, using the low-frequency coefficient of the luminance component to embed watermark

In this paper an invisible mode of video watermarking is proposed with LDPC codes, for more security different spreading sequences are convolved during the embedding process. The paper is organized as follows

II. Proposed Approach

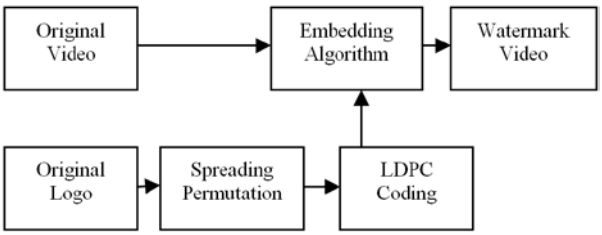

Figure 2(a): Embedding process

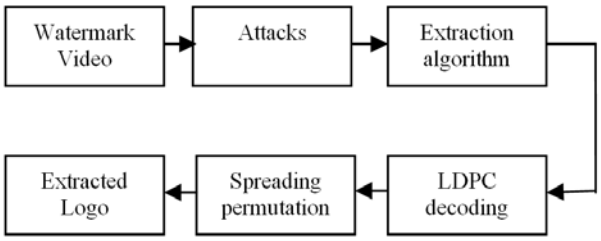

Figure 2(b): Extraction Process

Figure 2 : Block diagram of embedding and extraction process

Original Video: In this paper for the experimental analysis different videos available at [10]. The sample video frames are displayed below

Figure 3 : Video frames of the video samples considered for experiments

a) Embedding Algorithm

- *Consider a frame which is in true color RGB which is converted into Ycbcr.*
- *Consider the Y component of the color transformed frame*
- *Apply DCT (Discrete Cosine Transform) [11][12] and consider the middle frequency components for embedding line [32:32: MxN] where M & N are the x & y dimension of the frame.*
- *Consider a logo to be embedded of size 32x32 and make the values to be as {-1, +1}.*
- *Generate a random sequence of size [1 MxN] and consider the frequency position as stated in before point*
- *Encode the message data with LDPC*
- *The embedding process is*

$$V_i^{'} = V_i + a_i b_k p_k \quad (1)$$

Where 'i' is the i[th] Dct coefficient and 'k' is the middle frequency component , V_i is the original DCT coefficient and $V_i^{'}$ is the modified coefficient , $p_k \in \{-1,1\}$ is the spreading sequence .the value of a_i is set as

$$\begin{aligned} &\text{If } |V_i|<2 \text{ then } a_i = 2 \\ &\text{If } 2<|V_i|<10 \text{ then } a_i = 2.5 \\ &\text{If } 10<|V_i|<20 \text{ then } a_i = 3 \\ &\text{If } |V_i|>20 \text{ then } a_i = 5 \end{aligned} \quad (2)$$

Spreading sequences: In this paper three different types of spreading codes were used PN sequence [13], Gold Codes [14] and Walsh/Hadamard codes [15].

b) Extraction Process

- *The watermarked video frame is converted into Ycbcr from which the 'Y' component is selected for the process*
- *Apply the DCT transform and convolve the middle frequency coefficients with spreading sequence.*

$$E_k = \sum_{\substack{i=kxcr \\ Cr=32}}^{(k+1)xcr-1} V_i^{'} p_i \quad (3)$$

- *Consider the sign of the resultant coefficient value and perform LDPC decoding to extract the logo*

III. Experimental Results

Experiments were conducted using the video sequences from [10] on Matlab 2012 Version, windows 7 OS

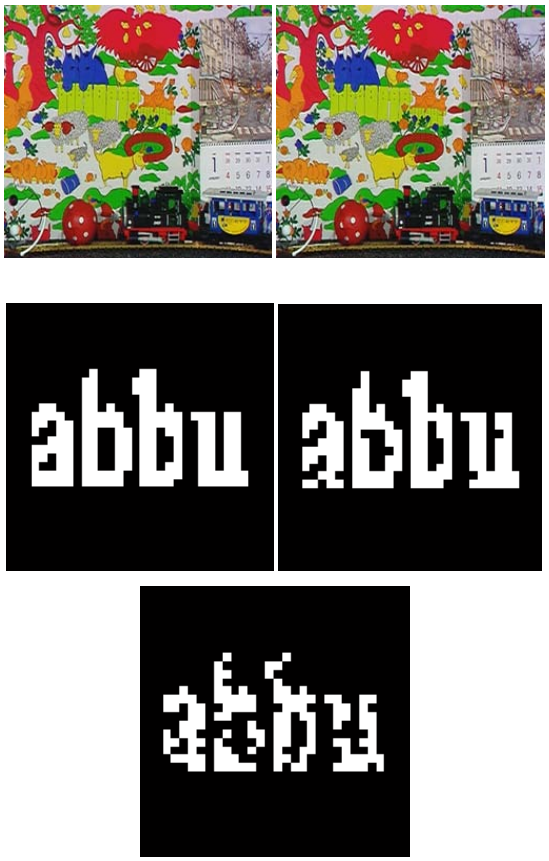

Figure 4: (a) Original Video frame (b) Watermarked frame (c) Original Logo (d) extracted with PN spreading sequence and LDPC coding (e) extracted Without LDPC coding

Table 1 : Analytical results with and without Pre coding

Parameter	NO PRE-CODING	LDPC
BER	0.04	0.01
NC	0.99	0.99
PSNR	49.28	49.31

Table 2 : Analytical results for extraction with different spreading sequences

Parameter	LDPC with PN seq	LDPC with gold codes	LDPC with Hadamard
BER	0.01	0.011	0.011
PSNR	48.29	48.32	48.27
MSE	0.964	0.956	0.967

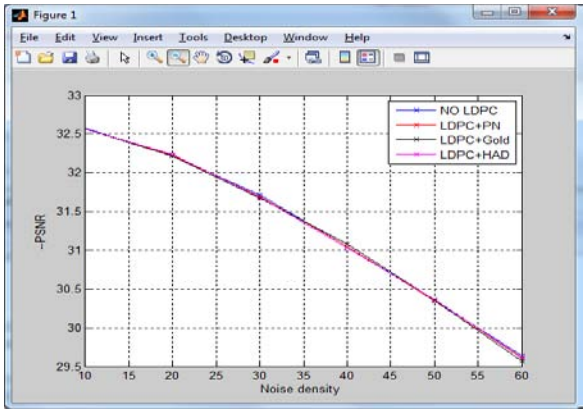

Figure 5 : Performance analysis for mobile video sequence with proposed approach

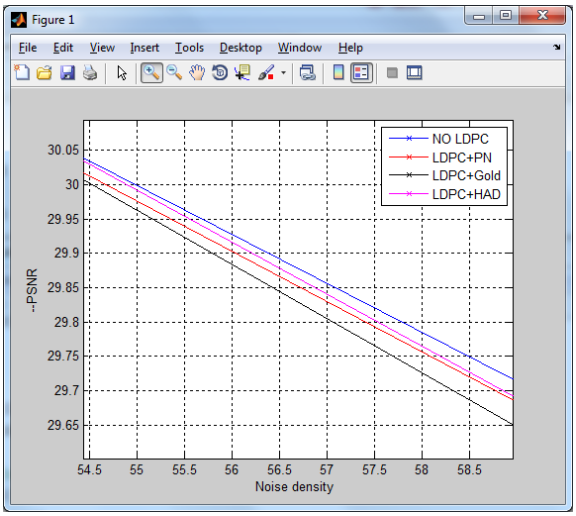

Figure 6 : Zoomed Graph of the figure 4

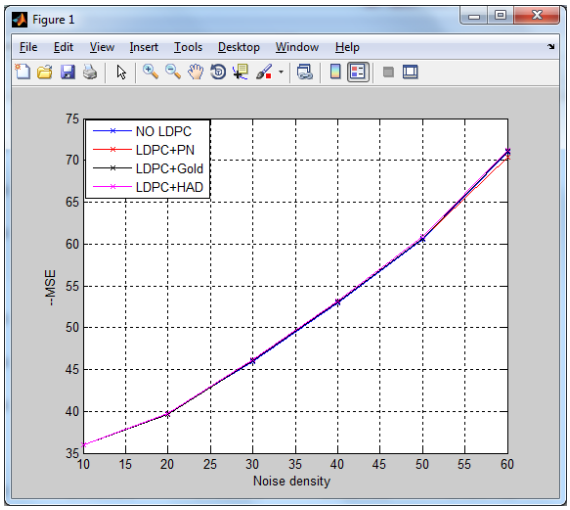

Figure 7: Mean square Error Analysis of the proposed approach for the Mobile.avi video sequence

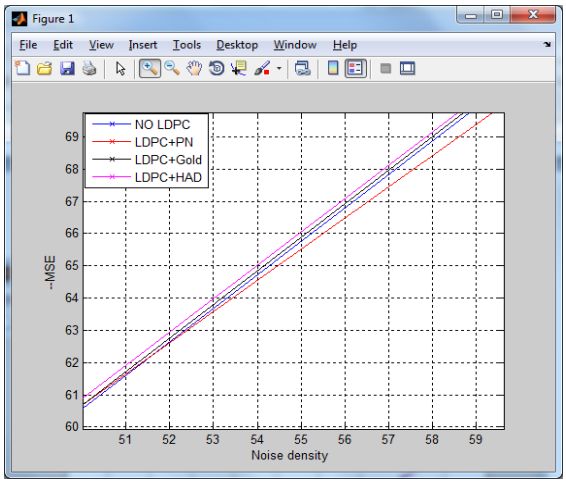

Figure 8 : Zoomed graph of figure 6

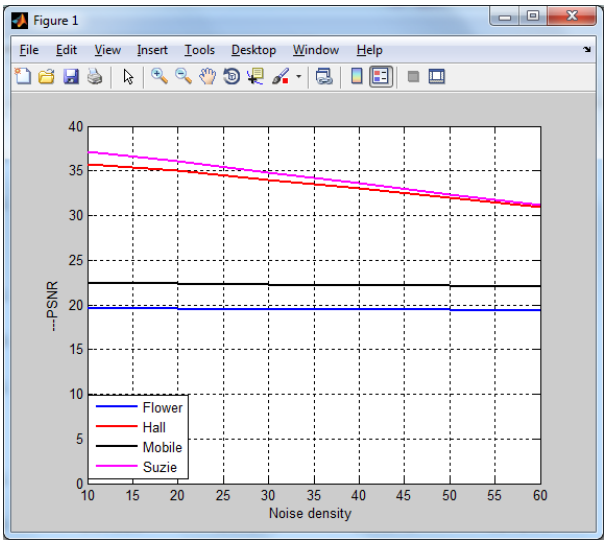

Figure 9 : PSNR analysis for different video sequences

IV. Conclusion

A invisible mode of video watermarking with pre coding and spreading sequences is proposed in this paper , the present approach is compared against three spreading sequences and found that when encoded with LDPC gold sequences of spreading leads to the low bit error and also high visual quality of the video sequence. This work can implemented for all the DVB and internet services where the quality of video is of greater demand. This work can be further extended by implementing this methodology with advanced trans forms like contour let and curve lets.

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A Case Study Regarding the WIFI Bluetooth-based Implementation in Smart Narrow Field Communication

By J. Varsha Benarjee, B. Hemanth Kumar & K. Raghava Rao
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Abstract- A Smart Narrow Field Communication (SNFC) deals with the wireless tag system which is developed through devices. Generally, on the internet it is hard to read long contents of the URL Present. On the internet these URL can be converted into QR code and NFC (Near Field Communication). First of all a device which is useful for wireless applications is given a name and considered as a tag. This device is used for recognizing a target content. Both of these are taken into a relation the URL are maintained on our cloud system along with the device name. Not only the device name the system also considers other user contents like gender and age in order to identify the target content. In Smart Narrow Field Communication all common device can be used as a tag. Ex: WIFI router, Bluetooth mouse etc. keywords: WIFI tag, Bluetooth tag mouse, Smart Narrow Field Communication, NFC, QR code.

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keywords: WIFI tag, Bluetooth tag mouse, Smart Narrow Field Communication, NFC, QR code.

I. Introduction

Now-a-days the main important task is for leading a user can see both the printed content on the website with some more additional information. We have identified a new code called "QR code" which is printable and cheap and it is one of the most famous solutions. Another alternative for this purpose is Near Field Communication. One draw back for this type of Communication is both request the user to both parties come to nearer space. On the other hand, the information cannot be transferred to multiple users at the same time. Hence, another method which can transfer information to the multiple users should be proposed and it should be low cost.

Taking all these into account, there is a method called WIFI-based tag system called WIFI-tag is proposed. In WIFI-tag System estimate BSSID and ESSID of WIFI which are access points as a tag. In the same way, WIFI assumes the terminal can scan these information. As we know WIFI access points are widely spreader, there is a advantage as it low cost. In order to maintain the maximum and minimum values of the tag we need to maintain a threshold for the signal which has been received (RSSI). It helps to notice the deployed tags. However, for some positioning systems which are based on WIFI, we don't need to get accurate and correct position but we need to realize a easy and cheap but useful wireless tag system. This type of system in very low in cost, terms.

The drawback of WIFI-tag cannot be used in current IOS, so we extend to deal with Bluetooth, where we develop particular SDK's for two operating systems IOS and Android. Generally IOS cannot connect other than the devices which consists of other softwares. This may be a major problem regarding the transfer of data. Thats the reason why we are using the wifi tag and Bluetooth tag for communication. This method provides us a scope for effective communication.

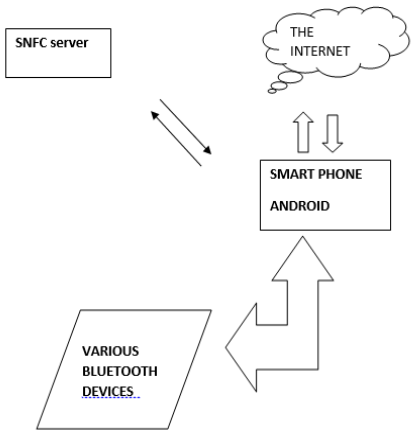

Figure 1 : System architecture of SNFC

points is not allowed to use in current iOS. It results that WIFI Tag works only on Android.

Therefore, we extend WIFI Tag to deal with Bluetooth, and change the name to SNFC. In addition, we develop SDKs (Software Development Kit) for both Android and iOS. This is because we should prepare a library for application developers in order to spread SNFC widely. Furthermore, we develop a content

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registration application for preventing from improper registration by malicious users.

II. System Architecture of SNFC

Figure-1 is the model representation of SNFC, where the components are divided as following 1.SNFC client 2.Tags for SNFC 3.The Internet 4.SNFC server.

SNFC application for the client Processing are installed on smart phones and in various tablets. Now we have previously developed software Development Kit is considered and they can be easily embedded into the required applications by the application developers. As we are dealing with Bluetooth devices, we can use both the Android and IOS where it is used as a client terminal. As in IOS there is still allowance of Bluetooth scan. Some other kinds of Bluetooth devices are wireless headset, wireless mouse. These can be used as tags for SNFC. The relation between the device names and URL are managed by SNFC server. The entry of each section are maintained by the content holders which is done through a special application. The prominent function provided by a SNFC server whether the user context like gender and age in order to decide a proper context. The location of assigned context are meant to be internet. With the help of tag we can assign all the contexts on the internet. At the time of registering we can apply some conditions and the context holder may assign several URL's for the same tag.
the same tag.

III. Working of SNFC

According to the figure-1 gives a sequence of protocol in order to display the contents of the internet which are associated with a specific tag. The radio signals of WIFI and Bluetooth and scanned and SNFC clients. The second step considering the process is all the data that has scanned by client then all the data will be sent to SNFC server and the information of the user is also given to SNFC server. Now taking all this into account, the SNFC server considers and selects the particular URL and replies it back to the client. At the last stage the client can access to the URL which is obtained through the server and contents are obtained in the form of QR code. Before the introduction of SNFC we used NFC (Near Field Communication)in which there is a short range of high frequency signals with wireless communication technology that enables the interchanging and exchange of data between devices about a distance of 10 cm(centimetre or 4inches).the interesting phase of SNFC is it can be used for sharing RDF queries and data with other devices using the android phones. Here we does not need to calculate the distance and number of access points. it is associated with the digital contents not with the location instead we use AP and for AP we use BSSID, ESSID, RSSI

The information is uploaded by WIFI which is scanned and given to the WIFI server where we can get a proper URL as in the form of response. so considering this process the real to virtual connection is realized easily and as an example associating the lab SSID to lab HP, once a visitor comes he can access a lab HP directly, when visitor enters in to the lab. Here we don't require a camera which is required for QR code as well as in this process a special card reader and also touch action also not required .No additional cost is required for this system as we already has existing WIFI system and through experiments the results are verified.

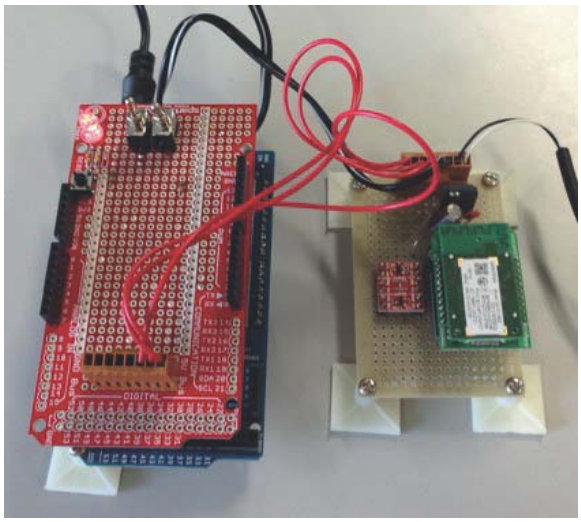

Figure 2 : Our developed WIFI-Bluetooth Tag

IV. Conclusion and Future Work

In our paper we have presented both the advantages of Bluetooth- WIFI tag and implementation of new method of SNFC. Although the previous method of WIFI tag system in which the QR Code system has been enhanced and successfully carried out the URL contents in the internet to the client. There is a disadvantage with this method is that it cannot work with IOS. The problem is resolved by adopting SNFC method which uses both Bluetooth and WIFI as a tag. An SNFC tag based on Arduino network that deals with both the signals. SNFC components include SNFC server, Software Development kits of SNFC for both IOS and ANDROID has been developed. We can see the functioning of WIFI-Bluetooth tag by registering users and transferring the required content of information to the clients.

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MSEP-E: Enhanced Stable Election Protocol with Multihop Communication

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Abstract- In this paper, we have implemented cluster based novel multihop stable election protocol extended (MSEP-E) which does multihop communication between CHs and sensor nodes towards the sink. The sensor nodes and CHs which are nearer to sink send data directly to the sink while the nodes which are farther from the sink send data to its nearest hop towards the sink. Multihop communication is often required when communication range of sensor nodes is limited or number of sensor nodes is very large in the network. Evaluation and comparison reveals that MSEP-E protocol utilizes less power and attain greater network lifetime compared to stable election protocol extended (SEP-E).

Keywords: *Multihop, SEP, SEP-E, MSEP-E.*

GJCST-E Classification : *C.2.5*

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MSEP-E: Enhanced Stable Election Protocol with Multihop Communication

Raju Pal [α] & Ajay K. Sharma [σ]

Abstract- In this paper, we have implemented cluster based novel multihop stable election protocol extended (MSEP-E) which does multihop communication between CHs and sensor nodes towards the sink. The sensor nodes and CHs which are nearer to sink send data directly to the sink while the nodes which are farther from the sink send data to its nearest hop towards the sink. Multihop communication is often required when communication range of sensor nodes is limited or number of sensor nodes is very large in the network. Evaluation and comparison reveals that MSEP-E protocol utilizes less power and attain greater network lifetime compared to stable election protocol extended (SEP-E).

Keywords: Multihop, SEP, SEP-E, MSEP-E

I. Introduction

A wireless sensor network (WSN) in its simplest form can be defined as [1, 2, 3] a network of (possibly low-size and low-complex) devices denoted as nodes that can sense the environment and communicate the information gathered from the monitored field (e.g. an area or volume) through wireless links; the data is forwarded, possibly via multiple hops relaying, to a sink (sometimes denoted as controller or monitor) that can use it locally, or is connected to other networks (e.g. the Internet) through a gateway. The nodes can be stationary or moving. They can be aware of their location or not. They can be homogeneous or heterogeneous.

In cluster based approach, solely some of sensor nodes (CHs) in particular WSN are permitted to transmit sensed data towards the sink. The primary issue is that, this allows sensor nodes to sense and transmit the sensed information (in data packet form) to CHs directly, instead of routing through its neighbor and then all data is aggregated by CHs and sent over to the sink. In clustering, it is evident that the CH nodes will be over-loaded with the long-range communication to sink. Since energy dissipation during communication is proportionate to the square of distance to the sink from sending sensor node, energy of C H nodes exhausts drastically and hence the lifetime of the network get significantly reduced. One solution to this is to rotate the role of a CH among over all the sensor nodes as proposed in low-energy adaptive clustering hierarchy (LEACH) [4], power-efficient gathering in sensor information systems (PEGASIS) [5], and hybrid energy efficient distributed clustering (HEED) [6]. However, these protocols have shown poor performance in heterogeneous environment because the low-energy nodes will die more quickly than the high-energy ones. In [7], G. maragdakis, I. matta and A. bestavros proposed stable election protocol (SEP) in which every sensor node in a heterogeneous two-level hierarchical network independently elects itself as a cluster head based on its initial energy relative to that of other nodes. In [8], F. A. Aderohunmu, J. D. Deng have proposed enhanced stable election protocol (SEP-E) which introduce three level heterogeneity in SEP. Similarly, many authors have proposed new clustered routing schemes to address the issues of heterogeneity [9, 10, and 11].

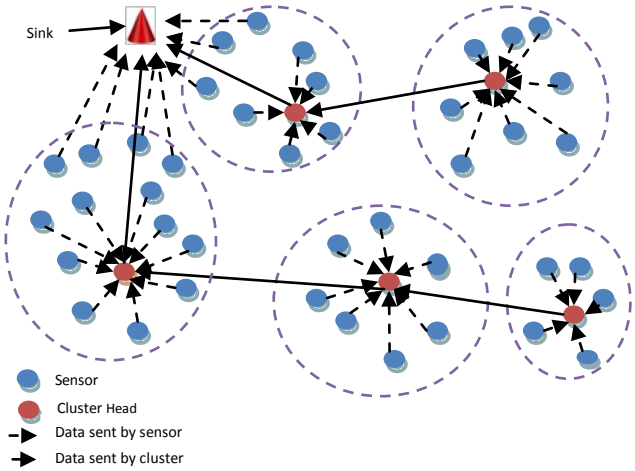

Figure 1 : Proposed multihop network

In this paper, we have further extended the SEP-E by using multihop communication between the sensor nodes. The nodes which are nearer to the sink send data directly to it rather than sending data to the CHs to reduce the load on CHs. The CH which is farthest from the sink sends data to the nearest CH towards the sink. Similarly all CHs send their data to the CH which is nearer to it compared to the sink. This communication scenario is depicted in Figure 1.

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The rest of the paper is organized as follows. Section 2 includes a detailed survey of the related research. Section 3 exhibits the detail of the proposed scheme. Simulation results and its discussion are presented in Sections 4 and 5. Finally, Section 6 concludes the paper.

II. Related Works

Clustering is a key technique used to extend the lifetime of a sensor network by reducing energy consumption [12]. Low Energy Adaptive Clustering Hierarchy (LEACH), a clustering based protocol that utilizes randomized rotation of local cluster base station (cluster-heads) to evenly distribute the energy load among the sensors in the network was proposed in [4]. These sensors organize themselves into clusters using a probabilistic approach to randomly elect themselves as heads in an epoch. During the setup phase, when clusters are being created, each node decides whether to become a CH for the current round. This decision is based on a predetermined fraction of nodes and the threshold T(s), which is given by the following equation:

$$(s) = \begin{cases} \frac{p_{opt}}{1-p_{opt} \times (r \bmod (1/p_{opt}))} & if\ s \in G \\ 0 & otherwise \end{cases} \quad (1)$$

Where p_optthe predetermined percentage of CHs and r is is the count of current round. The G is the set of sensor nodes that have not been CHs in the last 1/p_opt rounds. Using this threshold, each node will be a CH at some round within 1/p_opt rounds. After 1/p_opt rounds, all nodes are once again eligible to become CHs. In this way, the energy concentration on CHs is distributed.

However, LEACH protocol is not heterogeneity-aware, in the sense that when there is an energy imbalance between these nodes in the network, the sensors die out faster than they normally should have if they were to maintain their energy uniformly. In real life situation it is difficult for the sensors to maintain their energy uniformly, thus, introducing energy imbalances. LEACH assumes that the energy usage of each node with respect to the overall energy of the system or network is homogeneous. Conventional protocols such as Minimum Transmission Energy (MTE) and Direct Transmission (DT) [13] do not also assure a balanced and uniformly use of the sensor's respective energies as the network evolves.

Stable Election Protocol (SEP), was proposed in [7], a heterogeneous aware protocol, based on weighted election probabilities of each node to become cluster head according to their respective energy. This approach ensures that the cluster head election is randomly selected and distributed based on the fraction of energy of each node assuring a uniform use of the nodes energy. In the SEP, two types of nodes (two tier in-clustering) and two level hierarchies were considered. Enhanced stable election protocol (SEP-E), was proposed in [8]. Using a heterogeneous three-tier node setting in a clustering algorithmic approach, nodes elect themselves as cluster heads based on their energy levels, retaining more uniformly distributed energy among sensor nodes.

In clustered WSNs, two typical methods are used to aggregate data. In the first method data is aggregated after it has been collected from all member nodes before the inter-cluster communication occurs and in the second method data is aggregated over each passing hop [14, 15]. In [15, 16], the authors have presented multihop routing algorithm for inter-cluster communication. This algorithm is based on multi-hop routing, which works on the principle of divide and conquer, and performs well in terms of load balance and energy efficiently as compared to LEACH.

In [17], the authors have studied LEACH scheme and proposed two new schemes (i.e., energy-LEACH and multihop LEACH). Energy-LEACH improves the CH selection method and Multihop LEACH (M-LEACH) [18] improves the communication mode from single-hop to Multihop between CH and BS. Both the schemes have better performance than LEACH scheme. In this paper we enhance the SEP-E proposed in [8], by introducing multihop communication to prolong the network lifetime and stability of the network.

III. Radio Energy and Network Model

a) Radio energy model

Radio Energy Model used is based on [4, 19]. Energy model for the radio hardware energy dissipation where the transmitter dissipates energy to run the radio electronics and the power amplifier, and the receiver dissipates energy to run the radio electronics. Here both the free space (d2 power loss) and the multipath fading (d4 power loss) channel models have been used, depending on the distance between the transmitter and receiver. Power control can be used to invert this loss by appropriately setting the power amplifier—if the distance is less than a threshold do, the free space model is used; otherwise, the multipath model is used. Thus, to transmit an l-bit message a distance, the radio expends

$$E_{Tx}(l,d) = \begin{cases} l.E_{elec}^{Tx} + l.\varepsilon_{amp}\ .d^n & if\ d < do \\ l.E_{elec}^{Tx} + l.\varepsilon_{amp}\ .d^n & if\ d \geq do \end{cases} \quad (2)$$

And to receive an *l*-bit message, radio expands

$$E_{Rx}(l,d) = l.E_{elec}^{Rx} \quad (3)$$

Where *l* is the length of the transmitted/received message in bits, *d* represents the distance over which

the data is communicated and d_o is the distance threshold for swapping amplification models, which can be calculated as $d_o = \sqrt{\varepsilon_{fs}/\varepsilon_{mp}}$ As it can be seen, the transmitter expends energy to run the radio electronics and power amplifier, while the receiver only expends energy to run the radio electronics. We consider both free space (n = 2, ε_{amp} =ε_{fs}) and two-ray multipath (n = 4, ε_{amp} =ε_{mp}) models to approximate signal attenuation as a function of the distance between transmitters and receivers.

b) Network Model

Our network model is composed of three types of nodes deployed uniformly in a square region, including normal nodes, advanced nodes, and a few super nodes (Figure 2). The selection probability of each node to become a CH is weighted by the initial energy of a node relative to that of the normal node in the network. We assume each sensor node transmits sensing data to the BS through a selected CH by using multihop communication approach. All the CHs are selected periodically by different weighted probability. If CH is farther from the sink it sends the data to another CH which is nearer to the sink. Similarly each member node sends data directly to sink if they are nearer to the sink compared to its associated CH.

Assumptions:

- All the sensor nodes uniformly dispersed within a square field
- All sensor nodes and sink are stationary after the deployment.
- Multihop communication towards sink.
- A WSN consists of heterogeneous nodes in terms of node energy.
- All the sensor nodes are of equal significance.
- CHs perform data aggregation.
- The sink has enough energy in comparison with the other nodes in the network.

IV. MSEP-E

In this section we proposed an extension of enhanced stable election protocol by introducing multihop communication between the nodes. When we consider a general sensor network that may be deployed over a large region, the energy spent in the power amplifier related to distance may dominate to such an extent that using multi-hop mode may be more energy efficient than single-hop mode.

a) Setup phase

i. *CH selection mechanism*

Let us assume the case where a percentage of the population of sensor nodes is equipped with more energy resources than the normal sensor nodes in the network. Suppose E_o is the initial energy of each normal node. The energy of each advance node is then $E_o(1+\beta)$and each super node is then $E_o(1+\alpha)$. The total initial energy of the new heterogeneous network setting is$n * E_o(1 + m * \alpha + m_o * \beta))$ [8].

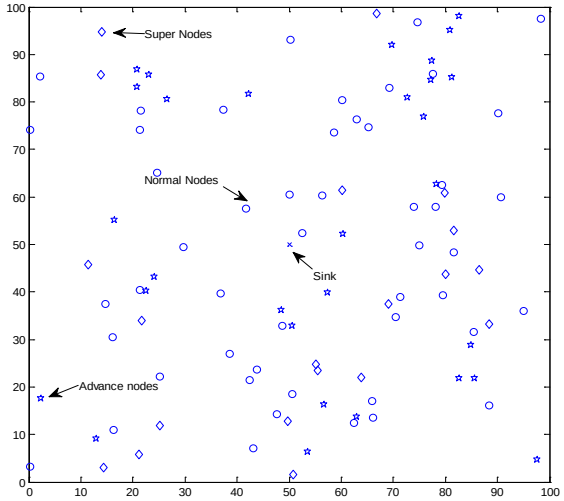

Figure 2 : Heterogeneous WSN model

Where n is the number of nodes, m is the proportion of advanced nodes to the total number of nodes n with energy more than the rest of the nodes and mo is the proportion of super nodes. So, the total energy of the system is increased by a factor of$1 + m * \alpha + m_o * \beta)$.

Our probability setting p_nrm, p_adv and p_sup and the threshold T(nrm), T(sup), $T(adv)$ for normal, advanced and super nodes respectively remains the same as in [8]. The cluster head have been selected based on the threshold value.

Once the nodes have elected themselves to be cluster heads they broadcast an advertisement message (ADV). Each non cluster-head node decides its cluster for this round by choosing the cluster head that requires minimum communication energy, based on the received signal strength of the advertisement from each cluster head. After each node decides to which cluster it belongs, it informs the cluster head by transmitting a join request message (Join-REQ) back to the cluster head. After receiving all the messages from the nodes that would like to be included into the cluster and based on the number of nodes in the cluster, the cluster head creates and announces a TDMA schedule, assigning each node a time slot when it can transmit. Each cluster communicates using different CSMA codes to reduce interference from nodes belonging to other clusters.

b) Steady phase

i. *Multihop communication mechanism*

Once the clusters are formed, each member node sends data messages in its time slot at the idle

state of a frame. In order to avoid collisions during communication, a kind of CSMA model is set up. Instead of transmitting the processed data to the CH directly, every node decides whether to choose another node as the next hop or not based on above pseudo code. Similarly, each CH decides whether to transmit the data to the BS directly or to send them to the next hop. When a CH has data to send to the BS (i.e., at the end of its frame), it must sense the channel to see if anyone else is transmitting data, if so, the CH waits to transmit the data.

The pseudo code for our multihop communication scheme described as follows:

```
// non-CH nodes communication (Association to the CH)
For i=1:1:n
If sensor_node_i.type='normal' and Energy(sensor_node)>0
        If cluster_number>=1
// calculate the distance of sensor_node_i to the sink as distance1
        For c=1:cluster_number
// find out which is nearer to the node i CH or sink
Temp=min(distance1,distance_from_cluster_C);
        If (Temp<distance1)
        distance1=Temp;
        cluster=c;
        Endif
        Endfor
// Energy dissipated by sensor_node_i to send data at distance1
// if data sent to cluster c then energy dissipated by cluster c
    Packet_to_CH=n-dead-cluster_number;
    Endif
    Endif
Endfor

// CH nodes communication
For c= 1:cluster_number
Dist_to_sink_C=distance of CH c from the sink;
    For i=1:cluster_number
Dist_from_CHs=distance of CH c from other CHs;
Temp1=minimum(Dist_to_sink_C, Dist_from_CHs);
    If (Temp1< Dist_to_sink_C)
    Dist_to_sink_C=Temp1
    // CH c is nearer then sink at Dist_to_sink_C;
    Endif
    Endfor
// Energy disspated by CH c in sending data at distance Dist_to_sink_C;
// if CH directly send data to sink then
Packets_to_BS= Packets_to_BS+1;
Endfor
```

When the sensor nodes are deployed in regions of dense vegetation or uneven terrain, it may be beneficial to use multi-hop communication among the nodes in the cluster to reach the cluster head. As it is possible for nodes to remain disconnected from the network due to a cluster head not being in range, each node is able to request another connected node to become a cluster head. This occurs after a timeout period and is done through a normal advertisement message.

V. Performance Matrices

The following matrices are used to evaluate the performance of MSEP-E and SEP-E in different network scenarios.

a) Network lifetime

Network lifetime strongly depends on the lifetimes of single nodes that constitute the WSNs. The lifetime of the network basically depends on two major factors: (i) how much energy it consumes over rounds and (ii) how much energy is available for its use *(Total Residual Energy*). The definition of the network lifetime is determined by the kind of service it provides. In many cases, it is necessary that all the sensor nodes stay alive as long as possible. Since the network performance decreases as soon as a single node dies. In this scenario, it is important to know when the first node dies (FND). Furthermore, sensor nodes can be placed in proximity to each other. Therefore, adjacent nodes could record the same or identical data in the network. Hence, the death of a single or few nodes does not affect the performance of the network. In this case, the metric half node dies (HND) denotes an estimated value for the half life period of a network. Finally, the metric last node dies (LND) defines network lifetime as the time until all nodes have been drained of their battery energy. This metric is very rarely used in clustering algorithms. Since more than one node is necessary to perform the clustering technique. Hence, in this paper, we use two metrics (i.e., FND and HND) for the evaluation of different algorithms Stability: This is the time interval when the first node of the network dies.

b) Throughput

We measure the total rate of data sent over the network, the rate of data sent from cluster heads to the sink as well as the rate of data sent from the nodes to their cluster heads.

VI. Simulation Results and Discussion

In this section, we evaluate the performance of MSEP-E via MATLAB simulations. We compare it with SEP-E in the same heterogeneous setting, where the extra initial energy of advanced nodes and super nodes is uniformly distributed over the sensor field. We use $100m \times 100m$ region of 100 sensor nodes (Figure 2). We

denote a normal node with "o", an advanced node with "*", a super node with◊", and the BS with "×". The simulation parameters are mentioned in Table 1.

Table 1 : Simulation parameters

Description	Parameters	Value
Network Size	M×M	100×100 m^2
Location of Sink	BS	(50,50)
Number of Nodes	n	100
Initial Energy of Nodes	E_o	0.1 J
Proportion of advanced nodes	m	0.2
Proportion of super nodes among advanced nodes	m_0	0.3
Energy factor for super nodes	α	2
Energy factor for advanced nodes	β	1
Energy dissipated per bit	E_{elec}	50 nJ/bit
Transmit amplifier if dBS ≤ $d0$	E_{fs}	10 pJ/bit/m^2
Transmit amplifier if dBS ≥ $d0$	E_{mp}	0.0013 pJ/bit/m^4
Data aggregation energy by CH	E_{DA}	5 nJ/bit/message
Size of Data Packet		4000 bits

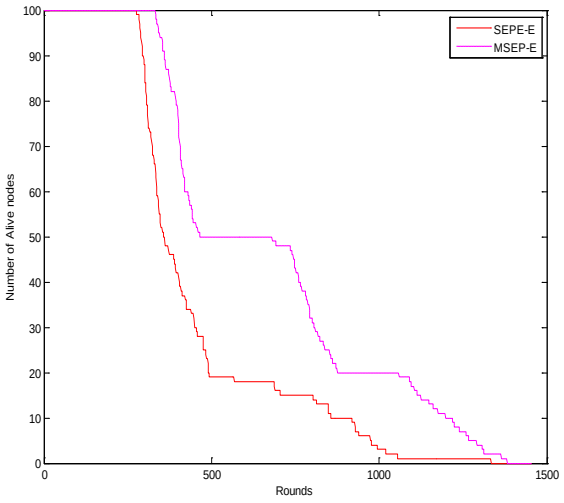

Figure 3 : Number of Alive nodes per round

fter a node drain its energy it dies, and it cannot communicate with other nodes any more. We run the simulation on above setting and found that MSEP-E outperforms the existing SEP-E protocol. Figure 3 clearly indicate that MSEP-E prolong the lifetime of the network. Since SEP-E adopts single-hop communication for both non-CH and CH communication, it shows poor performance in large network areas because all the sensor nodes have to consume more battery energy to perform the long haul communication whereas MSEP-E adopts multi-hop communication, hence consumption of battery energy is less.

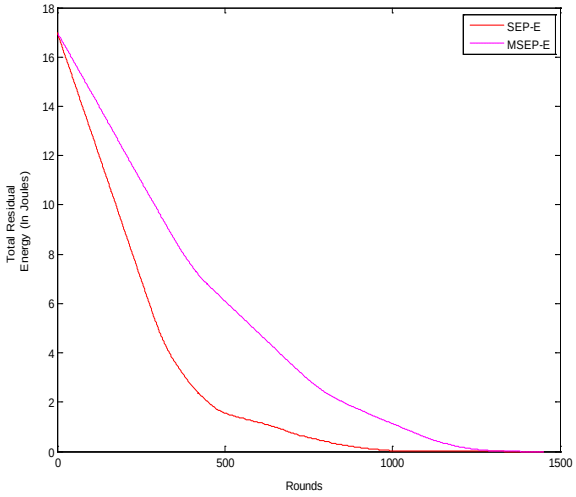

Figure 4 : Total Residual Energy per round

Table 2 : comparison of residual energy

Rounds	Total Energy (in joules)	
	MSEP-E	SEP-E
1	17	17
200	12.1954	9.0296
500	6.1238	1.5638
700	3.5419	0.7657
1000	1.1374	0.0316
1200	0.1908	0.0061

The comparison of total residual energy on different rounds is shown in Table 2 and Figure 4 demonstrates the overall increase in total residual energy per round. Initially all nodes have 0.1 joule (J) of energy and total energy of the network is 17 J. After 200 rounds total residual energy of the network will be 12.7954 J and 9.0296 J for MSEP-E and SEP-E respectively. This indicate that SEP-E consume more energy approx 8 J then MSEP-E (approx 5J) after 200 rounds. Similarly, Table 2 depicts the residual energy of both protocols after 500, 1000 and 1200 rounds. Hence, the energy consumption is very less when we use multihop communication.

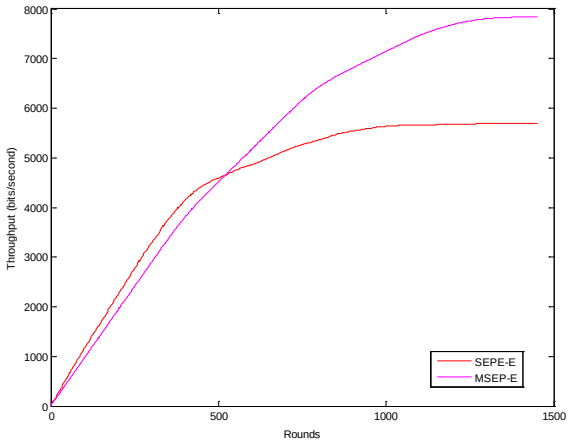

Figure 5 : Throughput of the network

Figure 5 illustrates the throughput of the network. The amount of data messages received at the sink will increase over number of rounds as compared with SEP-E since the lifetime of the network increased and we have more number of alive nodes. Hence the throughput of MSEP-E is increased by 3.5%.

Table 3 : Comparison of dead nodes

% Nodes	Number of rounds	
	SEP-E	MSEP-E
1%	277	333
25%	311	401
50%	360	680
100%	1335	1383

Table 3 and Figure 6 shows that stability of the network is increased by 20%. In SEP-E first node died (FND) at 277th round while in MSEP-E first node died at 333th round.

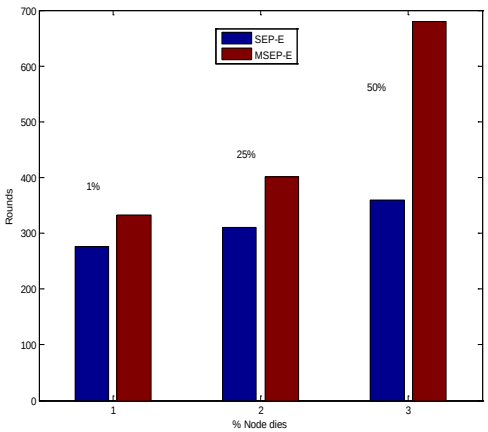

Figure 6 : Comparison of % node dies

The half life of the network also increased by 88%. The 50% of the nodes died (HND) at 360th round and 680th round for SEP-E and MSEP-E respectively. The last node of the network (LND) died at 1135th round and 1383th round for SEP-E and MSEP-E respectively. This shows that overall performance and lifetime of the network significantly increased in the case of MSEP-E.

VII. Conclusion

It has thus, been concluded that MSEP-E protocol consumes less energy as it uses energy minimizing techniques like multihop communication, clustering and data aggregation. The multi-hop communication approach is adopted for both non cluster head and cluster head nodes communication towards the sink. Simulation results indicate that MSEP-E can greatly balance energy consumption of an entire network and thus extends the network lifetime and stability of WSN. MSEP-E can be considered for applications such as health monitoring where energy utilization is critical.

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Energy Proficient and Security Protocol for WSN: AODV

By Devendra Kumar & Rajesh Sharma
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Abstract- Wireless sensor network is extensively used technology now a day in real time application. It consists of a number of autonomous sensor nodes which are organized in various areas of interest to accumulate data and jointly convey that data back to a base station. But the sensor node has limited battery energy and it is also found that the WSN more vulnerable to severe kinds of security threats such as denial of service (DOS), Sybil, hello flood attack etc. In this, we proposed group communication using election algorithm to make the network most energy efficient and also make the network secure. The simulation of the proposed methodology is done between different network parameter such as PDR, end-to-end delay, throughput and energy consumption using the network simulator NS-2.34.

Keywords: *battery, PDR, security, threats, throughput, wireless sensor network.*

GJCST-E Classification : *C.2.5*

Strictly as per the compliance and regulations of:

Energy Proficient and Security Protocol for WSN: AODV

Devendra Kumar [α] & Rajesh Sharma [σ]

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I. Introduction

Wireless sensor network (WSN) is extensively used technologies of the innovative area. The sensing electronics extents the ambient conditions associated to the environment nearby the sensors and renovate them in to an electrical signal. In various applications, the distribution of sensor nodes is performed in an ad-hoc manner without cautious planning and engineering. In the last few years, rigorous exploration studies addressing the prospective of association among sensors in data gathering and handling and in the coordination and administration of the sensing accomplishments were conducted. Nonetheless, the sensor nodes are self-conscious in energy supply and bandwidth. Energy conservation is serious in WSNs. Replacing or recharging the batteries is not an option for the sensors deployed in hostile environments. Usually, the communication electronics in the sensor use most of the energy. Immovability is one of the major anxieties accompanying with the progression of WSNs [1]. A number of WSN applications necessitate definite sensing, coverage, and connectivity all over its operating time duration. The death of the first node might cause unpredictability in the network. Consequently, all of the sensor nodes in the network must be active in order to accomplish the goal during that period. One of the main obstacles to confirm these marvels is the unbalanced energy in gestion rate. Numerous techniques have been proposed to decrease the energy consumption rate, likewise clustering, proficient routing, and data accumulation.

In a classic WSN application, sensor nodes are distributed in a province from where they collect data to accomplish definite goals. Data assortment may be an unbroken, intermittent, or event-based process. The WSN must be very steady in some of its applications such as security monitoring and motion tracking. The death of only one sensor node may agitate the coverage or connectivity and hence may weaken the immovability in this type of applications. Therefore, all of the organized sensor nodes in the WSN must be vigorous during their operational lifetime. Nevertheless, the sensor nodes are usually equipped with one-time batteries and most of the batteries are of low-energy type. Due to this intended, each sensor node must proficiently use its available energy in order to get better the lifetime of the WSN. Different techniques are used for the resourceful handling of this low obtainable energy in a sensor node. Group communication and election algorithm is one of the well known techniques.

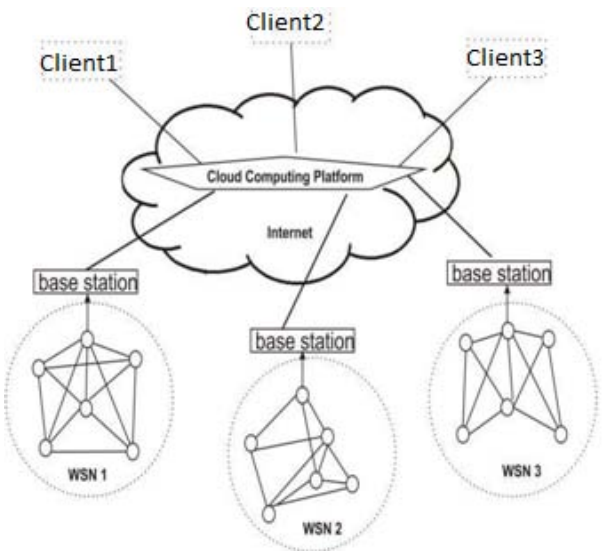

Figure 1 : Wireless Sensor Networks

In Section II discuss related work for decreasing the energy consumption. The Section III discusses about the different routing techniques. Section IV describes the proposed methodology and last section presents conclusion the paper.

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II. Related Work

Several techniques has been proposed or implemented to enhance the network lifetime and to form a secure network. In this section we discuss different methods proposed and implemented by various researchers in field of energy consumption and related to security threats over the network. *Luigi Coppolino et al [2]* proposed a hybrid, lightweight, distributed Intrusion Detection System (IDS) for wireless sensor networks. This IDS uses both misuse-based and anomaly-based detection techniques. It is composed of a Central Agent, which performs highly accurate intrusion detection by using data mining techniques, and a number of Local Agents running lighter anomaly-based detection techniques on the motes. Decision trees have been adopted as classification algorithm in the detection process of the Central Agent and their behaviour has been analysed in selected attacks scenarios. The accuracy of the proposed IDS has been measured and validated through an extensive experimental campaign. *K. Parameswari et al [3]* proposed to develop an energy efficient secured data aggregation protocol for wireless sensor networks, which will alleviate the node misbehavior in thewireless sensor networks. The protocol involves mechanism for energy efficient aggregator selection. Mechanism for efficient node selection for reducing the network lifetime and the delay. Source node authentication by the sink. Aggregate or authentication as per listed in the packet header, by the sink. This protocol can be constructed on top of the preexisting key distribution and encryption schemes in the wireless sensor networks. *Roshan Zameer et al [4]* proposed a mechanism to provide security with a reactive security scheme that includes studying the behavioral aspect of attacks and congregating the security demands. This method in sequence conglomerates the security and the network rescue mechanism free from attacks and their impacts on the network. The simulation results such as Packet Delivery Ratio (PDR), malicious node movement, delay; transmission power illustrates various attack behaviors in WSN along with the reception power rate observed by the sink node and the Packet loss. *Sudharsan Omprakash [5]* proposed, a Secured Energy Efficient Clustering and Data Aggregation – [SEECDA] protocol for the diverse WSN, in which the security, energy proficient clustering, data aggregation are pooled to accomplish a best performance in terms of QOS by energy and security measures. The proposed approaches incorporate a security method, and an innovative cluster head election mechanism and the route will be chosen with less energy needed. The simulation result shows that the SEECDA balances the security, energy effectiveness and extends the network life time are high when compared to LEACH, EEHCA and EDGA, EECDA respectively. *Malika BELKADI et al [6]* presented the Secured Directed Diffusion routing protocol and regarding to the different types of transmissions in this protocol, it use three types of keys. These keys are: the individual key of a node u (IKu), which is used to secure communication between a node and the base station, the pair-wise key (Kpair) to secure communication between a node and one of its neighbors and finally the global key (BK), all the nodes in the sensor network share this key with the base station. The base station uses global key to encrypt the interest message and all the nodes in the network uses this key to decrypt the announcements from the base station. The nodes store the interest information in their interest cache and then encrypt the message using the global key to further broadcasting it. The communication cost is reduced by using this key. With the help of these keys they reduce the power consumption of nodes, so the lifetime of the network will be extended. *Babaket al [7]* proposed an algorithm which makes healthier use of energy and bandwidth which are two restrictions in wireless sensor networks. In the algorithm mobile agent is used to cluster the network and also create the tour to attain collected data from each cluster-head and deliver it back to the sink node. With suitable parameters set, simulation shows that the proposed algorithm exhibits better performance than original direct diffusion in terms of energy consumption [8].

Di Tang [9] proposed new secure and efficient cost-aware secure routing protocol to deal with these two conflicting issues through two modifiable parameters: energy balance control (EBC) and probabilistic-based random walking. They determine that the energy consumption is rigorously disproportional to the consistent energy exploitation for the given network topology, which significantly reduces the lifetime of the sensor networks. To resolve this problem, they also proposed well-organized non-uniform energy exploitation strategy to optimize the lifetime and message delivery ratio under the same energy resource and security prerequisite. We also provide a quantitative security analysis on the proposed routing protocol.

III. Overview of Routing Techniques

The efficiency of energy can be improved using some algorithms. That route the data as per network and data communication systems. In this we will some of the energy efficient routing protocols which will be discussed which are LEACH (Low Energy Adaptive Clustering Hierarchy), PEGASIS (Power Efficient Gathering in Sensor Info. Systems) and TEEN (Threshold Sensitive Energy Efficient Sensor Network), HEED (hybrid energy-efficient distributed clustering method for ad hoc sensor networks) etc.

a) LEACH

The function field of sensor network is the environment surveillance and location tracing. In such situation, the end user does not require any frequent data as each node of the data is not associated to each other. The responsibility of LEACH (low energy adaptive clustering hierarchy) is to merge ordinary date by cluster head and sent to sink. For that cause, any frequent data is not sent to the sink [10].

The LEACH postulations are as follows.

i. Every node has adequate energy to send data to the sink and can manage transmission energy.
ii. Every node has data to send at any time and close nodes have data associated with each other.

The key objective of routing protocol for routing is transferring data from convey node to object node and finding the most appropriate path with exactness. Accordingly, with limited shared resources, energy disbursement needs to be optimized on transmission bandwidth in the network overhead or surrounded by the nodes. For this motive, the sensor network circumvents replica of data among the adjoining sensor nodes by clustering simplify routing and energy expenditure can be supervised proficiently.

b) *PEGASIS*

The power-efficient gathering in sensor information systems [11] is a voracious chain-based power efficient algorithm. In addition, PEGASIS is based on LEACH. The key characteristics of PEGASIS are:

- The Base Station is preset at long distances from the sensor nodes.
- The sensor nodes are identical and energy constrained with consistent energy.
- No mobility of sensor nodes.

PEGASIS is based on two ideas that are chaining and data fusion. In PEGASIS every node can take twirl of being a leader of the chain where the chain can be created using greedy algorithms that are organized by the sensor nodes. PEGASIS presupposes that sensor nodes have a global understanding of the network nodes are motionless (no alliance of sensor nodes) and nodes have locality of information about all other nodes. PEGASIS performs data fusion excluding the end nodes in the chain. PEGASIS better than LEACH by removing the transparency of cluster formation decreases the sum of distances that non leader node have to broadcast less the number of transmissions and receives all nodes and use only one transmission to the BS per round. PEGASIS has the identical problems that LEACH suffers from. Also the PEGASIS does not extent, cannot be useful to sensor network where comprehensive knowledge of the network is not simple to obtain. Power efficient gathering in sensor information systems (PEGASIS) is an enhancement of the LEACH protocol. Rather than designing several clusters it makes chains of sensor nodes so that each and every node transmits and receives from a neighbourhood and only one node is selected from that chain to transmit to the base station. Collected data transfer from node to node, amassed and eventually sent to the base station.

c) HEED

A hybrid energy-efficient distributed clustering methodology for an ad hoc sensor networks has a complement the insufficiency of the cluster head election algorithm in LEACH. HEED has the following features [10].

i. Sensor nodes are the analogous type of nodes and consume energy.
ii. Sensor nodes have no mobility.
iii. Sensor nodes do not have their individual location information.

d) TEEN

Threshold sensitive energy efficient sensor network protocol is used for precipitous changes in the sensed attributes in the network. It uses a data centric mechanism and makes clusters in a hierarchical manner. Two threshold values are transmits to the nodes: hard threshold and soft threshold. The hard threshold is the least promising value of an attribute. Sensor nodes mail data to the cluster head only if they found the sensed value is higher than the hard threshold.

If sensor nodes found that the sensed value is less than the feature value of threshold than they do not send the data to the cluster head. Due to this way only relative data is send by the sensor nodes. In addition, when sensor node again sense value greater than the hard threshold value than they check the difference between current and earlier value with soft threshold. If the dissimilarity is again greater than the soft threshold than the sensor nodes will send recent sensed data to the cluster head. This process will remove encumber from the cluster head [12].

IV. Proposed Methodology

The energy efficiency of cooperative communication has recently been investigated in [13] and [14]. The authors of [13] investigated the energy issues in a clustered sensor network, where sensors collaborate on signal transmission and/or reception in a deterministic way. It is shown that, if the long haul transmission distance (between clusters) is large enough, cooperative communications can dramatically reduce the total energy consumption still when all the association overhead is considered. Based on [13], the authors in [14] combine the cooperative communication scheme with a cross-layer design framework for multi-hop clustered sensor networks. The system is optimized to improve the overall energy efficiency and to reduce the network delay.

Cooperative communication for clustered sensor networks has also been investigated in [15]. In [16], the authors analyze distributed space-time block coding (STBC)-based cooperative communication for multitier clustered wireless sensor networks. Based on their analysis on the SER and throughput performance, the authors show that cooperative communication is more energy efficient than direct communication. However, the number of cooperative nodes in each cluster is fixed, and the inherent circuit energy consumption of wireless transceivers is ignored, which has recently been reported to be important for low-power wireless sensor networks. In this paper we uses group communication and election algorithm to make the network energy efficient and form secure network for data transmission.

An Election algorithm is a particular principle algorithm, which is run for selecting the coordinator procedure among N number of procedures. These coordinator or leader process plays a significant role in the distributed system to sustain the consistency through synchronization. For example, in a system of client server mutual exclusion algorithm is preserved by the server process Ps, which is chosen from among the processes Pi where i=1, 2... N that is the group of processes which would use the crucial region. Election Algorithm is essential in these circumstances to prefer the server process among the existing process. Eventually all the processes must agree upon the leader process. If the coordinator process fails due to diverse reasons then instantly the election should happen to choose a new leader process to take up the job of the failed leader. Whichever process can instigate the election algorithm whenever it encounters that the failure of leader process. There can be situations that all N processes could call N synchronized elections. In anytime, process Pi is one amongst the following two states, when the election happens: Participant refers to the process is directly or indirectly involved in election algorithm, nonparticipant refers to the process in not engaged with the election algorithm currently. The goal of Election Algorithm is to choose and declare one and only process as the leader even if all processes participate in the election and at the end of the election, every process should agree upon the new leader process without any mystification. With no loss of simplification, the elected process should be the process with the largest process identifier. This may be any number demonstrating the order /birth/ priority/ energy of the process. All the process has a changeable called LEAD, which contains the process id of the current leader. When the process participates in the election, it sets this lead to NULL.

Any Election Algorithm should assure the following two belongings [9].

1. *Safety:* Any process P, has LEAD = NULL if it is participating in the election, or its LEAD =P, where P is the highest PID and it is alive at present.
2. *Likeness:* All the processes should agree on the chosen leader P after the election. That is, LEAD = PID Pi where i=1, 2,...,N.

Energy Conservation and group communication using election/bully algorithm

Step 1 : Set Mobile Node
M = {MN_1, MN_2…….. MN_{i-2}, MN_{i-1}, MN_i, MN_{i+1}, MN_{i+2}, MN_{i+3}, MN_{i+4}…….. MN_n} //Set of mobile Node's

Step 2 : Set initial energy for each nodes
E = {en_1, en_2, ---------, eni_{-2}, en_{i-1}, en_i, en_{i+1}, en_{i+2}, en_{i+3}, en_{i+4}---------- e_n} // each node energy initialize here

Step 3 : Select random node
MN_i ϵ N for election message generation

Step 4 : Measure Speed, Where
$Speed_i$ = Dist / (t_2-t_1) // t^1 initial time, t^2 Broadcast Time, ^{D} distance travel

Step 5 : Broadcast Elected message
Elct-msg(en_i, MN_i, $Speed_i$) // eni energy of i^{th} node, $Speed_i$ is speed of i^{th} node
THEN
IF (radio-range<=550 && neighbour == True) THEN
{
Record time at t_n; // t_n time in second's
Get neighbour MN_{i-1}, MN_{i-2}, MN_{i+1}, MN_{i+2}
Get info MN[j][en_j][$Speed_j$] // j pointer not equal I, j node number, en_j energy , $speed_j$ speed of node
}
Now Compare
IF (MN[en_i] < MN[en_j] && MN[$speed_i$]> MN[$speed_j$]) THEN
{
MN_j eliminate from competition
Set new MN_i = MN_j ;
New MN_i will generate election msg; THEN
Go to step 5:
}
Else
{
MN_i, will act as a coordinator;
}
Else
{
Says ack as: Out of range;
}

After Group Formation how to sends data to group
//Manage and broadcast group message through coordinator under MANET
Set mobile node = M; // mobile node

Set group coordinator = MN_i; // MN_i € M, MN_i select on the bases of energy and speed
Send group_join msg (M_n , MN_i, No) // group join message
{
IF (range <=550 && MN_i == "true") THEN
{
Join group member's = {M1, M2…..M_n} // M_n € MN_i, if M_n is in radio range zone
}
Else
{
Says ack as: Out of range
}
}
Set sender node = S;
Set routing protocol = AODV; //Routing Protocol
PDRu,v =0.0;
Broadcast _RREQ(S, MN_i, rr)
{
IF (rr <= 550 && neighbour >= 1) THEN
{
Forward RREQ and create Rtable and
IF (MN_i =="true") THEN
{
Accept route packets and send group information
}
S = sends actual data to MN_i node; group-msg (S,M_n, type); //call function
}
}
Else
{
Node out of range or unreachable;
}
$PDR_{u,v}$ = PDR_u∩PDR_i∩--------PDR_j ∩ PDR_v //check pdr
If ($PDR_{u,v}$ <5)
Node has been less/discharged energy, then stop to send packet to them
Else
Communication starts, then sends packets to them
Group-msg(S, Mn, type) // type contain packet info
{
Search Mn nodes in radio range;
Broadcast actual data to all group members Mn;
}

V. Experimental Results

We have discussed an improved algorithm in previous section and it is compared with previous algorithm. The implementation of an algorithm is done in well known network simulator NS-2.34 [17]. The simulation environment is setup to simulate the algorithm in which we take an area of 900x900 to transmit the packet CBR/TCP protocol AODV is used and the node consist the energy 0.45 joule for the simulation time 400s. In this work, mainly focuses for providing better security by consuming less energy. The comparison of above is done using different parameter such packet delivery ratio, throughput, routing load, delay etc.

a) Measuring Parameter

The performance of the WSN can be measured by using different parameter such as Throughput, Packet delivery ratio, end to end delay, routing load [18].

b) Throughput

It is the average rate of successful message delivery over a communication channel.

$$Throughput \leq \frac{RWIN}{RTT}$$

c) Acket Delivery Ratio

Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources.
Mathematically, it can be defined as

PDR= S1÷ S2

d) End To End Delay

The average time it takes a data packet to reach the destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue. This metric is calculated by subtracting time at which first packet was transmitted by source from time at which first data packet arrived to destination.
Mathematically, it can be defined as:

Avg. EED=S/N

Table 1 : Simulation environment

Simulator	NS-2.34
Area	900x900
Nodes	30
Packet	CBR/TCP
Speed	0.45/packet
Initial Energy	.75 joule
Simulation Time	400
Protocol	AODV

e) Scenario Setup

Table 1 shows the simulation setup of our proposed algorithm. In this Scenario setup there are 30 mobile nodes placed defined with trajectory with 900m × 900m area. The simulation time was taken 400 sec. Here the locations of nodes are random with a speed of 0.45/packet.

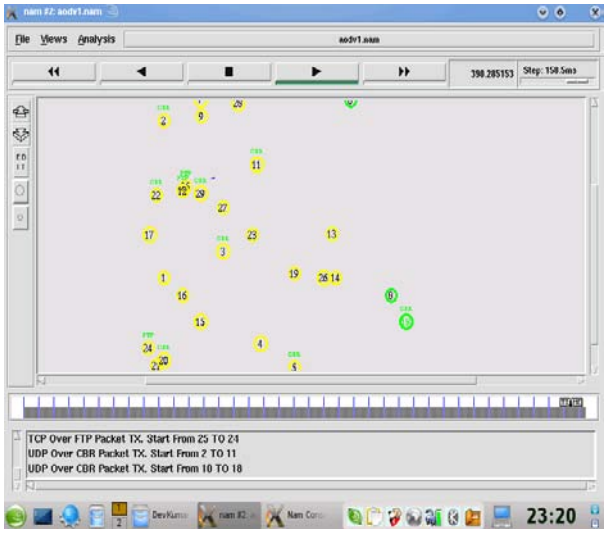

Figure 2 : A Snapshot of scenario setup for energy efficient Routing

In general, packet delivery ratio decreases as the number of load and network size were increased. The proposed algorithm is compared with the existing method in which our methodology provides greater no of the packet delivery ratio.

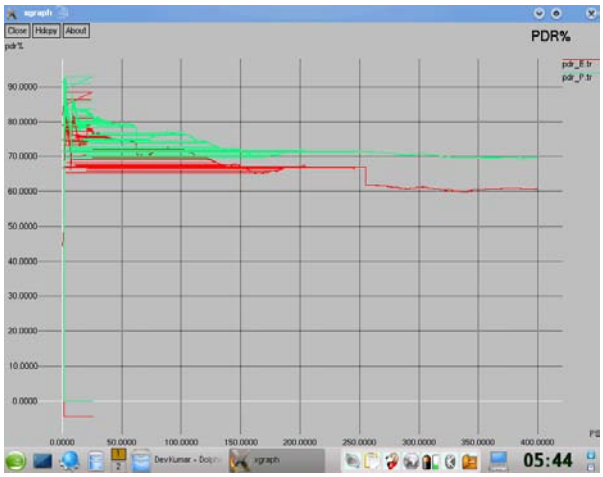

Figure 3 : Comparison of PDR% for existing and proposed methodology

The undesirable increase in End-to-End delay could be observed in Fig.4 as compared when the network size increases. In our work, the end to end delay is calculated increase in network size with respect to simulation time. The simulation result of proposed work decreases the delay comparing with the existing methodology.

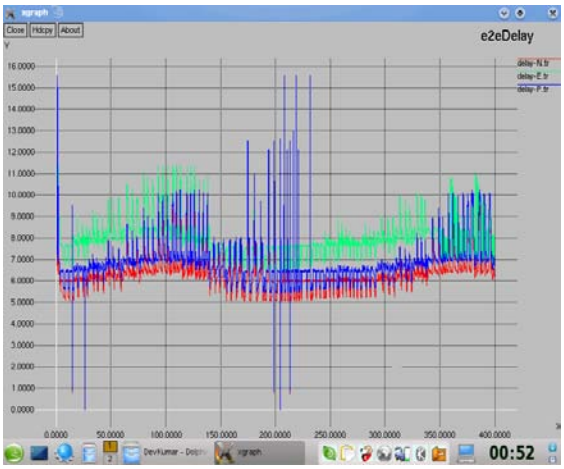

Figure 4 : Comparison of End to End Delay with existing and proposed methodology

The average energy consumption is compared with the existing and our methodology in which energy consumption is very less than the existing methodology as shown below in fig. 5

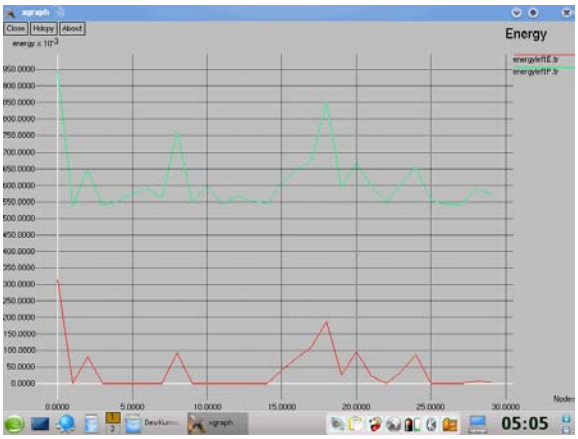

Figure 5 : Comparison of energy in joule Vs no. of nodes with existing and proposed methodology

In figure 6, throughput is calculated between the network size and simulation time, throughput is the average no of delivery of packets in the given time period. After simulating the methodology it proves that our approach gives better throughput than the existing ones.

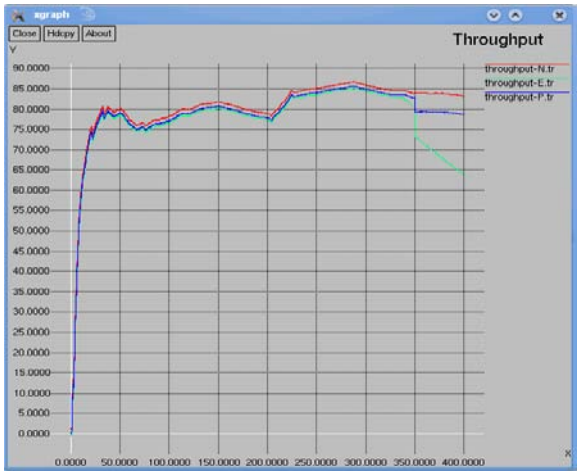

Figure 6 : Comparison of Throughput with existing and proposed methodology

VI. Conclusion

The basic requirement for the communication, secure and energy efficient network is the primary requirement which can be influence by different malicious node while the sensor node has limited energy to transmit the packets. In this paper we proposed group communication method using election/bully algorithm to lessen the consumption ratio of nodes energy. The comparison of proposed algorithm is done with the existing methodology and the simulation result proves that our method is more efficient.

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Policy-based Management of a Secure Dynamic and Multipoint Virtual Private Network

By Ayoub Bahnasse & Najib EL Kamoun
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Abstract- Although IP VPN technology has recently been imposed because of its cost effectiveness and that several research studies have been proposed for centralized policy management of intra / inter VPN domain, most solutions are only addressed to VPN site-to-site technology, according to our researches no centralized management model based on a server for dynamic multipoint VPN networks was proposed.

In this paper we propose a model "DMVPN Security Management System"for centralized policy management of dynamic multipoint multi-architectures VPN network, using a new web interface.

We have implemented and tested the model on Single Hub Single Cloud architecture consisting of ten Spokes, the time required for an expert on VPN networks for manual set up of this architecture is an hour, we moved that to five minutes with our model, in addition to time effectiveness the margin error is null.

Keywords: *VPN, multipoint, DMVPN, cloud, policy-based, WEB-BASED, HUB, SPOKE.*

GJCST-E Classification : *C.2.1 C.2.2*

Strictly as per the compliance and regulations of:

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I. Introduction

Through VPN technology, companies can communicate with each other securely through a public infrastructure with the least cost compared to alternatives such as Frame-Relay, ATM… [1] [2]. Companies steadily increasethe number of branches which poses a problem of scalability,

While reconfiguring all sites is mandatory when a change is made. Dynamic Multipoint VPN stands for DMVPN [3] proposed by Cisco corporation solution, offer scalability through its HUB and SPOKE architecture, Remote-Branch Offices (SPOKES) are linked to a central hub node called HUB with a permanent tunnel, but are not linked statically between them . These can communicate with each other through temporary tunnels created on demand, thanks to the intervention of the HUB. With this approach the problem of scalability is resolved, in case we add a SPOKE, other equipment previously configured will undergo no further modifications, we however had to configure the added SPOKE to register with the HUB and become a member of the current architecture.

DMVPN is based on technologies such as Resolution Next Hop Protocol (NHRP) and multipoint Generic Routing Encapsulation (MGRE) for the dynamic creation of tunnels, and Internet Protocol Security (IPsec) to ensure security of data exchanges between multiple sites, as well as routing protocols to route data optimally [4] [5], several research works have been conducted to study the impact of routing protocols on dynamic multipoint VPN networks or Non broadcast Multi-Access networks (NBMA) in general [6] [7]. The HUB maintains in its NHRP cache public and tunnel addresses of each SPOKE on the same network, ie the protocol is based on the client-server principle, spokes (NHRP Clients) send periodic NHRP updates containing public and tunnel addresses to the HUB (NHS) of the network, when SPOKE1 wants to communicate with SPOKE2 for example, SPOKE1 consults the NHRP cache of the NHS to determine public IP associated with the IP tunnel of SPOKE2. A GRE interface can maintain multiple IP sec tunnels to both to simplify the configuration and save time of configuration thanks to MGRE protocol. GRE protocol encapsulates various higher layer protocols [8] and carry all traffic types (uni cast, multicast and broadcast), but doesn't provide any authentication mechanism, integrity or confidentiality. IP sec [9] is a suite of protocols Encapsulation Security Payload (ESP) [10] and Authentication Header (AH) [11], the first protocol ensure the integrity, authentication and confidentiality of trade, the second provides data integrity and authentication for data exchange. IP sec operates in two modes, tunnel and transport mode, transport mode does not change the initial header it sits between the network layer and transport of the OSI model, for this mode, NAT can cause a problem of integrity [12], the tunnel mode replaces the original IP and encapsulates the entire packet header.

Centralized VPN policy management is an active area of research to date, several contributions were made to negotiate and create VPN policies between equipment from different areas [13] as well as to manage the control plane of IP sec protocol for multiple VPN [14] and provide a man/machinery interaction using a customized web-based interface, for the management of VPN networks[15] [16]. Previous works deal with the central management of site-to-site VPN policies using Web-based interfaces, our contribution is in relation with the dynamic and multipoint aspect of VPN network for various architectures, it provides a model of centralized policy management and a GUI man/machinery application designed for this type of networks.

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This paper is organized as follows: in section 2 we will discuss the developed model "DMVPN Security Management System" and define its various modules in Section 3, we will detail the operation of the model, Section 4 will be reserved for a demonstration and tour on the application implemented, and we will conclude in section 5.

II. DMVPN Security Management System

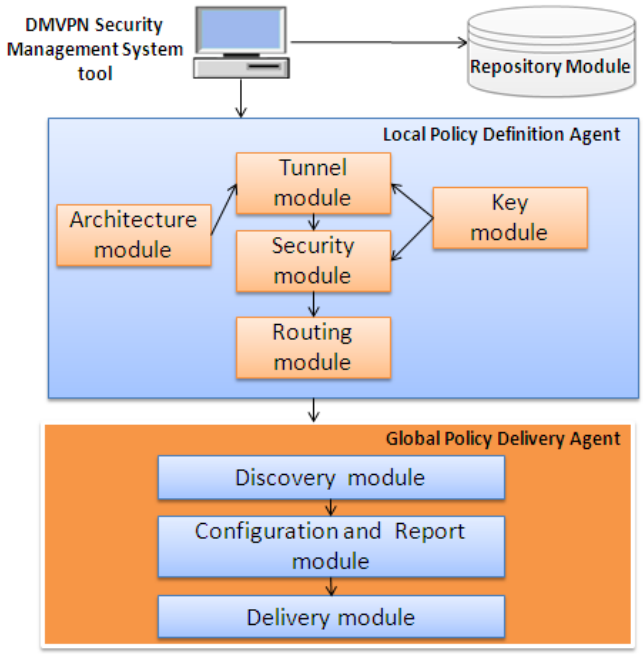

Figure 1 : Architecture of Model DMVPN Security Management System

The proposed model [FIG. 1] is composed of two main agents, "Local Policy Definition Agent" and "Global Policy Delivery Agent";

✓ *Local Policy Definition Agent:* Used to define locally the attributes of security and routing policies of DMVPN networks through a graphical man/machinery interaction. This agent is composed of several modules; Architecture Module, Tunnel Module, Security Module, Routing Module and Key Module.

- *Architecture Module:* This module defines the type of architecture to handle: Single Hub Single Cloud, Multiple Hub Multiple Cloud. Each generated architecture is characterized by a unique sequence number that will be used for further modification or addition of equipment.
- *Tunnel Module:* This module is responsible of establishing tunnels between the Hubs and Spokes depending on the type of architecture described in the previous module. The identification and authentication of tunnels will be made by the attributes of Key Module
- *Security Module:* This module defines the IPsec protocol to use and whichcould be AH or ESP, encryption protocols (DES, 3DES, AES) and integrity protocols (MD5, SHA) for both IKE phases, by default the mode used is transport to avoid a third encapsulating of the IP header.
- *Key Module:* This module defines the tunnel key ID, the DMVPN cloud ID, the authentication key for access to the DMVPN network as well as the IP sec password.
- *Routing Module:* This module allows the generation of a more suitable configuration of routing protocol for a specific DMVPN architecture, our model supports; Routing Information Version 2 (RIPv2), Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF) and Interior Border Gateway Protocol (IBGP).

✓ *Global Policy Delivery Agent:* Detects the version of the manufacturer of the end equipment and convert user data to specific commands, store policies configuration and deliver them remotely using SSH tunnel. This agent consists of three modules; Discovery module, Configuration and report module and Delivery Module.

- *Discovery Module:* This module performs automatic detection of the manufacturer of the end equipment.
- *Configuration and store Module:* This module translates the user data to specific command lines for the equipment detected by the Discovery Module, and stores data on the repository module.
- *Delivery Module:* This module opens an encrypted SSH tunnel to the end devices and delivers encrypted data for safety measures.
- *Repository Module:* This module is a Structured Query Language Server(SQL) used to store the data of each module for a given architecture created by a specific user. With this module when adding new equipment for a specific architecture, security and routing policies applied to previous equipment will be applied by default on new one without manual user specification.

III. Operation of the Model DMVPN Security Management System

Our model allows centralized management of security policies for a dynamic multipoint VPN, ensuring scalability.

The graph shown in [FIG. 2] shows the steps to follow for centralized management.

1. The user must choose the architecture to deploy; Single Hub Single Cloud or Multiple Hub Multiple Cloud;
2. If the user selects Single Hub Single Cloud, a specification of number of Spokes to deploy is necessary, according to the specified number by the user a graphical user interface will be generated automatically composed of n + 1 rows, where n is the number of Spokes and 1 is the HUB line;
3. The user must specify for each device its Public IP addresses, private IP address, the name of the public interface and SSH authentication data for secure data delivery of configurations, the user can check the settings of SSH authentication from the same graphical interface, the model detects the availability of equipment, Round Trip Time (RTT), and state of TCP port 22, and the validity of the SSH authentication data;
4. The user defines graphically the security settings of IKE Phase 1 and 2, specifies the NHRP password, NHRP +mGRE keys and finally chooses the routing protocol (RIPv2, EIGRP, OSPF, iBGP)
5. If the user chooses Multiple Hub Multiple Cloud, a specification of number of Hubs and Spokes to deploy is necessary;
6. The user must specify for each device its Public IP address, private IP address, the name of the public interface, the SSH authentication data for secure data delivery of configurations and the priority of each HUB, if routers have the same priority, load balancing with equal costwill be made between HUBs, if not the router with the highest priority will be the primary router, the other will be considered secondary. The user can verify the authentication settings from the same graphical interface, the model detects the availability or not of equipment, Round Trip Time (RTT), the state of TCP port 22, and the validity or invalidity of the SSH authentication data;
7. The user defines graphically the security settings of IP sec IKE Phase 1 and 2, specifies NHRP password, NHRP + MGRE keys and finally chooses the routing protocol (RIPv2, EIGRP, OSPF, IBGP)
8. A unique ID will be generated for the created architecture;
9. User data will be stored in a SQL server for future reference or modification;
10. The translation of user data into specific command line and delivery to destinations via the SSH tunnel;

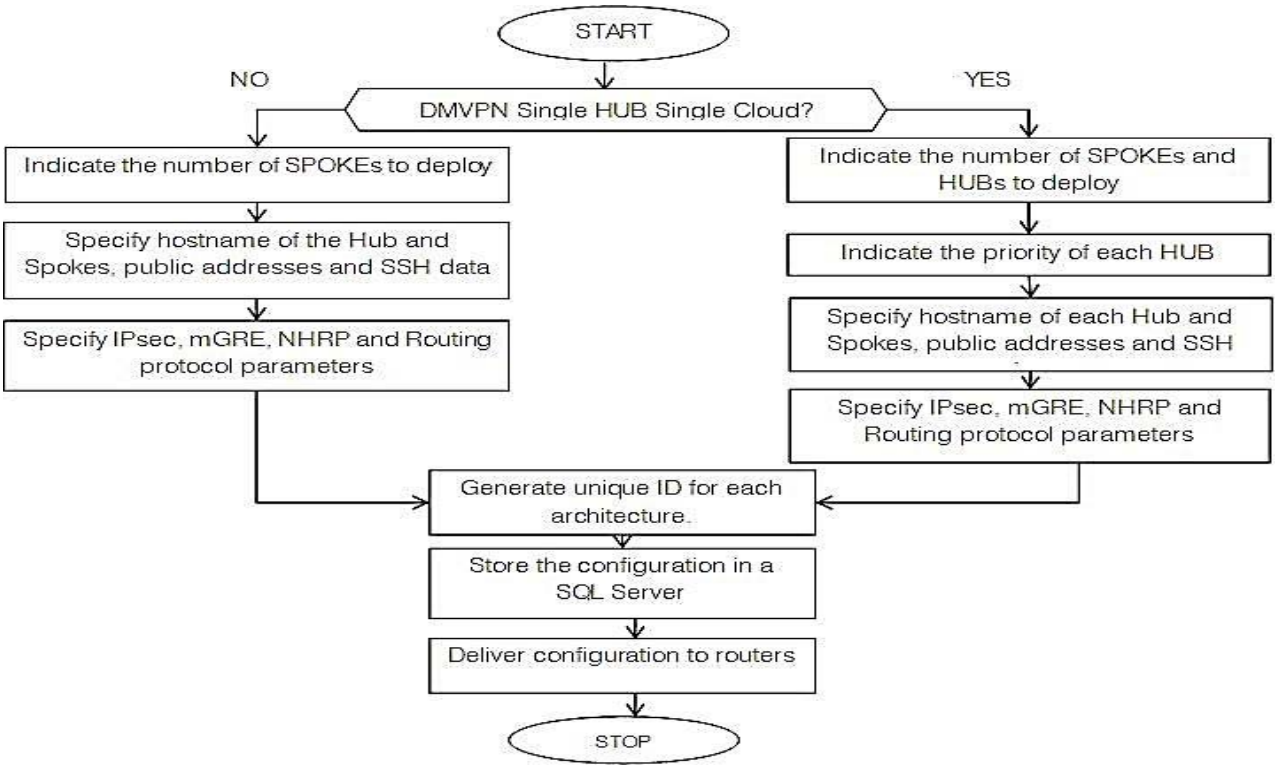

Figure 2 : Diagram illustrating the initial use of the model

Although our model provides scalability, Figure [FIG. 3] shows how a user can make subsequent changes to a given architecture.

1. The user specifies the ID of the architecture to be modified;
2. The application performs a test to check if the currently logged in user is the owner of the architecture to be modified, if the result is false the operation is stopped, if not:

3. If the identifier of the architecture refer to a Multiple HUB Multiple Clouds architecture ,then;
4. The user specifies the number of additional Hubs and Spokes to deploy;
5. The user specifies the priority of each HUB;
6. The user must specify for each device its Public IP address, private IP address, the name of the public interface and SSH authentication data for secure data delivery of configurations, the user can check the settings of SSH authentication data from the same graphical interface, the model detects the availability of equipment, Round Trip Time (RTT), and state of TCP port 22, and the validity or invalidity of the SSH authentication data. Security and routing policies associated with the architecture being modified will be applied automatically to added new equipment;
7. If the identifier of the architecture does not refer to a Multiple HUB Multiple Clouds architecture, then;
8. The user specifies the number of additional Spokes to deploy;
9. The user must specify for each device its Public IP address, private IP address, the name of the public interface and SSH authentication data for secure data delivery of configurations, the user can check the settings of SSH authentication from the same graphical interface, the model detects the availability or unavailability of equipment, Round Trip Time (RTT), and state of TCP port 22, and the validity or invalidity of the authentication data SSH. Security and routing policies associated with the architecture being modified will be applied automatically to added new equipment;
10. A Notification email will be immediately sent to the administrator upon successful addition of new equipment.
11. The new changes of the architecture being modified will be stored on the SQL server;
12. The translation of user data into specific command line and delivery to destinations via the SSH tunnel;

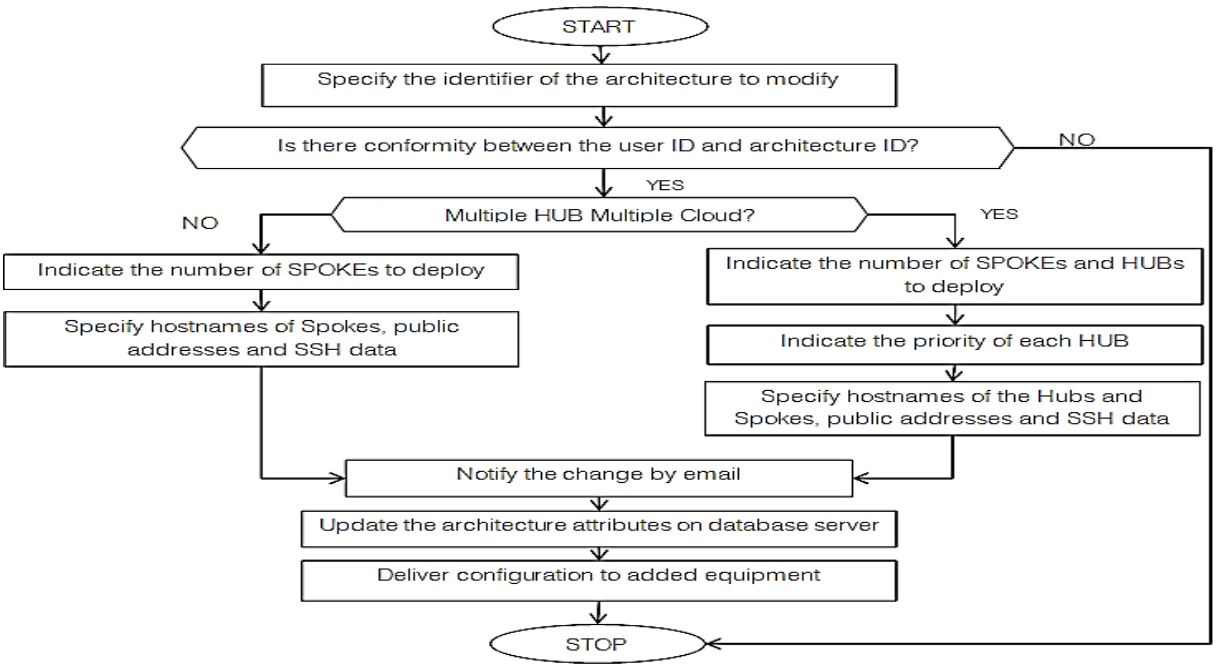

Figure 3 : Illustration Diagram of the operation of the model in case of change

IV. Demonstration and Guided Tours

In order to validate the Designed model, we have implemented and tested it on a network of communicating company; its implementation is based on a graphical web interface usable from any operating system.

The following demonstration will be for the establishment of Dynamic Multipoint VPN Single Hub Single Cloud architecture.

Figure 4 : Main Menu

The user through the menu (FIG.4) can choose to deploy a Single Hub Single Cloud architecture (1) Multiple Cloud Multiple Hub (2) or Edit a specific architecture (3).

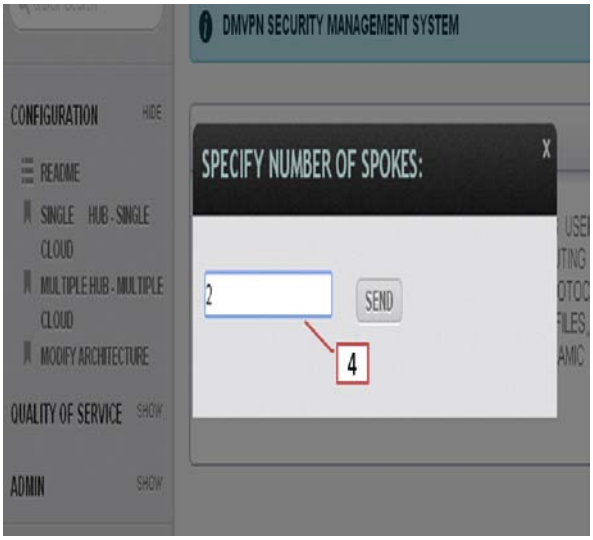

Figure 5 : Number of Spokes to deploy

A window appears [FIG.5], prompting the user to specify the number of Spokes to deploy (4)

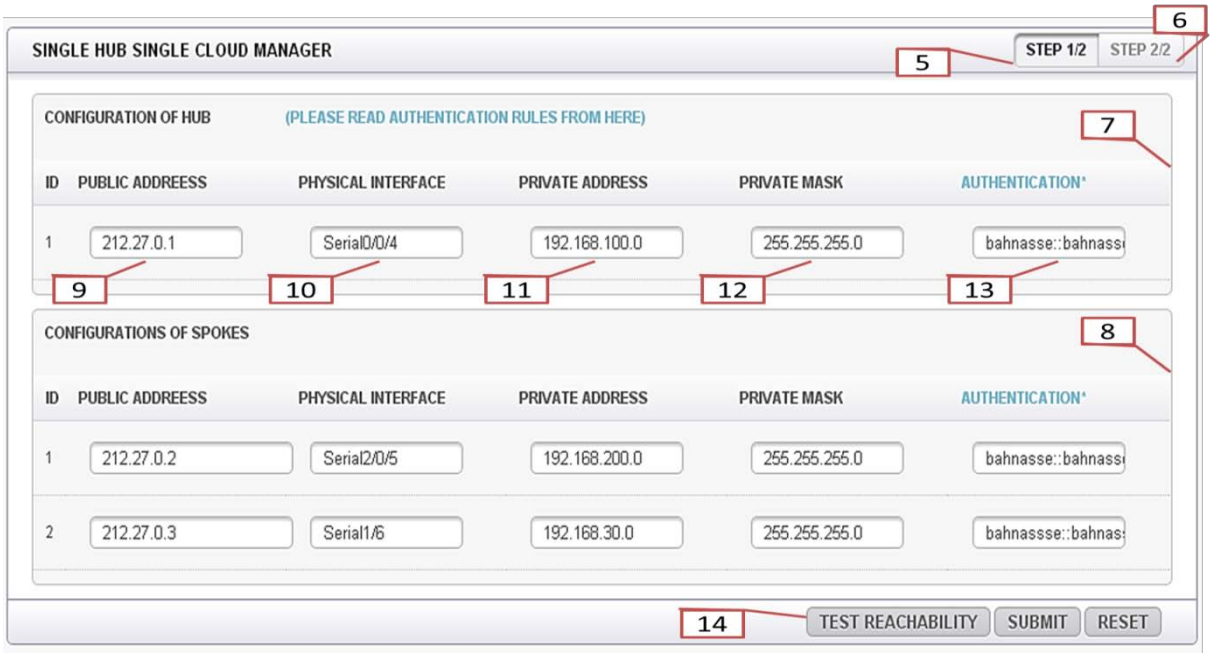

Figure 6 : Configuring identity and authentication SSH

After specifying the number of Spokes to install, a window [FIG. 6] is displayed, the window is mainly composed of two parts: identity configuration and SSH authentication (5) securityand routing policies configuration (6). The flap (5) consists of two sections: HUB Configuration (7) and Spokes Configuration (8), the two sections are composed of the following fields: public IP address(9) outside interface(10), private IP address (11), subnet mask of private address (12) and SSH authentication data (13). The option (14) is used to: test the accessibility or inaccessibility of the remote device, calculate the Round Trip Time (RTT), the status of port 22 (Active or Inactive) and the validity of the authentication or not (refer to FIG. 7).

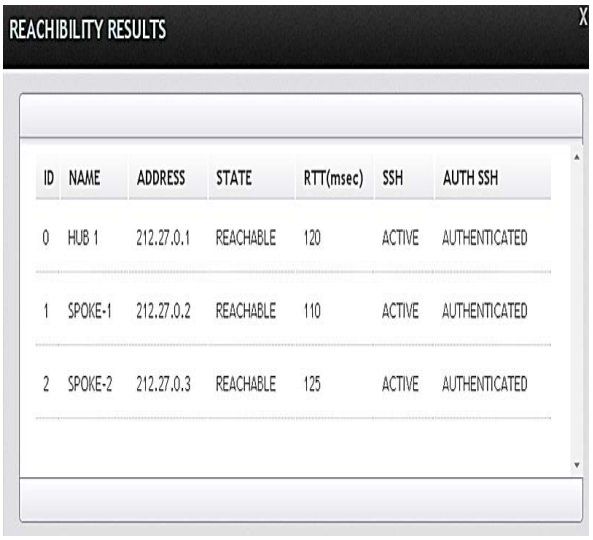

Figure 7 : Accessibility Test

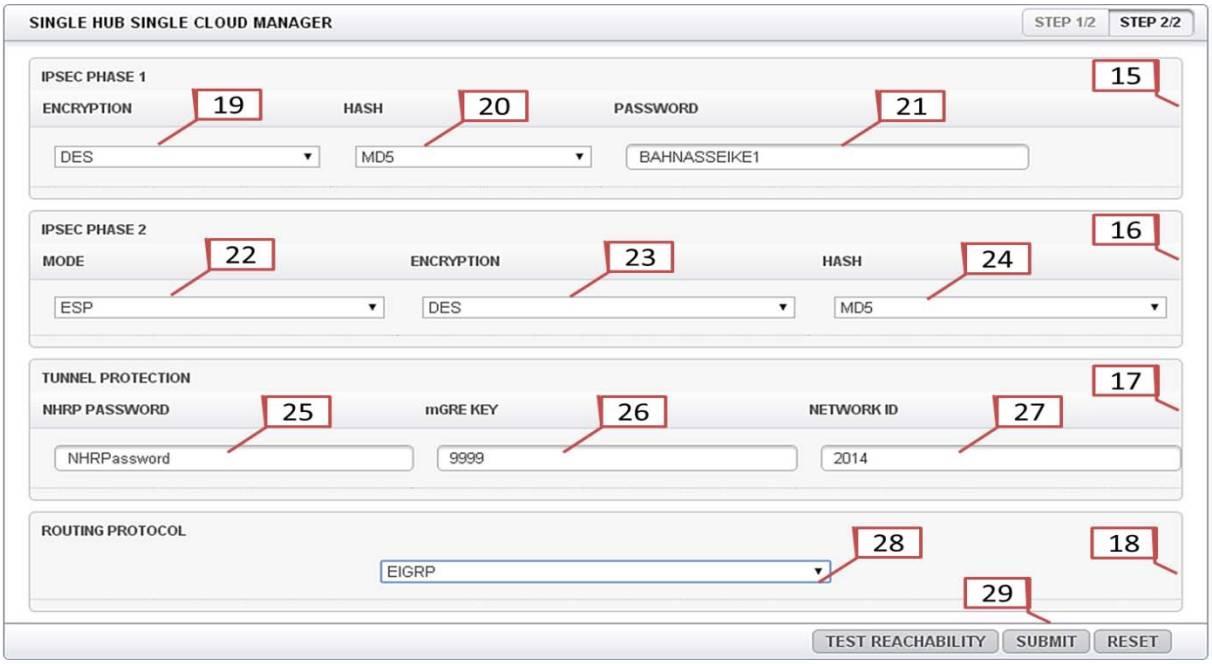

Figure 8 : Configuration of security and routing policies

The second section, security and routing policies configuration consists of four main sections: IPsec phase 1 configuration (15), IP sec second phase configuration(16), tunnel protection (17) and the choice of routing protocol (18).

Section (15) is composed of three fields, the choice of encryption protocol (19), the integrity protocol (20) and the password key derivation (21).

Section (16) is composed of three fields, the protocol IP sec to use ESP or AHP (22), encryption protocols and integrity respectively (23) and (24); the default mode is set to Transport.

Section (17) is composed of three fields, NHRP password of current network (25), MGRE tunnel key (26) used to separate tunnels and provide authentication and the identifier of the NHRP network (27).

The last section (18) allows the user to pick through a list the protocol to be implemented which can be one of these protocols RIPv2, EIGRP, OSPF or IBGP (28).

After completing the customization of the architecture, user clicks on submit button(29), and the application detects and delivers commands to the equipment, if the equipment is not available, the application generates a compressed file containing the configuration of each device, these files can be sent later manually by the user (refer to FIG.9)

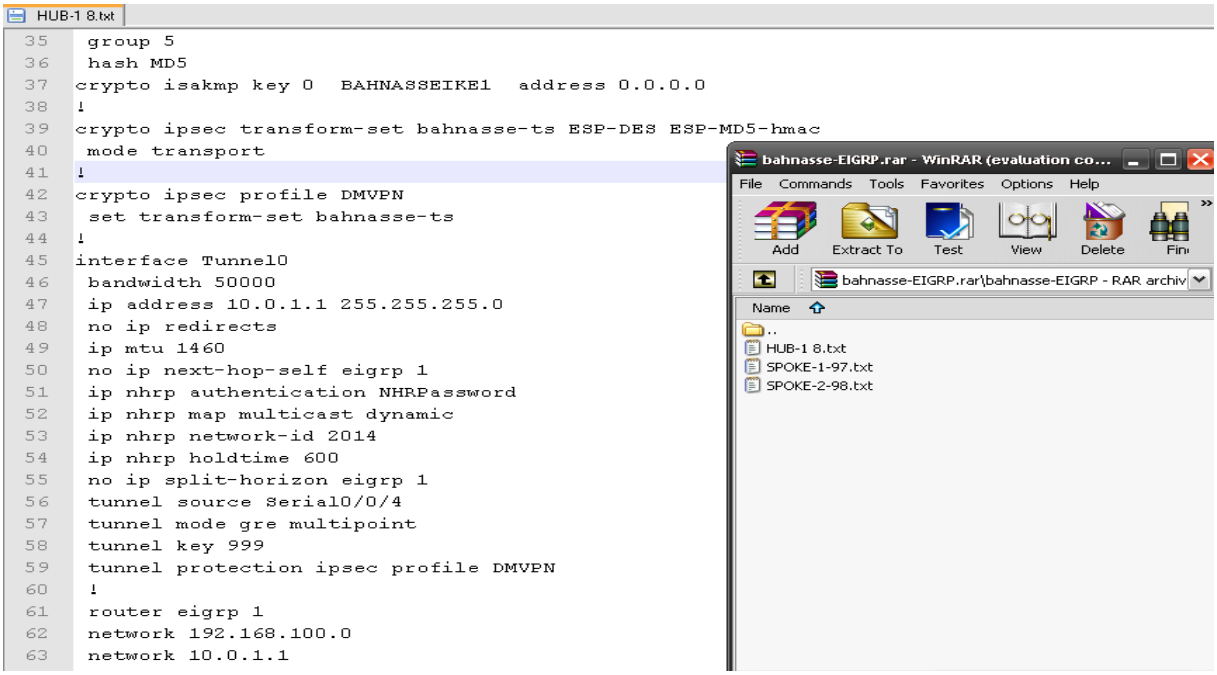

Figure 9 : Configurations files generated

V. Conclusion

In this article we presented our model« DMVPN Security Management System », although the big amount of work addressed only to the management of IP VPN Site to Site network, this model addresses the issue of centralized management of secure dynamic and multipoint VPN through a simple web-based GUI, we discussed the components of the model and its operation and presented the tool via a demonstration.

The model was implemented and tested on Single Hub Single Cloud architecture consisting of ten Spokes, the time required for an expert on VPN networks for manual set up of this architecture is an hour, we moved that to five minutes with our model, in addition to time effectiveness the margin error is null.

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A Prototype Modelling of Ebers for Video Transmission in Wireless ADHOC Network

By Ganashree T. S & Dr. Josephine Prem Kumar
East Point College of Engineering & Technology, India

Abstract- Provisioning of video streaming over ad hoc wireless networks exhibits challenges associated with high packet loss rates and are delay sensitive. Excessive packet loss can cause significant degradation in quality of video perceived by users of real-time video applications. The recent studies suggest that Forward Error Correction (FEC) is a good technique for decreasing the negative impact of packet loss on video quality in error control scheme. This paper introduces an Estimation based Error Reduction Scheme(EBERS) to support video communication in ad hoc wireless networks. The EBERS considers a frame estimation parameter to support varied bandwidths and attain the delay requirements to support video communication. It is also responsible for improvising the QoS offered. The EBERS considers layered and embodies distortion limiting features owing to which reduced forward error correction is achieved, thus obtaining reduced frame errors, transmission errors and retransmission of frames. Thereby obtaining high degree of quality of service(QoS).The comparative study conducted proves the efficiency of the EBERS scheme over the existing mechanisms.

GJCST-E Classification : C.2.1 C.2.2

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A Prototype Modelling of EBERS for Video Transmission in Wireless ADHOC Network

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Abstract- Provisioning of video streaming over ad hoc wireless networks exhibits challenges associated with high packet loss rates and are delay sensitive. Excessive packet loss can cause significant degradation in quality of video perceived by users of real-time video applications. The recent studies suggest that Forward Error Correction (FEC) is a good technique for decreasing the negative impact of packet loss on video quality in error control scheme. This paper introduces an Estimation based Error Reduction Scheme(EBERS) to support video communication in ad hoc wireless networks. The EBERS considers a frame estimation parameter to support varied bandwidths and attain the delay requirements to support video communication. It is also responsible for improvising the QoS offered. The EBERS considers layered and embodies distortion limiting features owing to which reduced forward error correction is achieved, thus obtaining reduced frame errors, transmission errors and retransmission of frames. Thereby obtaining high degree of quality of service(QoS).The comparative study conducted proves the efficiency of the EBERS scheme over the existing mechanisms.

I. Introduction

Wireless Ad Hoc Networks are characterized by their ability to communicate amongst one another independently sans any existent infrastructure. Such networks could be vital for multiple applications like medical applications, for emergency applications, rescue operations to name a few. Support for multimedia applications over wireless ad hoc networks has gained tremendous momentum in the past decade.

There are large variety of exciting multimedia applications over the Internet that could broadly classified into three classes:

Streaming of stored audio and video,
Streaming of live audio and video, and
Real-time interactive audio and video.

The research work presented here is primarily targeted towards realization of real time video communication in wireless ad hoc networks. When any video is transmitted from a transmitter to a receiver in any wireless network, various video packets may be lost due to channel errors, transmission errors or low band width. Active video communications are time critical and to attain the required Quality of Service (QOS) it is essential to minimise the packet loss [1]. Lower packet loss also results in reduced number of re-transmissions and enables packet delivery as per the required deadline. Considering the ad-hoc networks in which data to the receiver is provided through numerous intermediate nodes the end to end delay increases. To minimize end to end delays it is critical to adopt effective Forward Error Correction (FEC) to reduce the number of retransmissions of lost packets.

Streaming live video is similar to traditional broadcast of radio and television except that transmission takes place over the Internet. Video broadcast can be either unicast or multicast from the server. In a unicast connection, the transmission is replicated by the server for each endpoint user where as in multicast connection as one transmission of same signal to multiple clients over the network is happening. The broadcast from the server to the clients where there are many requests at the same time could be done using live streaming. This paper introduces the EBERS for Scalable high efficiency video coding (HEVC) to support layered video communication in ad-hoc wireless networks.

In this approach we use a 100x100 network. Initially we use 2x2 matrix as the input. The EBERS further encodes the part of Enhancement Layer and the Base Layer of the video using multiple descriptor coding techniques and custom packetization schemes discussed in the third section of this paper to reduce packet losses in the network thus achieve superior QOS.

II. Literature Review

Provisioning of QOS to support multimedia streaming has been comprehensively studied by researchers. B Sat and B wah [2] have studied the provisioning of VoIP, providing detailed study about skype and google talk. These mechanisms cannot be directly employed for wireless ad hoc networks due to the delay introduced by the multi hop transmission nature. The data packets transfer from node to node network is given in [3]. To overcome the packet losses which are inherit properties of networks and at the same time to meet the play out time researchers have proposed multiple path establishment between the

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source node and destination node. In addition to multiple path establishments the use of video's enables to minimize the packet loss, packet delay and improve QOS. The use of multiple description coding scheme [8][9][10] is adopted in the EBERS scheme proposed. Streaming of video packets over the internet is given in [4]. [5] The paper specifies a payload format for generic forward error correction of media encapsulated in Real time protocol (RTP). It uses FEC algorithms based on the parity operation. The arbitrary block lengths and parity scheme is being transmitted using payload format. This allows for the recovery of both the critical RTP header fields and payload. The paper addresses the problem by presenting an end-to-end architecture for transporting MPEG-4 video over the Internet [6].It present a framework for transporting MPEG-4 video, which includes error control, feedback control, packetization and source rate adaptation. The important contributions of this paper are: (1) a feedback control algorithm based on Real Time Protocol and Real Time Control Protocol (RTP/RTCP), (2) an adaptive source encoding algorithm for MPEG-4 video which is able to adjust the output rate of MPEG-4 video to the desired rate, and (3) an efficient and robust packetization algorithm for MPEG video bit-streams at the sync layer for Internet transport. In [7], we propose a reliable high-speed UDP-based media transport with an adaptive FEC (forward error correction) error control. The amount of redundancy by monitoring the network so that it can effectively adapt to the fluctuations of underlying networks is proposed by an adaptive transport scheme controls. The monitored feedbacks of the receiver enable the sender to be aware of current reception status (i.e., rate/type of packet loss and delay change) and to estimate the expected network status. By using this, the proposed media transport attempts to enable reliability by adaptively controlling the amount of both total sending rate and the FEC code ratio. Thus provides increase quality of the video using scalable coding [11].

III. Estimation based Error Reduction Scheme for Scalable HEVC (EBERS)

The EBERS scheme proposed considers a layered encoded video communication streams for transmissions in the network. The video data is encoded using the SHVC into two streams. The important stream namely the Base Layer($\mathcal{Q}$) and the unimportant stream or the Enhancement Layer($\mathcal{P}$) is generally considered to reconstruct high quality video streams.

Considering both the $\mathcal{P}$ and $\mathcal{Q}$ streams can often lead to higher transmission errors. To minimize the error propagation the EBERS adopts a packetization scheme as shown in the Figure 1 where $\mathcal{P}$ is split into two sub packets $\mathcal{P}'$ and $\mathcal{P}''$.

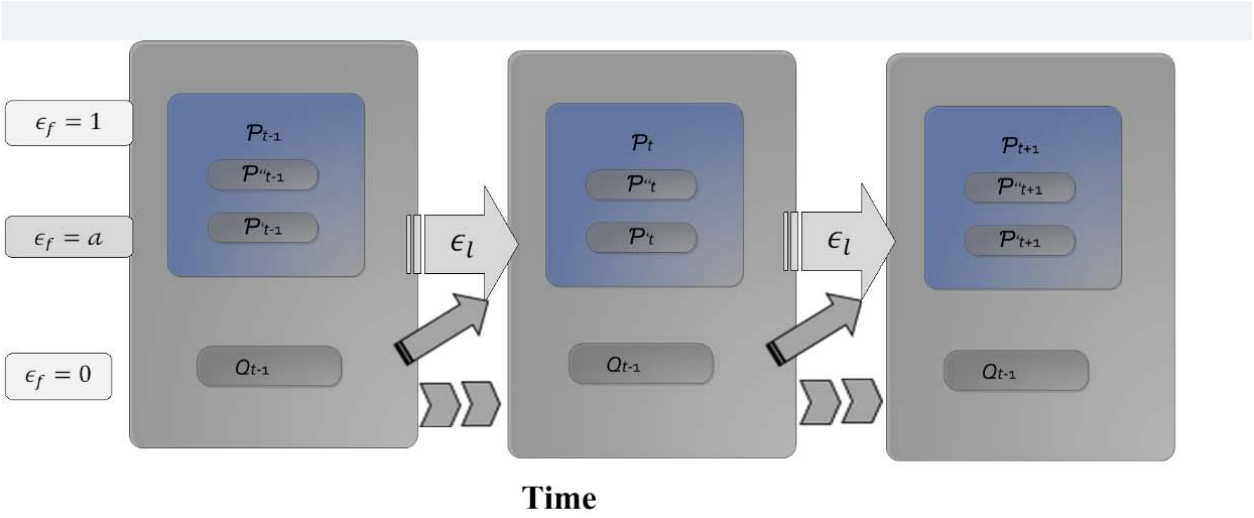

Figure 1 : Packetization Scheme Adopted in EBERS

The enhancement layer packet $\mathcal{P}'$ is derived by a forward estimation factor ϵ_l where $\epsilon_l \in [0,1]$.The video message $\mathcal{P}$ bits coded $\mathcal{M}'^{\mathcal{P},cd}_{t}$ at a given time instance t is derived from the preceding $\mathcal{Q}$ $\mathcal{M}^{\mathcal{Q}}_{t-1}$, preceding $\mathcal{P}$, $\mathcal{M}^{\mathcal{P}}_{t-1}$. In the below equation cd stands for coding and is defined as

$$\mathcal{M}'^{\mathcal{P},cd}_{t} = \left((1-\epsilon_l)\mathcal{M}^{\mathcal{Q}}_{t-1}\right) + (\epsilon_l \times \mathcal{M}^{\mathcal{P}}_{t-1}) \quad (1)$$

From the above definition it is clear that if ϵ_l tends towards 0 the $\mathcal{P}$ would be completely eliminated and would result in decreased quality of video transmissions in the network. If the $\epsilon_l \approx 1$ then the errors induced in the communication would increase and the video quality would significantly improve. The packetization scheme construct $\mathcal{P}'$ and $\mathcal{P}''$ from $\mathcal{P}$ based on the frame estimation factor ϵ_f. The frame estimation factor is an adaptive factor to accommodate

varied modes supported in the scalable high efficiency video coding (SHVC). Incorporating the fram estimation factor the video message $\mathcal{M}'^{\mathcal{P},\mathrm{cd}}_{t}$ could be redefined as

$$\mathcal{M}'^{\mathcal{P},\mathrm{cd},\epsilon_{\mathrm{f}}}_{t} = \left((1-\epsilon_{\mathrm{l}})\mathcal{M}^{\mathcal{Q}}_{t-1}\right) + \left(\epsilon_{\mathrm{l}} \times \mathcal{M}^{\mathcal{P},\epsilon_{\mathrm{f}}}_{t-1.}\right) \quad (2)$$

In the ad hoc network considered let $r_x[a]$denote the received signal, $t_x[a]$denote the transmitted signal and $n_{\mathrm{awgn}}[a]$ denote the additive white Gaussian channel considered in the network. The channel coefficients matrix whose elements are independent and identically distributed variables having a variance defined as$\sigma^2_{\hbar}$.All the variables of the channel coefficient matrix are assumed to be zero mean complex Gaussian random variables. If the channel coefficient matrix is represented as $\mathcal{H}[a]$ then the received signal for the a^{th}thsymbol is defined as

$$r_x[a] = \mathcal{H}[a]t_x[a] + n_{\mathrm{awgn}}[a] \quad (3)$$

Let $\varepsilon_{xy}[a]$denote the channel estimation error for the a^{th}symbol transmitted from the y^{th}transmitting node in the considered network to the x^{th}receiving node in the same network, and then $\varepsilon_{xy}[a]$can be considered as a complex Gaussian variable and the variance is defined as

$$\sigma^2_{\varepsilon}[a] = 1 - \mathcal{W}^*[a]\mathcal{C}\mathcal{M}^{-1}\mathcal{W}[a] \quad (4)$$

Where $\mathcal{CM}$ represents the auto correlation matrix. The covariance vector between $\hbar_{xy}[a] \in \mathcal{H}$ and the received samples is represented as $\mathcal{W}[a]$. In the EBERS considering that all the channels of the ad hoc nodes are autonomous, the radio layer channel estimation errors can be considered as a matrix whose elements are independent and identically distributed Gaussian variables exhibiting an variance as defined in the above equation.

The $\mathcal{CM}$ autocorrelation matrix and the received samples $\mathcal{W}[a]$are dependent on the modulated carrier wave, the signal to noise ratio(SNR), spreading factors and the frame transmission rate. The EBERS assumes that the SNR of the carrier wave and the frame rate are equivalent to the channel coherence and the data SNR. QPSK modulation scheme is considered in the radio layer of the ad hoc network. The $\mathcal{P}$kt packets each having a symbols are allocated to a frame.

Let cr_x denote the channel rate and $\rho t x_{\mathrm{x}}$ denote the packet transmission parameter for the x^{th} packet. If the error rate experienced by the x^{th} packet is represented as $e_x(cr_x, \rho t x_{\mathrm{x}})$ and that if $z$packets are successfully transmitted and a transmission error occurs at $z+1$ packet. The probability Prob($z \mid \mathcal{P}$kt)of such an occurrence in the ad hoc network is defined as

$$\mathrm{Prob}(z \mid \mathcal{P}\mathrm{kt}) = \begin{cases} e_1(cr_1, \rho t x_1), & z = 0 \\ \prod_{y=1}^{z}\left(1 - e_y(cr_y, \rho t x_y)\right) \times \left(e_{z+1}(cr_{z+1}, \rho t x_{z+1})\right), & 0 < z < P\mathrm{kt} \\ \prod_{y=1}^{\mathcal{P}\mathrm{kt}}\left(1 - e_y(cr_y, \rho t x_y)\right), & z = \mathcal{P}\mathrm{kt} \end{cases} \quad (5)$$

Considering that $\mathcal{M}_y$is the total number of symbols of the y^{th}packet, the data or the bits received at the receiving node of the ad hoc network when if $z$zpackets are successfully transmitted from the source node is defined as

$$\sum_{y=1}^{z}\left(cr_y \times \mathcal{M}_y\right) \quad (6)$$

Considering the forward estimation factorϵ_land the frame estimation factor ϵ_{f}, the average distortion is defined as

$$\mathcal{A}vg[\mathfrak{D}(\epsilon_{\mathrm{l}}, \epsilon_{\mathrm{f}})] = \mathfrak{D}(0, \epsilon_{\mathrm{l}}, \epsilon_{\mathrm{f}})\mathrm{Prob}(0 \mid \mathcal{P}\mathrm{kt}) + \sum_{z=1}^{\mathcal{P}\mathrm{kt}}\left(\mathfrak{D}\left(\sum_{y=1}^{z} cr_y, \mathcal{M}_y, \epsilon_{\mathrm{l}}, \epsilon_{\mathrm{f}}\right)\mathrm{Prob}(z \mid \mathcal{P}\mathrm{kt})\right) \quad (7)$$

where the distortion of the bits of the $\mathcal{Q}$ layer and the $\mathcal{P}^{\mathrm{tx}}$ bits of the $\mathcal{P}$ layer that are received effectively is represented as $\mathfrak{D}(\mathcal{P}^{\mathrm{tx}}, \epsilon_{\mathrm{l}}, \epsilon_{\mathrm{f}})$

From the above equation it is evident the average distortion observed in the transmission depends on the estimation factor ϵ_{l} and the frame estimation factor ϵ_{f}.

The proposed EBERS considers the bit error rate observed by the frame to compute the total forward error observed in the prorogation of video data in the ad hoc network. The subsequent section of the paper discusses the experimental evaluation of the EBERS and its efficiency over the existing schemes to support real time video communication over ah-hoc wireless networks.

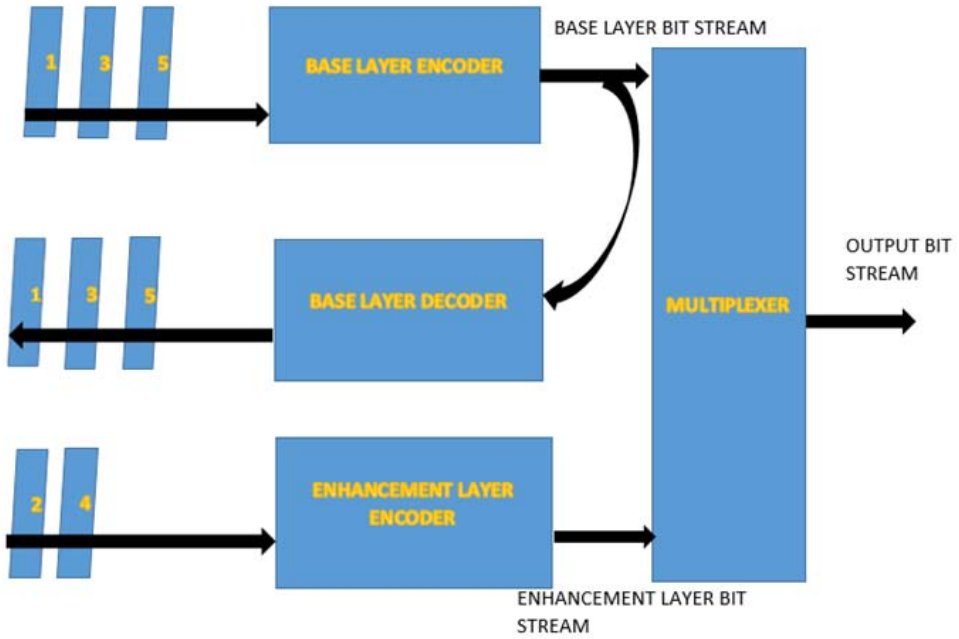

Fig 2: EBERS Architectural diagram

IV. Experimental Study

We have used a 100x100 network with 40 nodes. We are applying 25 frame transmissions and each frame is further divided into 80 bits. All these bits are sent throughthe baselayerand enhancement layer, depending on the PSNR ratio. We thus activate or deactivate or increase or decrease the estimation factor depending on the PSNR ratio, thus keeping in mind therequired scalability of the required video .We there by obtain low packet loss and high quality of video.
The various simulation results as shown below:

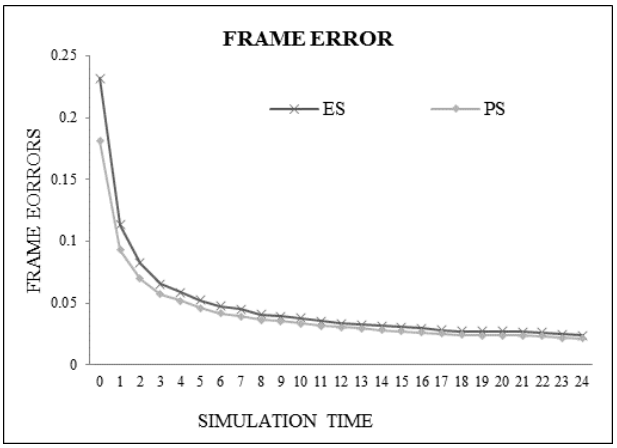

Figure 2 : Frame error versus simulation time

Fig.2 represents a graph indicating the frame error of both proposed system and the existing system versus the simulation time. In both the systems, as the simulation time increases, the frame error decreases. In the existing system initially the frame error was 0.24 at time t=1 unit of time and gradually reduced to 0.03 at 24 units of time. In the proposed system initially, the frame error was 0.18 which reduced to almost 0.02.

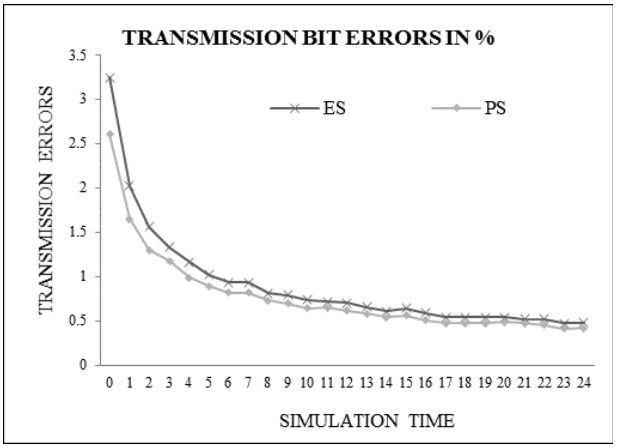

Figure 3 : Transmission error versus simulation time

Fig.3 represents a graph indicating the Transmission error of both proposed system and the existing system versus to the simulation time. In both the systems, as the simulation time increases, the transmission error decreases. In the existing system initially the transmission error was 3.3 at t=1 unit of time and gradually reduced to 0.6 at 24 units of time. In the proposed system initially the frame error was 2.6 which reduced to almost 0.05.

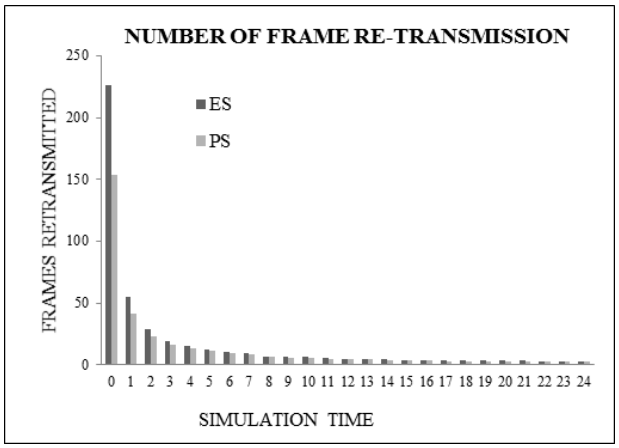

Figure 4 : Frames retransmitted versus simulation time

Fig.4 represents a graph indicating the retransmitted frame versus the simulation time of both proposed system and the existing system. In both the systems, as the simulation time increases, the number of frames to be retransmitted decreases. In the existing system initially the number of frames retransmitted 230 at t=1 unit of time and gradually reduced to 1 at 24 units of time. In the proposed system initially the frame error was 150 which at last reduced to almost 0.

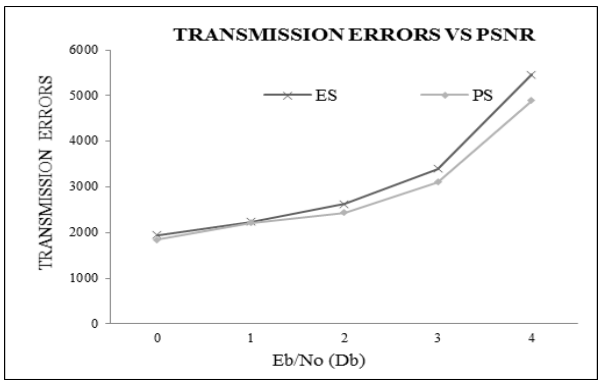

Figure 5 : Transmission errors versus PSNR

Fig.5 represents a graph indicating the transmission error versus the PSNR (peak-signal to noise ratio) of both proposed system and the existing system. In both the systems, as the PSNR increases, the transmission error increases. In the existing system initially the transmission error was 1900 atPSNR=0 dB and this gradually increased to 5500 at PSNR=4 dB .In the proposed system initially the transmission error was 1900 which at last increased to almost 5000 at 4 dB

V. Conclusion

In this research paper, we proposed estimation based error reduction scheme (EBERS) with an enhanced and base layer to efficiently support multimedia data transmission over wireless LANs. It introduces an Estimation based Error Reduction Scheme (EBERS) for Scalable HEVC scheme that not only reduces the transmission bit errors but also reduces the number of retransmission overheads providing the QoS required to support real time video transmissions in wireless ad-hoc networks. The proposed EBERS scheme achieves adaption by incorporating the frame estimation and forward estimation parameters. The EBERS also introduces a novel packetization scheme to reduce the number of retransmissions and yet achieve acceptable video quality in the presence of noisy communication environments. The EBERS discussed in this paper provides support for the transmission of the SHVC standardized by 3GPP. The experimental study discussed in this paper proves that the EBERS is able to achieve an FEC efficiency of about 28% over the existing FEC scheme. The future of the work presented here is considered to evaluate the FEC efficiency in terms of frame error rates and also study the adaptive nature of the EBERS to support varying bit rate transmissions of the SHVC yet achieving video quality over wireless ad-hoc networks.

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3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

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- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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