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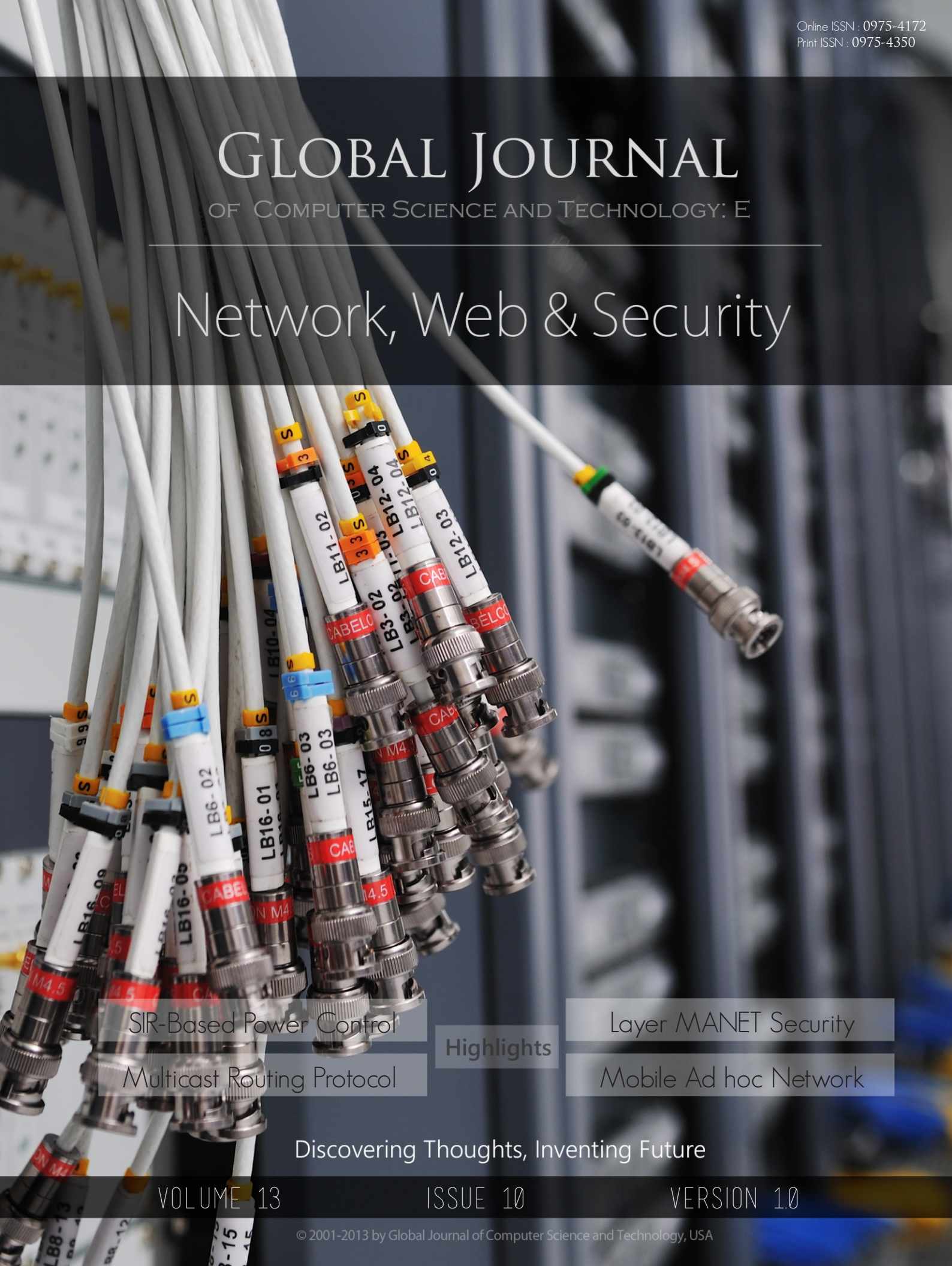

SIR-Based Power Control

Multicast Routing Protocol

Highlights

Layer MANET Security

Mobile Ad hoc Network

Discovering Thoughts, Inventing Future

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Privacy Management of Multi User Environment in Online Social Networks (OSNs)

By P. Amrutha & R. Sathiyaraj
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Privacy Management of Multi User Environment in Online Social Networks (OSNs)

P. Amrutha [α] & R. Sathiyaraj [σ]

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Indexterms : social network, multi party access control, MController, decision voting.

I. Introduction

Many people interested to share personal and public information and make social connections with friends, family, colleagues, coworkers and even with strangers through Online Social Networks(OSN) such like Facebook, Twitter, Google+ and etc,. OSN provide some space to each user for basic profile and sharing photos and videos with others. In photo sharing unfortunately some privacy and security problems are raised. Presently there is no mechanism to totally avoid these privacy issues. The main problem is collaborative authorization management, means if user tags the photo to his friend only. But the updates of photo are presented in both user as well as friends profiles. Then friend of friends or others may share that photo. So here the user expected privacy was spoiled. The existing protection for photos is binary condition either put or delete in profile space. If the photo was deleted after tagging, the content may loss in space, else the privacy was spoiled.

a) OSNs Privacy

In OSNs privacy restrictions form a spectrum between public and private data. On the public end, users can allow every particular OSN member to view their personal content. On the private end, users can restrict access to a specific set of trusted users. Despite the spectrum of available privacy settings, users have no control over information appearing outside their immediate profile page, when a user comment on friend's image, user and friend both cannot restrict the comment from other viewers. Similarly, if a user posts a photo and indicates the name of a friend in the photo, the friend cannot specify which users can view the photo. For both of these cases, Facebook currently lacks a mechanism to satisfy privacy constraints when multiuser is involved, So that the user's privacy may be violated. Privacy conflicts publicly expose personal information, slowly decreasing a user's privacy.

The user would have more control over his photos where a set of malicious users may want to make a shared photo available to a wider audience. If the malicious users can access the photo from original user then they tag photo with fake identities to others. Those may further share with other users. This continuous process, by this the original photo may change totally and shared with number of persons. At that time the privacy of photo which was expected by original user may collude totally. To prevent such an attack, three conditions need to be satisfied:

- No Fake Identity in OSNs.
- All Tagged Users are Real Users for the Photo.
- All Controllers are Honest to specify their Privacy policies for the photo.

II. MController

OSN is mainly relationship network including set of users as well as their data. So that OSN represented with directed labeled graph where each node represents user and edge denotes relationship between two users. The edge direction denotes the relationship from initial to terminal node. The profile space of the user managed himself with his privacy data and content. For that privacy data to maintain security several schemes are introduced. But no scheme gives totally security, mainly all those schemes have only one controller that is owner. By this single controller security and privacy issues may be raised on data which was personal to the owner.

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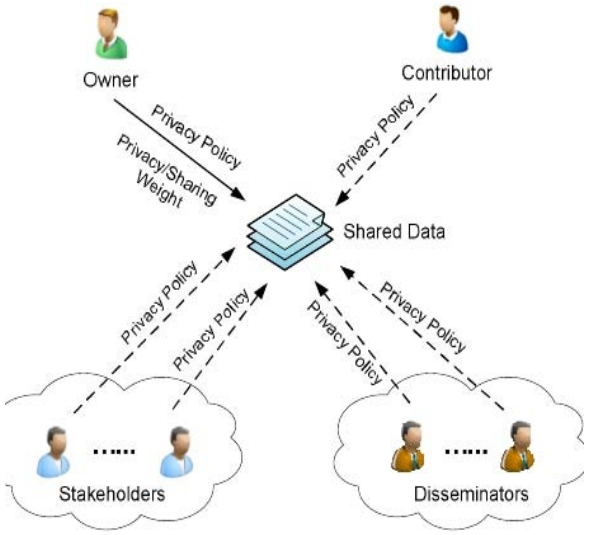

Figure 1 : MController Architecture

So that rather than the owner controlling additional controllers are need for the flexible privacy mechanisms in OSN. The additional controllers are contributor, stakeholder and disseminator which provide their own privacy policies on shared data by giving the permission either permit or deny to unauthorized user on shared data. Figure 1 illustrates different controllers providing their privacy policies on shared data. We define multi controllers as follows:

- *Owner (O) :* In the social network the user u is called the owner of the data item d, if d presents in the space m of user u. The user u is also called as contributor of d, when that user share data item d. The owner share data in three types, they are profile sharing, content sharing and relationship sharing. It enables the owner to discover potential malicious activities in collaborative control.
- *Contributor (C) :* In the social network the user u is called the contributor of the data item d, if d published by user u in someone else's space. The contributor tags content to other's space and the content may also have multiple stakeholders (e.g., tagged users). The memory space for the user will be allotted according to user request for content sharing.
- *Stakeholder (S) :* In the social network the user u is called a stakeholder of the data item d, if user u is tagged user T for d. A shared content has multiple stakeholders.
- *Disseminator (D) :* In the social network, let d be a data item shared by a user u from someone else's space to his/her space. The user u is called a disseminator of d. the real content sharing starts with the owner, then disseminator views the content and shares with others. This disseminated content may be re-disseminated again and again by others.

III. Multi Party Access Control (MPAC) Model

a) MPAC Specification

It is very essential for MPAC policies to regulate access and representing authorization requirements from multiple associated users to enable a collaborative authorization management of data sharing in OSNs.

- *Accessor Specification :* Accessor is the set of users who granted to access the shared data. Accessor can be represented with a set of user names, relationship names and group names in OSNs.

The accessor specification is defined as a set, accessors = {a1, a2. . . , an}, where each element is a tuple $< ac,at >$. where $ac \in U \cup RT \cup G$ be a user $u \in U$, a relationship type $rt \in RT$, or a group $g \in G$. $at \in \{UN,RN,GN\}$ be the type of the accessor specification, where UN,RN,GN represents user name, relationship name, and group name.

- *Data Specification :* The data specification represented in three ways; profile, relationship and content sharing. For effective privacy the different controllers provide sensitivity levels on data.

Let $dt \in D$ be a data item, sl be a sensitivity level (range 0.00 to 1.00) for data item dt. The data specification is defined as a tuple $< dt, sl >$.

b) MPAC Policy

To summarize the above-mentioned specification elements, we introduce the definition of a multiparty access control policy as follows:

The multi party access control policy is a 5 - tuple $P = <$ controller, Ctype, accessor, data, effect $>$ where

- Controller is a user who can regulate the access of data.
- Ctype is the type of the controller.
- Accessor is the set of users who granted to access the shared data.
- Data is represents a data specification.
- Effect $\in$ {permit, deny} is the authorization effect of the policy. Suppose a controller can leverage five sensitivity levels: 0.00 (none), 0.25 (low), 0.50 (medium), 0.75 (high), and 1.00 (highest) for the shared data.

c) MPAC Evaluation

Multi party access control is evaluated in two steps. In step-1, the individual decision are collected from different controllers, and in step-2, individual decision are aggregated and makes final decision for the access request.

Figure 2 illustrates that how MPAC evaluated in step by step. Initially an access request goes to under policy evaluation, which is done under four controllers. The four controllers provide their own privacy policies in the form of decision either permit or deny in step-1

process. After giving decisions by individual controllers, they are aggregated and make final decision by using decision voting schemes in step-2 process. The final decision making decides whether the access request is allowed or refused.

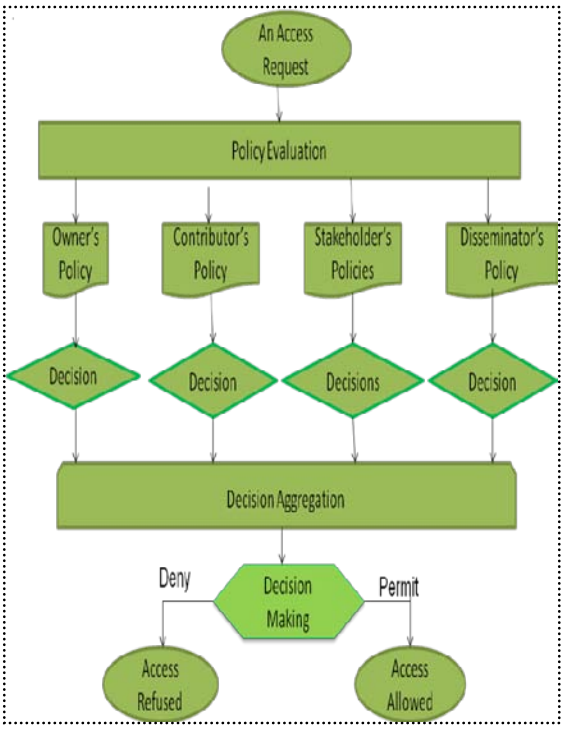

Figure 2 : MPAC Evaluation

From the process of evaluation in MPAC policies, the controllers give different decision for an access request. There may be a chance of occurring conflicts. So that a mechanism is needed to resolute the conflicts for taking an unambiguous decision for each access request. For the better privacy, a strong resolution for conflict may need. So it is better to consider tradeoff between privacy and utility in resolution of conflict. For this conflict issue, we introduce decision voting schemes resolving the MPAC conflicts which is simple and flexible.

IV. Final Decision Making Schemes

a) Decision Voting Mechanism

Decision making mainly depends on majority. For such decision making, we introduce a voting scheme for conflict resolution. In voting mechanism each controller's individual decision effects the final decision. Mainly this voting scheme is described in two voting mechanisms; they are decision voting and sensitivity voting.

i. *Decision Voting*

The policy evaluation derives the decision voting value (DV) either permit or deny as follows, Where Evaluation (p) represents the policy p decision:

$$DV = j \begin{cases} 0 & \text{if Evaluation(p)} = \text{Deny} \\ 1 & \text{if Evaluation(p)} = \text{Permit} \end{cases} \quad (1)$$

Assume that all controllers are equally important, an aggregated decision value (DVag) (range 0.00 to 1.00) from multiple controllers including the owner (DVow), the contributor (DVcb) and stakeholders (DVst), is computed with following equation:

$$DVag = (DVow + DVcb + \sum_{i \in SS} DV^{i}_{st}) \times 1/m \quad (2)$$

Where SS is the set of stakeholders for shared data item, and m is total number of controllers for shared data item.

For the shared data item each controller may have (i) a different trust level over the data owner and (ii) a different reputation value in terms of collaborative control. So we need to introduce weights for decision voting scheme. Weights for different controllers can be calculated by aggregating trust levels and reputation values. The weight of controller x is "weightx / sum of weights". Suppose ωow, ωcb and ωi sh are weights for owner, contributor and stakeholder controllers, respectively, and n is the number of stakeholders of the shared data item. A weighted decision voting scheme is as follows:

$$DVag = (\omega ow \times DVow + \omega cb \times DVcb + \sum_{i=1 to n} (\omega i_{st} \times DV^{i}_{st})) \times 1/(\omega ow + \omega cb + \sum_{i=1 to n} \omega ist) \quad (3)$$

ii. *Sensitivity Voting*

Each controller assigns a sensitivity level (SL) to the shared data item to reflect her/his privacy concern. A sensitivity score (SC) (range 0.00 to 1.00) for the data item can be calculated based on following equation:

$$SC = (SLow + SLcb + \sum_{i \in SS} SL^{i}_{st}) \times 1/m \quad (4)$$

b) Threshold-Based Conflict Resolution

A basic idea of our approach for threshold-based conflict resolution is that the sensitivity score (SC) can be utilized as a threshold for decision making. Obviously, if SC increased, then the chance of final decision to deny is increased, so that the utility of OSN services cannot be affected. The threshold-based conflict resolution calculates final decision as follows:

$$\text{Decision} = j \begin{cases} \text{Permit} & \text{if DVag} > \text{SC} \\ \text{Deny} & \text{if DVag} \leq \text{SC} \end{cases} \quad (5)$$

It is worth noticing that our conflict resolution approach has an adaptive feature which reflects the changes of policies and sensitivity levels. If any controller changes his privacy policy or sensitivity level on the shared data item, then the aggregated decision value (DVag) and the sensitivity score (SC) will be recomputed and accordingly the final decision may be changed.

c) Strategy-Based Conflict Resolution

If we treat all controllers equally important, then above threshold-based conflict resolution provides a

simple mechanism for making final decision. But in practical, different controllers may have different priorities making final decision. Especially the owner has highest priority in the control of shred data item. So that we provide strategy-based conflict resolution mechanism to satisfy owner authorization requirements of shared data.

Here the sensitivity score (SC) considered as guideline in selecting appropriate strategy for conflict resolution of shared data item. We introduce following strategies for the purpose of resolving multiparty privacy conflicts in OSNs.

- *Owner−overrides :* In final decision making, the highest priority goes to owner's decision. This strategy is totally owner controlling mechanism in data sharing. Based on the weighted decision voting scheme, we set ωow = 1, ωcb = 0 and ωst = 0,1 and the final decision can be made as follows:

$$\text{Decision} = j \begin{cases} \text{Permit if DVag} = 1 \\ \text{Deny if DVag} = 0 \end{cases} \quad (6)$$

- *Full−consensus−permit :* The final decision is deny, if any controller deny the access. This strategy can achieve the naive conflict resolution. The final decision can be derived as:

$$\text{Decision} = j \begin{cases} \text{Permit} & \text{if DVag} = 1 \\ \text{Deny} & \text{otherwise} \end{cases} \quad (7)$$

- *Majority−permit :* This strategy permits (denies, resp.) a request if the number of controllers to permit (deny, resp.) the request is greater than the number of controllers to deny (permit, resp.) the request. The final decision can be made as:

$$\text{Decision} = j \begin{cases} \text{Permit} & \text{if DVag} \geq ½ \\ \text{Deny} & \text{if DVag} < ½ \end{cases} \quad (8)$$

V. Logical Representation of Multiparty Access Control

We introduce an ASP program for multiparty authorization specification.

a) Logical Definition of Controllers and Relationships

The basic components and relations in our MPAC model can be directly defined with corresponding predicates in ASP. We have defined UDct as a set of user-to-data relations with controller type ct ∈ CT. Then, the logical definition of multiple controllers is as follows:

- The owner controller of a data item can be represented as:

$$\text{OW(controller,data)} \leftarrow \text{UD}_{\text{OW}}\text{(controller, data)} \wedge \text{(controller)} \wedge \text{D(data)}.$$

- The contributor controller of a data item can be represented as:

$$\text{CB(controller, data)} \leftarrow \text{UD}_{\text{CB}}\text{(controller, data)} \wedge \text{U(controller)} \wedge \text{D(data)}.$$

- The stakeholder controller of a data item can be represented as:

$$\text{ST(controller, data)} \leftarrow \text{UD}_{\text{ST}}\text{ (controller, data)} \wedge \text{U(controller)} \wedge \text{D(data)}.$$

- The disseminator controller of a data item can be represented as:

$$\text{DS(controller, data)} \leftarrow \text{UD}_{\text{DS}}\text{(controller, data)} \wedge \text{U(controller)} \wedge \text{D(data)}.$$

Our MPAC model supports transitive relationships. Then, friends-of-friends can be represented as a transitive closure of friend relation with ASP rule as follows:

$$\text{friendsOFfriends(U1, U2)} \leftarrow \text{friendOf(U1, U2)}.$$
$$\text{friendsOFfriends(U1, U3)} \leftarrow \text{friendsOFfriends(U1, U2), friendsOFfriends(U2, U3)}.$$

b) Logical Representation of Decision Voting Schemes

decision voting(C) = 1 ← decision(C, permit).
decision voting(C) = 0 ← decision(C, deny).
aggregation weight(K) ← K = sum{weight(C) : controller(C)}.
aggregation decision(N) ← N = sum{decision voting(C) × weight(C) : controller(C)}.
aggregation sensitivity(M) ← M = sum{sensitivity voting(C) × weight(C) : controller(C)}.

c) Logical Representation of Threshold-Based Conflict Resolution

decision(controllers, permit) ←N >M ∧ aggregation decision(N) ∧ aggregation sensitivity(M).
decision(controllers, deny) ← not decision(controllers, permit).

d) Logical Representation of Strategy-Based Conflict Resolution

- The conflict resolution strategy for Owner−overrides is represented as:

weight(controllers) = 1 ← OW(controller, data).
weight(controllers) = 0 ← CB(controller, data).
weight(controllers) = 0 ← ST(controller, data).
decision(controllers, permit) ← N/K == 1∧ aggregation weight(K) ∧aggregation decision(N).
decision(controllers, deny) ← not decision(controllers, permit).

- The conflict resolution strategy for Full−consensus−permit is represented as:

decision(controllers, permit) ← N/K == 1∧ aggregation weight(K) ∧aggregation decision(N).
decision(controllers, deny) ← not decision(controllers, permit).

- The conflict resolution strategy for Majority−permit is represented as:

decision(controllers, permit) ← N/K > 1/2 ∧ aggregation weight(K) ∧ aggregation decision(N).
decision(controllers, deny) ← not decision(controllers, permit).

- The conflict resolution strategy for Deny−overrides for dissemination control is represented as:

decision(deny) ← decision(controllers, deny).
decision(deny) ← decision(disseminator, deny).
decision(permit) ← not decision(deny).

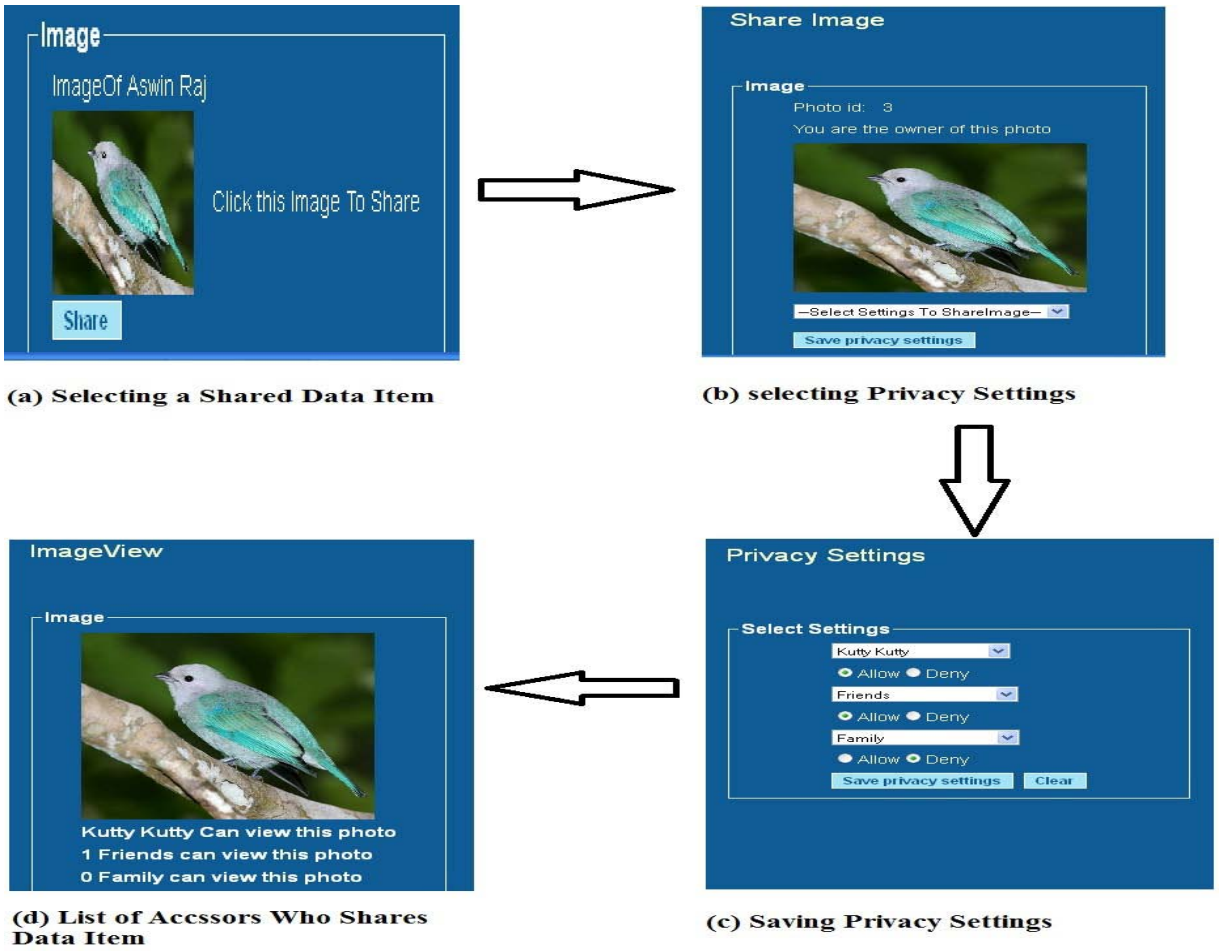

Figure 3 : Snapshot of MController

VI. Implementation

MController is third-party application development for Facebook. This is hosted in an Apache Tomcat application server supporting PHP and MySQL database. MController application is based on the iFrame external application approach. Using the Javascript and PHP SDK, it accesses users' Facebook data through the Graph API and Facebook Query Language. Once user install MController in his Facebook space and accepts the terms and conditions, then MController access the content and basic information of user. Mainly, it retrieves the list of all photos owned by user as well as tagged photos and uploaded. Now user access MController privacy settings on shared images and protect from other viewers.

A snapshot of main interface of MController is shown in Figure 3 illustrates that how MController runs in each step and execution. Initially the user selects the image which he needs share and click on share button as showing in figure 3.a. the figure 3.b shows share image and privacy setting option. This privacy setting option is the main aim of MController system. If the user selects the privacy settings option, settings page appeared as like figure 3.c. the figure 3.c shows the options of individual persons as well as groups. Here the user selects access or deny option for different groups like family, friends and coworkers. After settings completed, the user click on save button or else click on cancel button to reset the settings. Once the settings are saved by user, under the shared image, the list of visitors can appeared according to the user privacy

settings as shown in figure 3.d. The visitors list informed that who can only see and share the user's image.

VII. Related Work

Access control for OSNs is still relatively a new research area for privacy issues. Presently several access control models for OSNs have been introduced. Fong et al. proposed an access control model that formalizes and generalizes the access control mechanism implemented in Facebook, which admitting arbitrary policy vocabularies that are based on theoretical graph properties. Fong recently formulated this paradigm called a Relationship- Based Access Control (ReBAC) model that bases authorization decisions on the relationships between the resource owner and the resource accessor in an OSN. Carminati et al. recently introduced collaborative security policies, a new class of security policies, that basically enhance topology-based access control with respect to a set of collaborative users.

VIII. Conclusion

In this paper, we found the need of privacy for OSN and solution of collaborative authorization management of the shared data. We introduced MController technique to provide their own privacy preferences on a shared data by the different controllers. Additionally MPAC model evaluated providing decision voting schemes and the privacy evaluation.

IX. Future Work

In the future work, we are planning to investigate advanced MController technique to provide privacy settings for the group of photos at a time, because users may be involved to put privacy setting for the number of photos at a time. By this MPAC model it is time consuming process. So that we would study advanced MController for shared data to automatic configure the privacy.

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Interpretation of IEEE 802.16e (Wimax)

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Abstract - The development of 802.16 standards for Broadband Wireless Access technologies was motivated by the rapidly growing need for high-speed, ubiquitous and cost-effective access. The limitations of conventional Broadband wireless access have been overcome with the scalable features of WiMAX. The aim of this paper is to analyse all compulsory features of the WiMAX OFDM physical layer specified in IEEE 802.16e. This paper gives an overview about the WiMAX standard and studies the performance of a WiMAX transmitter and receiver. This is done in order to study the WiMAX network practically. WiMAX network is implemented and analysed in great detail with the help of simulation results. Simulation is performed in the Matlab simulink.

Keywords : *WIMAX, OFDM, 4G, WLAN.*

GJCST-E Classification : *C.2.1*

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Ruby Verma [α] & Pankaj Garg [σ]

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I. Introduction

Accompanying the explosive growth of the Internet during the last decades, the current expansion of wireless technology promises a greater impact on how people communicate, interact and enjoy their entertainment. With the demand for greater range of services, such as video conferences, or applications with multimedia contents, the telecommunication industry is changing. The increased dependence on computer networking and the Internet has resulted in a wider demand for connectivity to be provided "any where, any time", which leads to the rise in the requirement for higher capacity and high reliability in broadband wireless telecommunication systems. Wireless networks have become increasingly interoperable with each other and this reflects a paradigm shift towards new generations of mobile networks where seamless mobility across heterogeneous networks becomes fundamental. This generation is referred to as fourth generation (4G).

Future users will be connected through different available access networks when they move from one place to another (at home, in the office, on the bus, on the train or in the shopping mall) [1]. For example, a video teleconference can transparently switch from an enterprise Wireless Local Area Network (WLAN) to the traditional cellular environment when driving home and to the fixed home network when arrived. This shows that the users can access and maintain a seamless connectivity anywhere, anytime through any access technology owned by any operator to use any available service.

a) WiMAX Technology

WiMAX (also known as IEEE 802.16) is a wireless digital communication system that is intended for wireless "metropolitan area networks" (WMAN). It can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. In 2005, when IEEE introduced first Mobile WiMAX standard 802.16e, and some of the added features of 802.16e were:

Enhanced mobility and portability capabilities, improved NLOS coverage by using adaptive antenna system (AAS) with multiple inputs multiple output (MIMO) technology, increased system gain and improved indoor penetration by adopting denser sub channelization and handovers for portable and mobile access.

b) WiMAX 802.16/d/e and Related Standards

Table 1 shows a summary for WiMAX 802.16 /d/e and related standards specifications.

Table 1 : WiMAX Standards

Parameters	802.16	802.16d/HiperMAN	802.16e
Completed	December 2001	June 2004	2005
Spectrum	10-66 GHz	<11 GHz	<6GHz
Channel Conditons	Line-of-sight service	Nonline-of-sight Service	Nonline-of-sight Service
Bit Rate	32-134 Mbps in 28MHz channel bandwidth	Up to 75 Mbps in 20MHz channel bandwidth	Up to 15 Mbps in 20MHz channel bandwidth
Modulation	QPSK, 16QAM and 64 QAM	OFDM256FFT, QPSK, 16QAM and 64QAM	Scalable OFDMA, QPSK, 16QAM and 64 QAM
Mobility	Fixed	Fixed	Nomadic/mobile
Channel Bandwidths	20, 25 and 28 MHz	1.75-20MHz	1.75-20 MHz

II. Architecture

a) WiMAX Network Architecture

WiMAX architecture comprises of several components but the basic two components are BS and

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SS. Other components are MS, ASN, CSN and CSN-GW. The WiMAX Forum's Network Working Group has developed a network reference model according to the IEEE 802.16e air interface to make sure the objectives of WiMAX are achieved. To support fixed, nomadic and mobile WiMAX network, the reference model (Figure 1) can be logically divided into four parts [5].

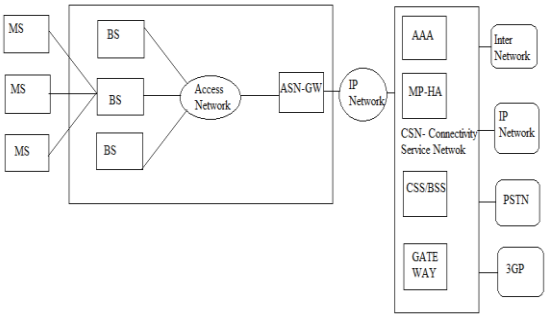


Figure 1 : WiMAX Network Architecture

- *Base Station (BS)*

The BS provides connection between operator networks and wireless subscriber devices. To enable wireless communications consists of antennas, transceivers, and other electromagnetic wave transmitting equipments.

- *Subscriber Station (SS)*

Also called Mobile Station (MS). The SS is the user that needs to use services while in motion at vehicular speed. These SS are battery operated compared to the fixed station. Generally mobiles and laptops are used as SS.

- *Access Service Network (ASN)*

It is owned by NAP, formed with one or several base stations and ASN gateways (ASN-GW) which creates radio access network. It provides all the access services with full mobility and efficient scalability. Its ASN-GW controls the access in the network and coordinates between data and networking elements.ASN–GW performs traffic management function within the ASN.

- *Connectivity Service Network (CSN)*

Provides IP connectivity to the Internet or other public or corporate networks. It also applies per user policy management, address management, location management between ASN, ensures QoS, roaming and security.

i. *Design Details*

As any other communication system, WiMAX has three basic elements, a transmitter, a receiver, and a channel over which the information is sent.

WiMAX comprises of two main parts:

1. WiMAX base station
2. WiMAX receiver

1. *WiMAX Base Station :* It is often called WiMAX tower or booster. The base station broadcasts radio frequencies to the receiver end.
   - Responsible for: Providing air interface to the MS and it performs in MAC and PHY.
   - Additional functions: Frequency reuse, handoff, tunnel establishment, QoS & classification of traffic etc.
   - Management: Session management, bandwidth management for uplink and downlink and multicast group management etc.
   - Practical Face: Tower in outdoor environment and electronic equipment in indoor environment.
2. *WiMAX Receiver :* WiMAX receiver receives the radio frequency from the WiMAX base station and makes sure the connectivity of WiMAX network is in range.
   - Responsible for: Providing connectivity between subscriber equipment (such as mobile phone or laptop) and a WiMAX base station.
   - Additional function: Packet priority, network interoperability and QoS.
   - Connection: Backhaul, high speed microwave link which is also referred to a connection between core network and WiMAX system.
   - Provides User: VoIP, multimedia and Internet access and many mobile applications.
   - Practical face: Customer Premises Equipment (CPE) for indoor and outdoor purposes.

ii. *WiMAX Simulation Model*

The Simulink model of WiMAX PHY developed for the study is as shown in Figure 2, the model consists of transmitter and receiver section linked by the Channel sub systems.

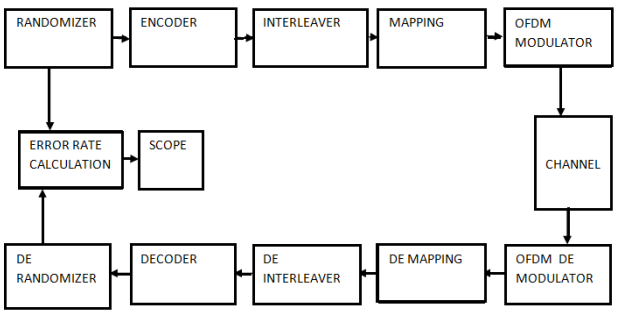


Figure 2 : Block Diagram of WiMAX Simulation Model

Main subsystems are detailed as:

a. *Randomization*

Randomization is the first process carried out in the physical layer after the data packet is received from the higher layers. Each burst in Downlink and Uplink is randomized. Randomizer operates on a bit by bit basis. The purpose of the scrambled data is to convert long sequences of 0's or 1's in a random sequence to improve the coding performance . The main component

of the data randomization is a Pseudo Random Binary Sequence generator which is implemented using Linear Feedback Shift Register. The generator defined for the randomizer is given by Equation 1:

$$1 + x^{14} + x^{15} \quad (1)$$

b. *Reed Solomon Encoding*

The purpose of using Reed-Solomon code to the data is to add redundancy to the data sequence. The encoding process for RS encoder is based on Galois Field Computations to do the calculations of the redundant bits. Galois Field is widely used to represent data in error control coding and is denoted by GF (2m). WiMAX uses a fixed RS Encoding technique based on GF(28) which is denoted as:

$$RS\ (N = 255, K = 239, T = 8)$$

Where:

N = Number of Bytes after encoding
K = Data Bytes before encoding
T = Number of bytes that can be corrected

Eight tail bits are added to the data just before it is presented to the Reed Solomon Encoder stage. This stage requires two polynomials for its operation called code generator polynomial g(x) and field generator polynomial p(x). The code generator polynomial is used for generating the Galois Field Array whereas the field generator polynomial is used to calculate the redundant information bits which are appended at the start of the output data. These polynomials are defined by the standard as below:

Code Generator Polynomial:

$$g(x) = (x+\lambda^0)(x+\lambda^1)(x+\lambda^2)(x+\lambda^3)..(x+\lambda^{2T-1})$$

Field Generator Polynomial:

$$p(x) = x^8+x^4+x^3+x^2+1$$

c. *Interleaving*

Interleaving is done by spreading the coded symbols in time before transmission. The incoming data into the interleaver is randomized in two permutations. First permutation ensures that adjacent bits are mapped onto nonadjacent subcarriers. The second permutation maps the adjacent coded bits onto less or more significant bits of constellation thus avoiding long runs of less reliable bits.

d. *Modulation*

The interleaver reorders the data and sends the data frame to the IQ mapper. The function of the IQ mapper is to map the incoming bits of data from interleaver onto a constellation. In the modulation phase the coded bits are mapped to the IQ constellation, starting with carrier number -100 on up to carrier number + 100. To simplify transmitter and receiver designs, all symbols in the FCH and DL data bursts are transmitted with equal power by using a normalization factor. The constellation-mapped data is subsequently modulated onto all allocated data carriers in order of increasing frequency offset index.

iii. *Simulation Results*

For performance analysis of the PHY model, simulation is performed by considering the standard test vectors specified in the WiMAX standard document. Several test cases and test vectors for each component are provided in hexadecimal format.

Input Data (35 bytes long)

45 29 C4 79 AD 0F 55 28 AD 87 B5 76 1A 9C 80 50 45 IB 9F D9 2A 88 95 EB AE B5 2E 03 4F 09 14 69 58 0A 5D

In WiMAX, this is simulation of transmitter. In figure 3 (a) the diagram simulation is after randomizer input. Different types of encoder is used for encode the data and figure 3(b) is the output after the encoder block. Interleaving is a technique commonly used in communication systems to overcome correlated channel noise such as burst error or fading. The inter leaver rearranges input data such that consecutive data are spaced apart. Figure3 (c) is simulation after inter leaver block of WiMAX. During the symbol mapping stage, the sequence of binary bits is converted to a sequence of complex valued symbols and figure 3(d) is the output after the mapper block.

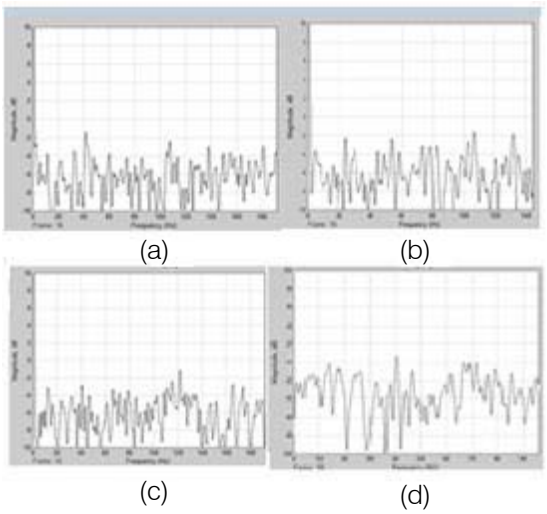


Figure 3 : Signal after (a) Randomizer block, (b) Encoder block, (c) Interleaver, (d) Mapper

A scatter plot or scatter graph is a type of mathematical diagram using Cartesian coordinates to display values for two variables for a set of data. The data is displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis which shows in figure4.

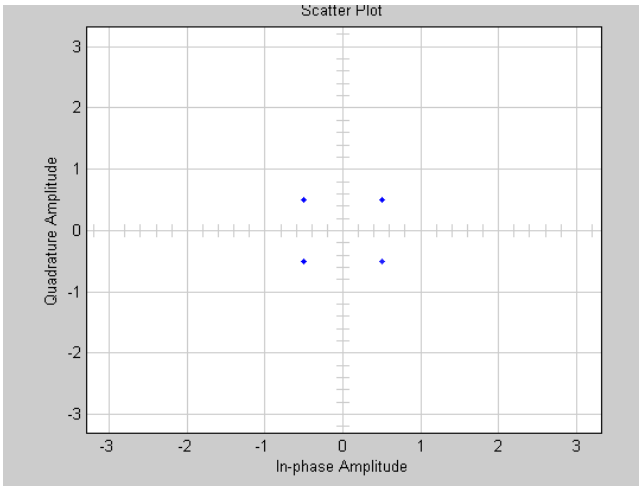
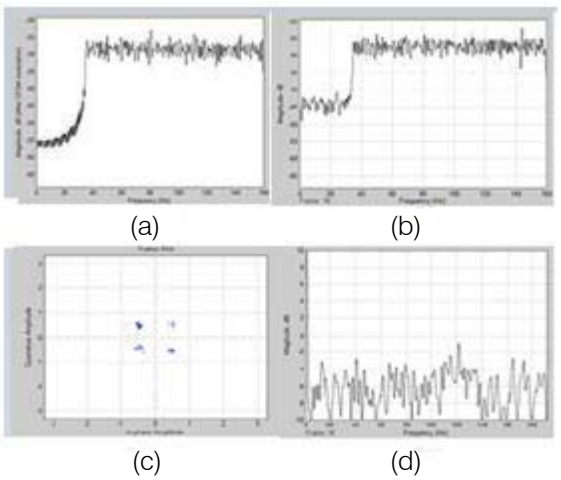


Figure 4 : Scatter plot after mapping

Modulation is very necessary for communication for long distances. So figure 4(a) is output after modulation block. After modulation the AWGN channel is used this adds noise and fading which shows in figure 5(b) that is before demodulation. Scatter plot shows the output before the de-mapper figure 5(c) and after de-mapper the output is figure 5(d) which has some effect of noise due to channel and we can see that the scatter plots are not pointed due to noise.

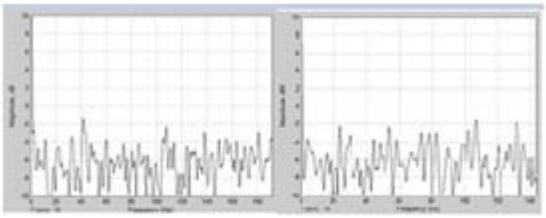


(a) (b)

(c) (d)

Figure 5 : Signal After (a) Modulator Block (b) Before Demodulator (c) Before De-Mapper (d) After De-Mapper

After de-mapping of signal, signal passes through the decoder block which decodes the original signal and figure 6(a) shows the output after decoder and finally at the receiver end de-randomizer is done to get the original signal which shows in figure 6(b).



(a) (b)

Figure 6 : Signal After (a) Decoder Block, (b) De-Randomizer Block

After running the simulink block in MATLAB the waveforms that are analyzed are shown in figure, figure, figure, and figure. The results are analyzed by observing the error rate calculation in MATLAB.

III. Conclusion

As foreseen by many researchers, the next generation wireless mobile communications (4G) will be based on the heterogeneous underlying infrastructure integrating different wireless access technologies in a complementary manner. By using the simulation tool, I have analyzed the various waveforms after each block of the signal transmitted and received over the channel in a WiMAX network.

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Enhancement of Network Life Time using Binary Tree Based Multicast Routing Protocol for Mobile Ad Hoc Network

By Prof. Arvind S & Guru Prasad
Guru Nanak Dev Engineering College, India

Abstract - A mobile ad hoc network (MANET) is an interconnected system of mobile hosts without a fixed infrastructure. In MANETs, each mobile host has multi-hop transmission capability, and it has to serve as a router. Owing to the dynamic topology and limited resources of mobile hosts, the routing scheme in MANETs presents an important challenge. In this study, a Enhancement of Network Life Time using Binary Tree Based Multicast Routing Protocol for MANET is proposed. In this proposed scheme, all nodes are randomly classified into two types, group-1 and group-2. To achieve the load balance, two multicast trees (tree-1 for group-1 and tree-2 for group-2) are constructed. The proposed system mainly focused on maintaining route stability. Thus proposed system outperform AOMDV version of AODV in term of Performance evaluation metrics such as packet delivery ratio, control overhead , Network life time, Normalized delay.

Keywords : *packet delivery ratio, control overhead, network life time, normalized delay.*

GJCST-E Classification : *C.2.2*

Strictly as per the compliance and regulations of:

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Prof. Arvind S [α] & Guru Prasad [σ]

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Keywords : packet delivery ratio, control overhead, network life time, normalized delay.

I. Introduction

A mobile ad hoc network (MANET) is an interconnected system of mobile hosts without a fixed infrastructure. Every node in an MANET must be able to function as a route to forward data to other nodes. When applications must send the same data to more than one destination, multicasting is often used. Multicasting reduces the communication costs for applications that send the same data to multiple recipients. Instead of sending via multiple unicast, multicasting minimizes the link bandwidth consumption, router processing and delivery delay .Existing multicast routing protocols for MANETs can be broadly classified into tree-based routing protocols [1–9] and mesh-based routing protocols [10–15]. Tree-based routing protocols build a tree structure that connects all multicast members and provide one path between a pair of source and destination nodes.

Mesh-based protocols yield a multi-path between the source and the destination nodes. When a link fails, mesh-based multicast protocols do not need to re-compute a mesh. Royer and Perkins [7] propose a multicast ad hoc on demand distance vector routing protocol (MAODV). MAODV establishes on-demand multicast tree and uses these for delivery of multicast data. MAODV is a typical tree-based multicast routing protocols. Ballaradie, A., Crowcroft J., Francis[3] proposed a new protocol called MQ, Multicast with QoS, which supports multimedia group communications with QoS guarantees for heterogeneous recipients. With MQ, while resource reservation is de-coupled from QoS multicast routing, they are integrated in a way to avoid the problem of sender-oriented path determination, a problem that occurs when RSVP is used in conjunction with QoS routing for heterogeneous reservations. Bommaiah, E .and McAuley, A[5]propose a multicast routing protocol for ad-hoc networks, which is particularly efficient for multi-source multicast transmissions. In order to minimize the total transmission power in MANETs, routing protocols have been proposed to increase the lifetime of networks[16 – 18].Minimum total transmission power (MTPR) [17] establishes on-demand unicast routing based on the transmission power. This paper is discussed in following number of section. Section II deals Ad-hoc wireless network, Section III deals with Routing protocol. Section IV Wireless Simulation, Section V deals with Simulation Results, Section VI deals with conclusion and section VII deals with References.

II. Adhoc Wireless Network

A mobile Adhoc network is a collection of wireless mobile nodes that communicate with one another without any fixed networking infrastructure. Ad Hoc networks are multi-hop wireless networks where all nodes cooperatively maintain network connectivity. These types of networks are useful in any situation where temporary network connectivity is needed, such as in disaster relief. In multi-hop wireless ad-hoc networks, designing energy-efficient routing protocols is important because nodes have limited power. However, it is also an inherently hard problem due to two important factors: First, the nodes may be mobile, this requires that the energy-efficient routing protocol should be fully distributed and adaptive to the current states of nodes; Second, the wireless links may be uni-directional due to asymmetric power configurations of adjacent nodes.

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III. Routing Protocol

Ad hoc Routing protocols is classified into two types such as proactive and reactive. The table-driven routing protocol is proactive, it worked on distance vector based or link state based routing strategies. The drawback of this algorithm is the frequent updation is required which consumes large amount of memory, bandwidth and power [31]. But, in the reactive routing protocol, each node does not need to maintain the routing table. When a source node is ready to send data, it initiates the route discovery procedure and maintains its routes only. The reactive routing protocol minimizes the routing overhead and also called on-demand approach.

a) AODV Protocol

The AODV [32] protocol based on the reactive routing discovery uses three different kinds of messages: Route request (RREQ), Route Reply (RREP) and Route Error (RERR). In addition, destination sequence numbers are used to ensure loop freedom at all times. In AODV, each source node finds a new route by the limited flooding of RREQ and obtains a route to its destination through RREP.

b) AOMDV Protocol

AOMDV [33] uses the basic AODV route construction process. In this case, however, some extensions are made to create multiple loop-free, link-disjoint paths. The main idea in AOMDV is to compute multiple paths during route discovery. It consists of two components:

1. A route update rule to establish and maintain multiple loop-free paths at each node.
2. A distributed protocol to find link-disjoint paths.

Before describing AOMDV, we first discuss AODV, from which it is derived. In AODV, when a source needs a route to a destination, it initiates a route discovery process by flooding a RREQ for destination throughout the network. RREQs should be uniquely identified by a sequence number so that duplicates can be recognized and discarded. Upon receiving a non-duplicate RREQ, an intermediate node records previous hop and checks whether there is a valid and fresh route entry to the destination in routing table. If such is the case, the node sends back a RREP to the source; if not it rebroadcasts the RREQ. A node updates its routing information and propagates the RREP upon receiving further RREPs only if a RREP contains either a larger destination sequence number (fresher) or a shorter route found. In AOMDV each RREQ, respectively RREP arriving at a node potentially defines an alternate path to the source or destination. Just accepting all such copies will lead to the formation of routing loops. In order to eliminate any possibility of loops, the advertised hop count is introduced. The advertised hop count of a node i for a destination d represents the maximum hop count of the multiple paths for d available at i. The protocol only accepts alternate routes with hop count lower than the advertised hop count, alternate routes with higher or the same hop count are discarded. The advertised hop count mechanism[33] establishes multiple loop-free paths at every node. These paths still need to be disjoint. Duplicate copies of a RREQ are not immediately discarded. Each packet is examined to see if it provides a node disjoint path to the source. For node-disjoint paths all RREQs need to arrive via different neighbors of the source. This is verified with the first hop field in the RREQ packet and the first hop list for the RREQ packets at the node. At the destination a slightly different approach is used, the paths determined there are link-disjoint, not node disjoint. In order to do this, the destination replies up to k copies of the RREQ, regardless of the first hops. The RREQs only need to arrive via unique neighbors.

c) Enhancement in Network Life time using binary tree based multicast routing protocol for mobile ad hoc network

In this study, a Enhanced Network Life Time tree-based multicast routing protocol (NLDTMRP) for MANETs is proposed. In the proposed scheme, all nodes are randomly classified into two types, group-1 and group-2. To achieve the load balance, two multicast trees (tree-1 for group-1 and tree-2 for group-2) are constructed .Each node maintained two routing tables: the neighbouring table and the routing table. The neighbouring table was easily obtained by the periodic broadcast of the hello packet. These tables are described below:

1. *Neighbouring Table :* Any node which want to know which are its neighbour with in its transmission range it will broadcast Hello packet . The nodes which are in transmission range will reply to Hello packet. The format of the table

Nodeid	Distance

2. *Routing Table :* This table contained the path that was used for the transmission of data. The format of the path table was

Src ID	DestID	Seqno	Routeclass	Next_hop

The src ID and Dest ID fields contains the unique addresses of the source and the destination node, respectively. The seqno field contains the sequence number of the source node (guaranteeing the loop-freedom of all routes to the destination node). The route_class field recorded the class of route for group-1 or group-2. The next_hop field contained the address of the neighbouring node to which data packets had to be forwarded.

Route Discovery Process

In the proposed scheme, power level threshold ($P_{threshold}$) is defined. When the source node wants to send the packet to the destination nodes, it broadcasts the route request (RREQ) packet to the neighbouring nodes in its transmission range, when the source node does not have a path in the routing table. The RREQ packet carries the following information in its header:

TYPE	Src	Dest List	Src Seq	Path Traversed	Class	RREQ Type

'Type' refers to the packet type: RREQ, RREP or RERR. 'Src' is the source node. 'SrcSeq' is a monotonically increasing sequence number. 'Src' and 'SrcSeq' are used to uniquely identify each RREQ packet. It can be used to check duplicate copies of an old request and detect the stale cached routes. 'DestList' is a set of destinations. 'Path Traversed' records the routing information. 'Class' is the type of node: group-1 or group-2. 'RREQType' refers to the RREQ type: RREQ, After neighbouring nodes receive the RREQ packet, the neighbouring nodes first check the remaining battery of nodes (P_{remain}). When P_{remain} of nodes is higher than $P_{threshold}$, the neighbouring nodes store received the RREQ packet and re-broadcasted the RREQ packet. The neighbouring node adds its ID to the routing path field of the RREQ packet and the class field of the RREQ packet is assigned a type (group-1 or group-2) of neighbouring node. When the destination node receives the first RREQ packet with group-1 and the first RREQ packet with group-2, the destination node selects the last hop of each RREQ packet as its upstream node to be the primary routing paths for tree-0 and tree-1. Then, the destination node sent two route reply (RREP) packets to the source node. The RREP packet carries the following information in its header:

TYPE	Source	Destination	ReversePath	Class	RREPType

Here 'Type' is certainly RREP. 'Source' is the source node. 'Destination' is the destination node. The field 'ReversePath' in each RREP packet includes the reverse path. 'Class' is the type of node: group-1 or group-2.The Class field of RREP packet is the assigned type for the RREQ packet. When the intermediate node receives the RREP packet, it selects the upstream node based on the corresponding type of RREP packet and sends the RREP packets to the source node. The detail of the route discovery process.

i. *Algorithm 1: Route discovery process*

A network is modeled as graph G(N, E), where N is the finite set of mobile nodes and E is a set of links. Suppose n is the number of mobile nodes and N is the set of mobile nodes N= {N1, N2, . . . , Nn}. Assume that source node Ni wants to find a path to destination node Nj. Node Ni broadcasts a RREQ packet, and node Nk receives the RREQ packet, where Ni, Nj, Nk [N, $1 \leq i, j, k \leq n$ and $i = j$]. if (node Nk is the destination node Nj)

{

1. Node Nk selects the first RREQ packet with group-1 and RREQ with group-2 as the upstream node and unicasts a RREP packet to the source node.
2. Each node receives the reply RREP packet and writes the entry to the current routing table. Then the node selects an upstream node with a corresponding type of RREP.

}

else if (P_{remain} of node Nk is higher than $P_{threshold}$) {

1. Node Nk stores the received RREQ packet in its list of upstream nodes.
2. Node Nk forwards the RREQ packet to the neighbouring nodes.

}

else

Node Nk discards the request packet.

Route Maintenance Process

It is divided in to three parts:

i. *Join Operation*

When a new member wants to join the multicast tree, it broadcasts a join route request (RREQJ) packet across the networks. Only a node that is a member of the multicast tree (i.e. a router for the group) may respond, if a node receives a RREQJ packet for a multicast group of which it is not a member or it does not have a route to that group, it creates a reverse route entry to the prospective node and then broadcasts the RREQJ packet to its neighbours. Any intermediate node receives the RREQJ, it rebroadcasts the RREQJ if the P_{remain} of the node is higher than $P_{threshold}$. When each member node of the multicast tree receives the RREQJ packets it sends back the join route reply (RREPJ) packet with set class field. When each intermediate node receives the RREPJ packet, the intermediate node selects a downstream node based on the corresponding type of RREPJ packet. The prospective node selects the first RREPJ packet with group-1 and the first join reply with group-2 to join the multicast tree.

ii. *Node Prune Operation*

When a node wants to move from the multicast tree, the pruning node broadcasts to its upstream node a pruning route request (RREQP) packet. When the upstream node receives the RREQP packet, it removes the corresponding entry from its multicast routing table. If the upstream node becomes a leaf node and it is not the tree receiver, the node can further prune itself from the tree.

iii. *Broken Link Maintenance*

In NLTMRP, when a node fails to deliver the data packet to the next hop of the route, it considers the link to be broken and sends a route error (RERR) packet

to the source node. When the upstream node receives the RERR packet, it removes the corresponding entry from its routing table and forwards the RERR packet to the source node. If only one of the two routes is broken, the source uses the remaining valid route to deliver data packets. When both routes of the path are broken, the source node initiates the route discovery process. The RERR packet carries the following information in its header:

a. *Aglorithm2*

A network is modeled as graph G=(N, E), where N is the finite set of mobile nodes and E is a set of links. Suppose n is the number of mobile nodes and N is the set of mobile nodes N ={N1 , N2 , .. . , Nn}. Assume that node Ni wants to send a packet to node Nj, where Ni, Nj, [N, 1 <= i, j<= n, i = j]and that the link between node Ni and node Nj breaks.

if (the link of node Ni to node Nj breaks)

1. Node Ni saves the current data packet.
2. Node Ni broadcasts a repair route request (RREQR) packet to node Nj , counts down

T_{time} out seconds, and waits for the repair route reply (RREPR) packet to return.

If (the RREPR packet is back in T_{time} out seconds)

{

1. Node Ni uses the replacement path to replace the path that breaks.
2. Node Ni continues packet transmission.

}

else

Node Ni sends an RERR packet to the source and restarts the routing discovery process.

The simulation was implemented by using NS2 (Network Simulation 2, version 2.35)[30]. The simulation modeled a network in a 900 m × 900 m area with varying mobile speed. We used random waypoint model was used as mobility model. In random waypoint model, each node randomly selects the moving direction, and when it reaches to the boundary of simulation area, it bounces back and continues to move. The transmission range was 150 m. The data packet size was 250 bytes. The initial power of each node was 10 J. $P_{threshold}$ was 0.5J. Each simulation was executed for 600sec. The source and destination nodes were randomly chosen and each node was randomly assigned an initial energy. We used constant bit rate (CBR) as the traffic type. In CBR model, the source transmits a certain number of fixed size packets. The parameters used in the simulations are listed as shown below. The performance evaluation metrics used in the simulations were:

1. *Packet Delivery Ratio*

The data packets delivered divided by the data packets expected to be delivered.

2. *Control Overhead*

The control packets transmitted divided by the data packets delivered.

3. *Packet Delivery Delay*

The interval from the time the multicast is initiated to the time the last host finishes its multicasting.

4. *Total Energy Consumption*

The total consumed Energy of all nodes after data transmission.

5. *Network Lifetime*

The duration of the network operation time until the first node failure because of battery depletion at the node.

IV. Wireless Simulation

The Network simulation-2 implementation has following important parts.

1. Generating wireless Environment.
2. Creating UPD and FTP Agent.
3. Various modules are added to simulate node mobility and wireless networking such as mobile node, ad-hoc routing such as aodv, MAC802.1.
4. Radio propagation Model and channel etc.

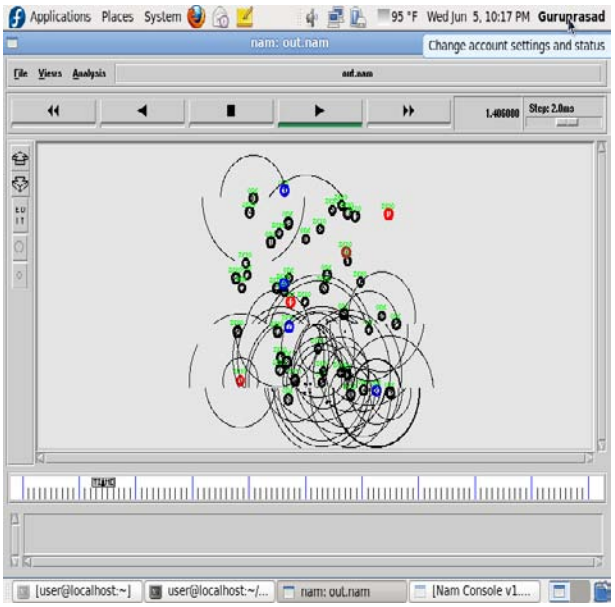

Figure 1 : Simulation shown with NAM animator

Table 1 : Simulation Parameters

Simulator	Ns-2.35
Routing Protocol	AODV, AOMDV, NLTMRP
Simulation Time	600sec
Number of Nodes	100
Mobility peed(m/s)	1-25 m/s
Mobility Model	Random way point Model
Simulation Area	900 X 900
Node transmission Range	150 m
Data packet Size	250 bytes
Traffic Type	CBR

The simulation was implemented by using NS2 (Network Simulation 2, version 2.35) [30]. The simulation modeled a network in a 900 m × 900 m area with 50 mobile nodes. We used random way point model was used as mobility model. In random waypoint model, each node randomly selects the moving direction, and when it reaches to the boundary of simulation area, it bounces back and continues to move. The mobile speed of each node was from 1 to 25 m/s. The transmission range was 150 m. The data packet size was 250 bytes. The initial energy of each node was 10 J. P(threshold) was 0.15J . Each simulation was executed for 600s. The value in the following simulation figures are the average values of 50 runs. The source and destination nodes were randomly chosen and each node was randomly assigned an initial energy. We used constant bit rate (CBR) as the traffic type.

V. Simulation Results

In the following, the impact of mobility speed on AODV, AOMDV and NLTMRP is studied. These protocols have been simulated for packet delivery ratio, packet delivery delay, total energy consumption and Network Life Time.

From **Figs. 2–5**, we depict the routing performance of three protocols under different mobility speeds. **Fig.2** shows the performance of the packet delivery ratio under various mobility speeds. As shown in **Fig.2,** the packet delivery ratio decreased with increasing mobility because of more link breaks. Notice that the packet delivery ratio is high when the nodes have low mobility. NLTMRP achieves a much higher packet delivery ratio than AOMDV and AODV because energy is evaluated while establishing of two stable routing paths for multicasting. Thus, the packet delivery ratio of NLTMRP is higher than that of AOMDV and AODV protocol.

From **Fig.3** we depict performance of the packet delivery delay under various mobility speeds. As shown in **Fig.3,** as the mobility speed increases, the packet delivery delay also increases. The packet delivery delay of NLTMRP is lower AOMDV and AODV. This is also because energy is evaluated while establishing of two stable routing paths for multicasting.

From **Fig. 4,** shows the performance of the total energy consumption energy under various mobility speeds. Owing to the mobility of the node making the control overhead increases, it consumes more energy. Therefore the total energy consumption increases with increasing mobility. As observed in **Fig. 4,** the total energy consumption of NLTMRP is lower than that of AOMDV and AODV. This is because of NLTMRP reducing the energy consumption by using dual trees for transmission.

Fig. 5 shows the performance of the control overhead under various mobility speeds. As is expected, the control overhead increases as the mobile nodes became more mobile. The reason is that there are more chances for routes to break when the speed of the mobile nodes is faster. Thus, the number of rebroadcasts increased. NLTMRP not only eliminates inefficient nodes to decrease the number of control packets, but also structures dual trees to reduce the number of route reconstructions. Therefore NLTMRP has a lower control overhead than AOMDV and AODV protocol.

From **Fig. 6** shows the performance of the network lifetime at various mobility speeds. From this figure, the network lifetime of NLTMRP outperforms that of AOMDV and AODV. This is because the node residual battery power of NLTMRP is always higher than that of AOMDV and AODV.

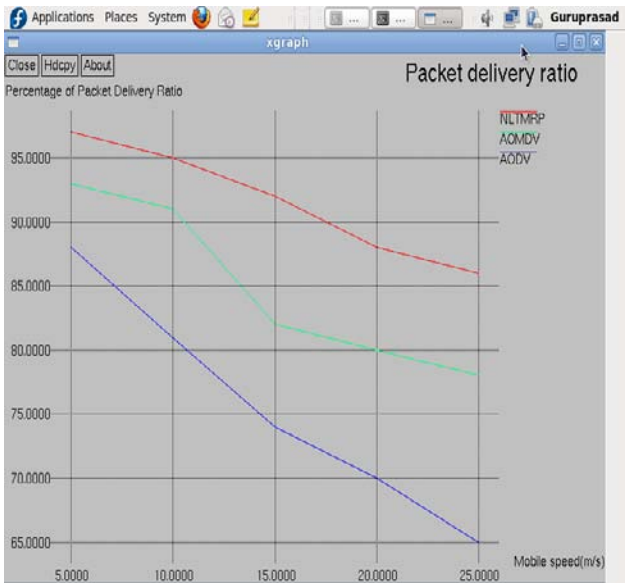

Figure 2 : Packet Delivery Ratio against Mobile Speed

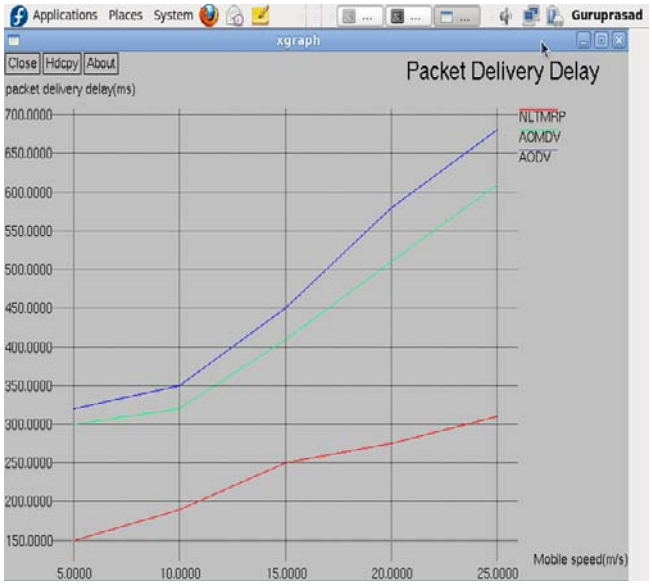

Figure 3 : Packet Delivery Delay against Mobile Speed

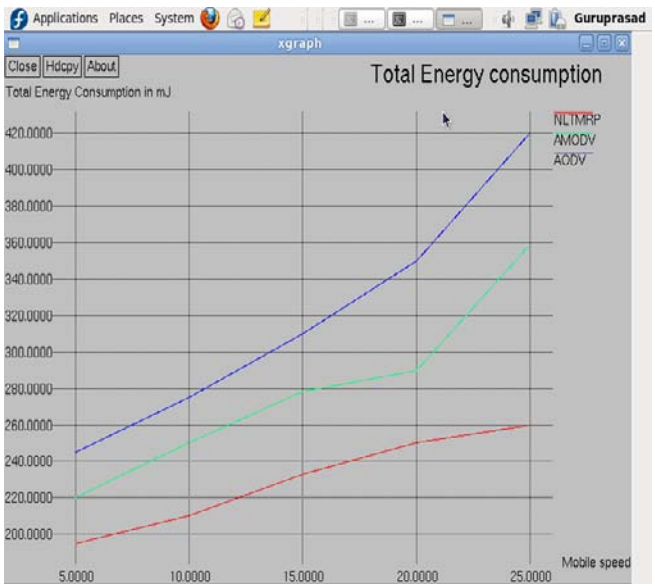

Figure 4 : Total Energy Consumption against Mobile Speed

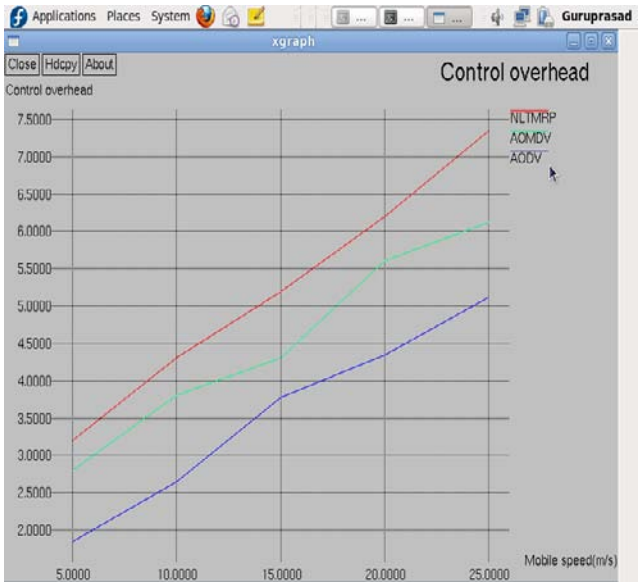

Figure 5 : Control Overhead against Mobile Speed

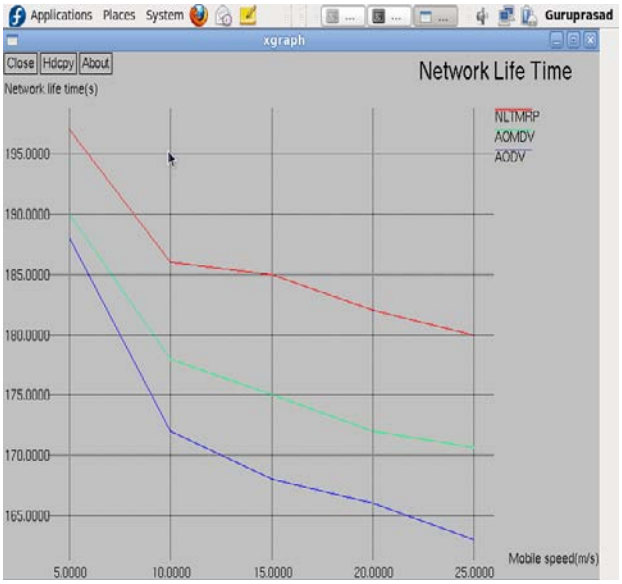

Figure 6 : Network Life Time against Mobile Speed

VI. Conclusion

In this paper, we propose a NLTMRP for MANETs. In this scheme, load balance is used to increase the lifetime of a network. In the route discovery, this scheme not only improves the route stability of multicast routing, but also achieves the load balance of data transmission. Therefore the control overhead for route construction and the number of route reconstructions can be decreased. Simulation results show that the packet delivery ratio and the packet delivery delay of the proposed scheme outperform that of AOMDV and AODV. Moreover, the traffic load can be balanced and the network lifetime can be prolonged. NLTMRP is a energy-aware multicast routing protocol. The node with low energy does not selected as a member of multicast tree. NLTMRP improves the route

stability of multicast routing. The total energy consumption can be decreased and the network lifetime can be prolonged.

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Exploring the Usability of the Pakistani Medical Colleges/ Universities Websites

By Muhammad Shahid Khan & Muhammad Abid Khan
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Abstract - Websites have a great role in the field of internet. Usability has also a precious value in navigating the websites. The objective of this paper is exploring the usability of Pakistani Medical Colleges/Universities and providing the idea of developing the websites in such a way that it fulfilled the user requirements and are easy for the user in using/accessing these sites. Different parameters were checked regarding the usability in the websites of different Medical Colleges/Universities in Pakistan. It was analyzed that these Colleges/ Universities have some gaps in light of usability not following the rules. The usability of can be enhanced by applying the one fixed rule for every aspect so that the user can meet every task easily with no boring exertion and perplexity. The rules should be from government side limiting the sites to be restrictive to these rules entertaining the every type of user.

GJCST-E Classification : K.3.2

Strictly as per the compliance and regulations of:

Exploring the Usability of the Pakistani Medical Colleges/Universities Websites

Muhammad Shahid Khan [α] & Muhammad Abid Khan [σ]

Abstract - Websites have a great role in the field of internet. Usability has also a precious value in navigating the websites. The objective of this paper is exploring the usability of Pakistani Medical Colleges/Universities and providing the idea of developing the websites in such a way that it fulfilled the user requirements and are easy for the user in using/accessing these sites. Different parameters were checked regarding the usability in the websites of different Medical Colleges/Universities in Pakistan. It was analyzed that these Colleges/ Universities have some gaps in light of usability not following the rules. The usability of can be enhanced by applying the one fixed rule for every aspect so that the user can meet every task easily with no boring exertion and perplexity. The rules should be from government side limiting the sites to be restrictive to these rules entertaining the every type of user.

I. Introduction

Usability is a renowned aspect that analyzes the easiness of use of the interface for the user. Followings are the components that can easily explain the term "Usability" [1].

- Learnability is associated with encountering the plan for the first time; it will be effortless for the users to execute the crucial tasks.
- Efficiency is how swiftly a user can come across the diverse tasks after learning the design.
- Memorability is to which extent the user has the skill to perform different errands easily which he had encountered few years ago.
- Errors are how many mistakes made by the user, how scrupulous they are and how simple they can be recoverable.
- Satisfaction is to what confines the design is gratifying?

Usability plays a very important role in the field of web e.g. if the website is planned so that a user is feeling cool to accomplish different errands he wants and he is aware of the existing position in the website, so it is fine, or else he will be perplexed and will never visit this website.

a) Logo

A logo must be placed on every page of the website at a fixed place (Left top corner of the page) due to which a user will be sure about his visit of the site that he is on the same website which he is searching for some time.[2].

b) Title

Title/Name must be placed on every page of the site having a link on it [3].

c) Search

A search option should be present on every page which will ease the user to use the site and search everything without going to the home page [4].

d) Breadcrumbs

There should not be the expectations from the user for efficient use of the breadcrumbs. The proficiency of the routing can be increased by the efficient use of the breadcrumbs and guidelines will be provided to the users using the website [5].

e) Visited and Unvisited Links

The visited and unvisited links should be of specific color. There should be the proper colors for the visited and unvisited links. Before the visiting of a link, it should be of blue color and when it is visited then its color should be changed from blue color to purple which will be helpful for the user to discriminate between the visited and unvisited links [6].

f) Avoid Scrolling Horizontally

The page should have appropriate design to prevent the user from scrolling horizontally. The horizontal scrolling is time wasting and tedious process for the user of the site to visit the all items present on the page [7].

g) Back button is disabled

Different websites consist of bundle of navigation links which are open in the new window/new tab when they are clicked. The back button became disabled rather than enabled which is a tedious process because the new opened window is fresh having no information regarding the earlier visited links [8].

h) Font Size

The font size must be at least 12pts [9].The older persons (ages 65 and older) are the greatest developing on the web and 43% older persons face difficulty as compared to the young persons [10].

Author α : Gandhara University, Peshawar, Pakistan.
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Author σ : University of Engineering & Technology, Peshawar, Pakistan. E-mail : engrabid08@gmail.com

i) Typeface

The two font styles should be followed i.e. Verdana or Arial and the Verdana font style is the preferred style and is linked on all the pages of the website. This font style may be used to enhance the effectiveness of the site [11].

j) About Us

The About us is an important segment is visited by the users to gain the information/guidelines about the College/Institution website. Our studies demonstrate that companies ignore crucial vision to link with users through the portal [12].

k) Site Map

Site maps are the important parts of the site which summarize the whole website. It shows the hierarchy of the website [13].

1. *King Edward Medical University, Lahore (www.kemu.edu.pk)*

S#	Parameters	Yes	No
1	Logo	Yes	
2	Title	yes	
3	Search	Yes (Not on linked pages)	
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	yes	
8	Font Size	yes	
9	Typeface	yes	
10	About us used for org. info	Yes	
11	Site Map		No

In agreement with the diverse policy and probing for these regulations in the website of the above mentioned institution, it has been taken in the deliberation.

The monogram of the institution is present on the home page on the left top corner satisfying the rule. The title is also present on the home page as well as on the linked pages at the top of the page beside the monogram.

According to the regulations there should be a search choice on the top right side of the page on the home page as well as on the linked pages, So after searching the site of that institution, it has been seen that the search option is present on the top right corner of the home page but it was also seen that it was not present on the linked pages.

The breadcrumbs show the step by step navigation which was recently navigated, but in the site of this institution it is lacking.

The site was also checked for the colors of the visited and non visited links. When the link was clicked then it was observed that the clicked linked did not change color which is big problem for the user to discriminate between the visited and non visited links and he can't be aware of himself that which part of the site he has visited.

There is no horizontal scrolling in the website and the user is free of tedious effort to scroll horizontally.

When the site was tested for the back button, it was analyzed that when the different pages were navigated in the site, we were capable to go backside (the back button is enable) and the linked contents do not open in the new window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled back button.

The font size is at least 12pts according to the policy which is helpful for the old people using that site.

The typeface in the site used is Verdana and Arial as in the regulations.

As according to the rules, there should be an "About Us" option in which there will be the information about the institute/organization, which is present in site of that institution.

The "Site Map" shows all the stuffing of the site in tree structure, so by clicking on the "Site Map", it will be supportive for the user to see that what contents this site involves, but this site lacks the "Site Map".

2. *Punjab Medical College, Faisalabad. (www.pmc.edu.pk)*

S#	Parameters	Yes	No
1	Logo	yes	
2	Title	yes	
3	Search		No
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	yes	
8	Font Size	Yes	
9	Typeface	yes	
10	About us used for org. info	yes	
11	Site Map		No

The monogram of the institution is at the proper place (Left top corner). The title is available on the home page and on the linked pages also. Following the rules, there should be a search option on the top right side of the page on the home page as well as on the linked pages, but after searching that site, there is no search option on the home page and the linked pages.

Breadcrumbs are not creating in this site and the color of visited links is also not changing.

There is a horizontal scrolling in the website which is tedious effort for the user to scroll horizontally again and again to see the contents on the page. When the site was tested for the back button, it was analyzed that when the different pages were navigated in the site, we were capable to go backside (the back button is enable) and the linked contents do not open in the new

window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled back button.

The font size is at least 12pts according to the regulations which is helpful for the matured people using that site. The typeface in the site used is Verdana and Arial as in the rules.

"About us" is present in the site giving the information of the Institution.

"Site Map" is not present which can escort to puzzlement for the user because the "Site Map" provides the stuffing of the website in tree structure from which a user can guess that what the contents it involves in less time.

3. *Quaid e Azam Medical College Lahore (www.qamc.edu.pk)*

S#	Parameters	Yes	No
1	Logo		No
2	Title	Yes	
3	Search	Yes(Not on right top corner & not present on the linked pages)	
4	Breadcrumbs		No
5	Visited & unvisited Link	Yes	
6	Avoid Scrolling horizontally		No
7	Back button enable	Yes	
8	Font Size	Yes	
9	Typeface	Yes (Times New Roman)	
10	About us used for org. info	Yes	
11	Site Map		No

The monogram of the institution is not at the proper place (top left corner).

The title is present on the home page and on the linked pages.

The search option in this site is present but is not at its proper place and there is no link on it which can create a big problem for the user because the user is aware only about its proper place and when he finds the search option absent on the page and he will be confuse about searching the required contents on the site.

The breadcrumbs in this site are not creating and the color of the visited links became changed from that as at the time of unvisited.

There is no horizontal scrolling in the website and the user is free of tedious effort to scroll horizontally.

When the site was tested for the back button, it was analyzed that when the different pages were navigated in the site, we were capable to go backside (the back button is enable) and the linked contents do not open in the new window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled back button.

The font size is at least 12pts according to the rules which is assistive for the aged people using that site.

The typeface in the site used is Arial as in the rules.

"About us" is present in the site supplying the information of the Institution.

The "Site Map" is lacking in the site of this institution.

4. *Rawalpindi Medical College Rawalpindi (www.rmc.edu.pk)*

S#	Parameters	Yes	No
1	Logo	Yes	
2	Title	yes	Link not available
3	Search		No
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	Yes	
8	Font Size		
9	Typeface	yes	
10	About us used for org. info	yes	
11	Site Map		No

The monogram of the institution is at the proper place (Left top corner). The title is available on the home page but is lacking on the linked pages. Following the rules, there should be a search option on the top right side of the page on the home page as well as on the linked pages, but after searching that site, there is no search option on the home page and the linked pages.

There is no creation of the breadcrumbs when the site is further searched/navigated.

When the site was navigated for analyzing the colors of the visited and non visited links, it was evaluated that the when the links were navigated for further searching and was back to that link, it was noticed that the color of the visited link was not change to purple which is a big exhaustion for the user using the site because he will not be sentient of himself that which part of the site he has navigated so far.

There is a horizontal scrolling in the website and the user will face much problem and will be time consuming in seeing the contents of the page and scrolling horizontally again and again.

When the site was checked for the back button, it was evaluated that when the different links were visited in the site, we were able to go back (the back button is enable) and the linked contents do not open in the new window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled rear button.

The font size is at least 12pts according to the rules which is assistive for the aged people using that site.

The typeface in the site used is according to the policy.

"About us" is present in the site supplying the information of the Institution.

The "Site Map" is not present in the site to support the user to see the stuffing of the website in less time.

5. *Hamdard College of Medicine & Dentistry, Karachi (www.hamdard.edu.pk)*

S#	Parameters	Yes	No
1	Logo	Yes	
2	Title	yes	Link not available
3	Search	Yes	
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	Yes	
8	Font Size		No (11 pts)
9	Typeface	yes	
10	About us used for org. info	yes	
11	Site Map	yes	

The monogram of the institution is at the proper place on every page.

The title is available on the home page and on the linked pages but a link on it is not available.

The search option in this site is present on its proper place (top right corner) following the rule which is assistive for the experienced and fresh users to search all the contents of the website which he wants to search by saving precious time.

The breadcrumbs are not creating in this site.

When the site was navigated for analyzing the colors of the visited and non visited links, it was evaluated that the when the links were navigated for further searching and was back to that link, it was noticed that the color of the visited link was not change to purple which is a big exhaustion for the user using the site because he will not be sentient of himself that which part of the site he has navigated so far.

There is a horizontal scrolling in the website and the user will face much problem and will be time consuming in seeing the contents of the page and scrolling horizontally again and again.

When the site was checked for the back button, it was evaluated that when the different links were visited in the site, we were able to go back (the back button is enable) and the linked contents do not open in the new window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled rear button.

The font size is at least 11pts which is not following the rules.

The typeface in the site is according to the rules.

"About us" is present in the site supplying the information of the Institution.

The "Site Map" is also present providing the hierarchical structure of the contents of the site.

6. *Ayub Medical College, Abbottabad (www.ayubmed.edu.pk)*

S#	Parameters	Yes	No
1	Logo		No
2	Title	Yes (Link Not available)	
3	Search		No
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	Yes	
8	Font Size	Yes	
9	Typeface		No (It is Times New Roman)
10	About us used for org. info		No
11	Site Map		No

Logo is not present in the whole site and the title is present but link is not present on it.

According to the rules, there should be a search option on the top right side of the page on the home page as well as on the linked pages, but after searching that site, there is no search option on the home page and the linked pages.

The breadcrumbs are not creating in this site.

When the site was navigated for analyzing the colors of the visited and non visited links, it was evaluated that the when the links were navigated for further searching and was back to that link, it was noticed that the color of the visited link was not change to purple which is a big exhaustion for the user using the site because he will not be sentient of himself that which part of the site he has navigated so far.

There is a horizontal scrolling in the website and the user will face much problem and will be time consuming in seeing the contents of the page and scrolling horizontally again and again.

When the site was checked for the back button, it was evaluated that when the different links were visited in the site, we were able to go back (the back button is enable) and the linked contents do not open in the new window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled rear button.

The font size is at least 12pts according to the rules which is assistive for the aged people using that site.

The typeface in the site used is Time New Roman not following the rules.

"About us" is not present in the site.

The "Site Map" is not present in the site to assist the user to see the contents of the website in less time.

7. *Khyber Medical University, Peshawar (www.kmu.edu.pk)*

S#	Parameters	Yes	No
1	Logo	Yes	
2	Title	yes	Link not available
3	Search		No
4	Breadcrumbs	yes	
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	yes	
8	Font Size	yes	
9	Typeface	yes	
10	About us used for org. info	yes	
11	Site Map		No

The monogram of the institution is at the proper place on every page.

The title is available on the home page and on the linked pages but a link on it is not available.

According to the rules, there should be a search option on the top right side of the page on the home page as well as on the linked pages, but after searching that site, there is no search option on the home page and the linked pages and breadcrumbs are present in the website of this institution.

When the site was navigated for analyzing the colors of the visited and non visited links, it was evaluated that the when the links were navigated for further searching and was back to that link, it was noticed that the color of the visited link was not change to purple which is a big exhaustion for the user using the site because he will not be sentient of himself that which part of the site he has navigated so far.

There is a horizontal scrolling in the website and the user will face much problem and will be time consuming in seeing the contents of the page and scrolling horizontally again and again.

The back button in this site became disabled when further navigation is encountered which is problematic for the user because a new window is opened for each navigation and the user can't go back by clicking on the back button which became disabled.

The font size is at least 12pts according to the rules which is assistive for the aged people using that site.

The typeface in the site used is according to the rules.

"About us" is present in the site providing the information of the institution.

The "Site Map" is lacking in the site of this institution due to which a user can't understand the clear image of the site.

8. *Peshawar Medical College, Peshawar (www.prime.edu.pk)*

S#	Parameters	Yes	No
1	Logo	Yes (But on right top corner)	No
2	Title	Yes	Link not available
3	Search		No
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	Yes	
8	Font Size		No (9)
9	Typeface	Yes	
10	About us used for org. info		No
11	Site Map		No

In the site of this institution, logo is present but on the right top corner rather than on the left top corner and the title is also present but a link is not present on it. According to the rules, there should be a search option on the top right side of the page on the home page as well as on the linked pages, but after searching that site, there is no search option on the home page and the linked pages and the breadcrumbs are also not present in the website of this institution.

When the site was navigated for analyzing the colors of the visited and non visited links, it was evaluated that the when the links were navigated for further searching and was back to that link, it was noticed that the color of the visited link was not change to purple which is a big exhaustion for the user using the site because he will not be sentient of himself that which part of the site he has navigated so far.

There is a horizontal scrolling in the website and the user will face much problem and will be time consuming in seeing the contents of the page and scrolling horizontally again and again.

When the site was checked for the back button, it was evaluated that when the different links were visited in the site, we were able to go back (the back button is enable) and the linked contents do not open in the new window, so the user will feel relaxed to use that site and will be facilitated to visit auxiliary links by clicking on the enabled rear button.

The font size is 9 pts which does not follow the rule.

The typeface in the site is according to the rules.

"About us" is not present in the site providing the information of the institution.

The "Site Map" is not present in the site to assist the user to see the contents of the website in less time.

9. *Jinnah Medical College, Peshawar (www.jmcp.edu.pk)*

S#	Parameters	Yes	No
1	Logo		No
2	Title	Yes	No link on it
3	Search		No
4	Breadcrumbs		No
5	Visited & unvisited Link		No
6	Avoid Scrolling horizontally		No
7	Back button enable	yes	
8	Font Size	Yes	
9	Typeface	yes	
10	About us used for org. info	yes	
11	Site Map		No

The monogram of the institution is not present.

The title is available on the home page but having no link on it.

According to the rules, there should be a search option on the top right side of the page on the home page as well as on the linked pages, but after searching that site, there is no search option on the home page and the linked pages and the breadcrumbs are also not present in the website of this institution.

When the site was navigated for analyzing the colors of the visited and non visited links, it was evaluated that the when the links were navigated for further searching and was back to that link, it was noticed that the color of the visited link was not change to purple which is a big exhaustion for the user using the site because he will not be sentient of himself that which part of the site he has navigated so far.

There is a horizontal scrolling in the website and the user will face much problem and will be time consuming in seeing the contents of the page and scrolling horizontally again and again.

The back button in this site became disabled when further navigation is encountered which is problematic for the user because a new window is opened for each navigation and the user cant go back by clicking on the back button which became disabled.

The font size is at least 12pts according to the rules which is assistive for the aged people using that site.

The typeface in the site used is according to the rules.

"About us" is present in the site providing the information of the institution.

The "Site Map" is lacking in the site of this institution due to which a user can't understand the clear image of the site.

II. Conclusion

After comprehensive study of the sites of different universities/colleges, it has been accomplished that most of the colleges/universities are not the followers of the usability rules and there is a hurdle for every type of user in using the sites, due to which the users became bored and decide not visit that site again. The sites must follow the rules of the usability to entertain the user in exploring the different pages of the site and to save the precious time in searching the required contents. When the different parameters of the usability were checked for different colleges/universities websites, then it was noticed that most of the sites do not follow the regulations which restrict the interest of the user in using the websites and his objective to use this site is not fulfilled, so the idea is to be a specific rule to be applied to the sites and these sites must follow these rules to be valuable and attractive among different users. If the websites are according to the rules then it will save the precious time of the user in exploring and encountering the different tasks and the user will also be satisfied from his encountered tasks.

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Information Technology Managers Role and Responsibility: A Study at Select Hospitals

By Syed Murtuza Hussain Bakshi
Osmania University, India

Abstract - Information Technology (IT) is considered to be the most rapidly growing segment in the world ecosystem. IT development permeates every human activity. IT has radically changed the way medicine is practiced and now it is not confined to developed countries. Developing countries such as India has kept pace with the world in modern technology. With enormous IT investments it has become increasingly important to maintain and monitor IT resources. IT managers are responsible to carry out the core IT, allied activities and have to wear a lot of hats to perform their job efficiently. The present study is exploratory in nature and is undertaken to identify information technology managers' roles & responsibility in a hospital, to understand intricacy of IT manager. The sampling method followed is purposive sampling. The data was collected by face to face interview and data was analyzed through Interpretative Phenomenological Analysis. The research finding articulates that the Information technology managers play imperative roles. The IT managers role and responsibilities vary depends on the size, structure, nature of the hospital and its technology adaptation. The core role and responsibility of IT manages include Managerial role, Operational role, Web master role, Consultant role, Training role, Team leader role.

Keywords : *healthcare, information technology, informatation technology manager.*

GJCST-E Classification : *K.6.4*

Strictly as per the compliance and regulations of:

Information Technology Managers Role and Responsibility: A Study at Select Hospitals

Syed Murtuza Hussain Bakshi

Abstract - Information Technology (IT) is considered to be the most rapidly growing segment in the world ecosystem. IT development permeates every human activity. IT has radically changed the way medicine is practiced and now it is not confined to developed countries. Developing countries such as India has kept pace with the world in modern technology. With enormous IT investments it has become increasingly important to maintain and monitor IT resources. IT managers are responsible to carry out the core IT, allied activities and have to wear a lot of hats to perform their job efficiently. The present study is exploratory in nature and is undertaken to identify information technology managers' roles & responsibility in a hospital, to understand intricacy of IT manager. The sampling method followed is purposive sampling. The data was collected by face to face interview and data was analyzed through Interpretative Phenomenological Analysis. The research finding articulates that the Information technology managers play imperative roles. The IT managers role and responsibilities vary depends on the size, structure, nature of the hospital and its technology adaptation. The core role and responsibility of IT manages include Managerial role, Operational role, Web master role, Consultant role, Training role, Team leader role.

Keywords : healthcare, information technology, information technology manager.

I. Introduction

Information and communication technology paraphernalia are arguably the most rapidly growing segment of the world ecosystem. The development in the sector permeates every human activity; social, economic, cultural, religious, political and healthcare (Idowu P et al, 2008). Information technology has radically changed the way that many people employed, work and think. Over the years, technology has touched a new pinnacle and now it is not confined to developed countries. Developing countries such as India have kept pace with the world in modern technology. Information technology has revolutionized the way medicine is practiced and how healthcare information is documented, archived and retrieved at the point of care.

Healthcare professionals can no longer ignore the practical application of information technology. While information technology is facing challenges of adoption, communication technology is striving to create health information exchanges for connecting providers within multi-organization environments and across disparate geographical boundaries, using secure and fail-safe internet connectivity for high speed data, voice and video communication (Neeraj Gour & Dhiraj Srivastava, 2010, Dr. Ajit K. Nagpal, 2011).

With enormous investments and intervention of Information Technology, IT has become increasingly important. Organizations continue to understand the benefits from IT especially in conjunction with corporate initiatives such as business process reengineering (BPR). Furthermore, the impact of technology on non financial outcomes such as customer satisfaction and quality is gaining interest. (Sarv Devaraj & Rajiv Kohli, 2000). In order to manage IT related product and service IT manager has to wear a lot of hats. Different part of organization will have different expectations of this position which has to be matched. (Bill Holtsnider and Brian D. Jaffe, 2012). It is also held that to be an effective IT manager he should develop a border frame of references, admit information you might otherwise ignore and consider other professional viewpoint (Rob Aalders and Peter Hind, 2002)

II. Methods

The present study is exploratory in nature. The data is largely descriptive and categorized as a non-experimental qualitative study. The research is undertaken to identify information technology manager's roles & responsibility in a hospital and to understand intricacy allied with the job. The sampling method followed is purposive sampling. A prior appointment was taken from 45 participants including senior IT managers and junior IT managers who were working at least for one year with the hospital and were full time employees. They were briefed about the research study and encouraged to expel information relating to role and responsibilities as an IT manager .The data was collected by face to face interview; the facts were recorded manually. After the recording from the entire 45 participants data was analyzed through Interpretative Phenomenological Analysis. The study is restricted to hospitals of Hyderabad and Secunderabad.

III. Discussions

The research finding articulates that the Information technology managers play imperative roles. The IT managers role and responsibilities vary depends on the size, structure, nature of the hospital and its

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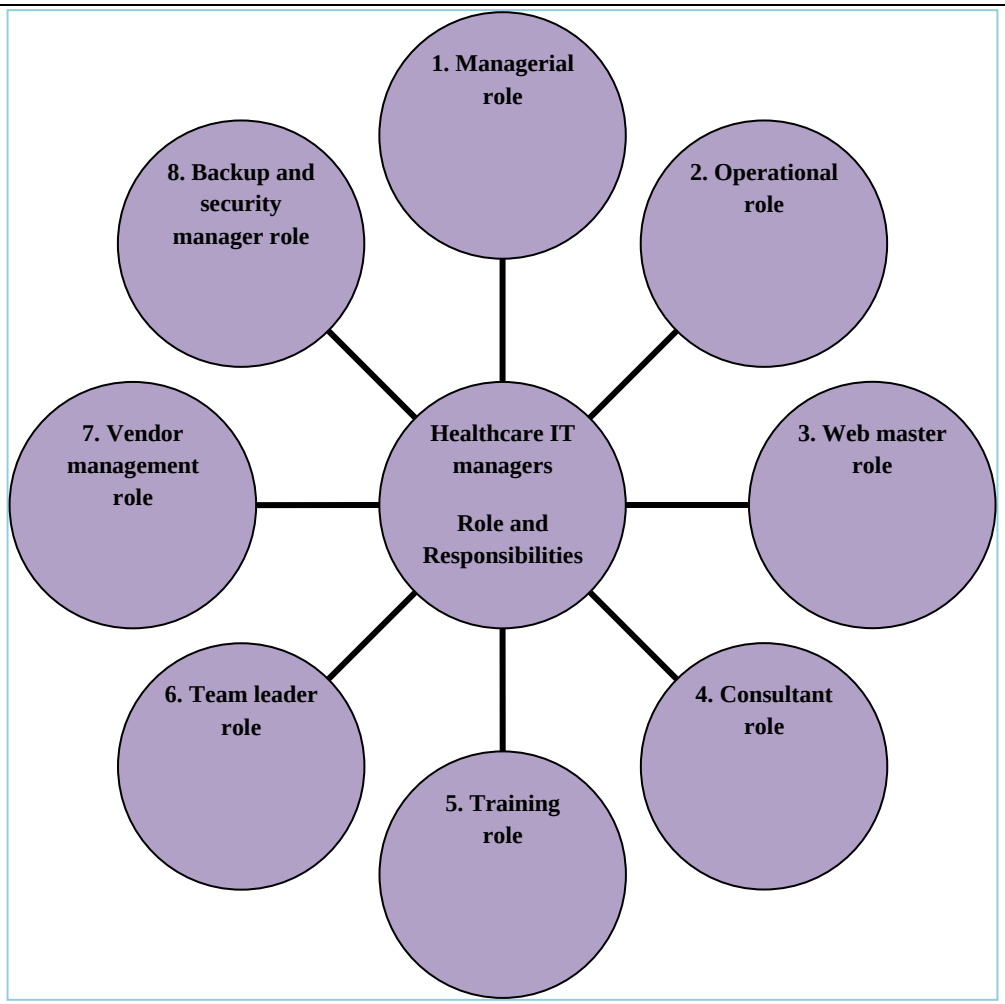
technology adaptation. It was evident from the research that the IT managers are supported with full team that included a junior IT manager with skilled assistance and domain experts. The primary or core IT managers roles and responsibilities that were expressed after the study are represented in the form of sketch.

Figure 1 : Role and Responsibilities of IT Manager



a) Managerial Role

- Supervision and development of ideal IT system with staffing the IT team.
- Create an IT roadmap and action plan for future growth.
- Provide direction, consulting, approve, administration and monitor major projects, IT budgets, priorities, standards, procedures, and overall IT performance.
- Involve in testing integrity and performance of various information networks and software applications.
- Regular Periodic review and evaluate how current systems and applications are meeting the needs of the hospital and employees working. Coordinate with all head of the departments within hospital and take their inputs to improve the technology solutions, implementation and adoption.
- Regular review meetings with all the key stake holders to update on IT actions. Review the adequacy and allocation of IT resources in terms of funding, personnel, equipment, and service levels.
- Researching and installing new and improved systems.
- Control the computer systems budgets and expenditures.

b) Operational Role

- IT Manager is responsible for managing the end-to-end IT operations of the hospitals. That include Plan, organize, direct, control and evaluate the operations of information systems and electronic processing.
- Provide network design, installation, monitoring, management, and troubleshooting for WAN and LANs including main locations and remote sites. If

needed Provide networking support to partner organizations.

- Ensures successful implementation and rollout of various modules of the Hospital Management System at the hospital. Setup and manage help desk support for staff within the facility.
- Ensuring equipment interface setup and maintenance.
- Valuating user needs and system functionality and ensuring the facilities meet these needs i.e. Coordinate priorities between the IT department and user departments.
- Maintain current and accurate inventory of technology hardware, software and resources.

c) Web Master Role

- IT manager's role includes E-business planning, particularly in terms of defining the Internet presence of a hospital with all latest informational updates and web support.
- Higher backend E- process and responsibilities range from encrypting , tracking information collected from visitors visiting the sites (Medical Tourism), developing and monitoring online community tools (social networking), such as message boards, feedback forms, surveys, software and hardware related to Internet.

d) Consultant Role

- IT managers also serve as consultants to executive level officers when it comes to developing and applying information technology policy and standards.
- IT manager's coordinates with system analysts, computer programmers, developers, support staff and assign priorities during in house software development process.
- IT manager identifies, communicates and implement new technologies to enhance the long-term operational and strategic goals of the hospital.

e) Training Role

- Train staff about new and potential use of the system.
- Provide orientation to new users of implemented technology.
- Providing User Training on various business applications and application software.
- Provide individual training and support on request.

f) Team Leader Role

- Leads the IT team at the Hospital which comprises of the hardware, networking, software and database specialists.
- Manage the requirement of various specialists and harmonious functioning of the IT team.

g) Vendor Management Role

- Approve and handle IT vendors used by the organization, AMC, Support agreements, Review meetings.
- Obtaining competitive prices from suppliers, to ensure cost effectiveness.
- Ensuring that software licensing laws are adhered to.

h) Backup and Security Manager Role

- Scheduling upgrades and security backups of hardware and software systems.
- Troubleshoot all technology issues.
- Maintain log and/or list of required repairs and maintenance.
- Provide network accounts and passwords as required.
- Identify and prepare hardware for disposal when appropriate.
- Ensure hardware is stripped and secured before disposal.

IV. List of Abbreviations

AMC : Annual Maintenance Contract
E- Process : Electronic Process
HIS : Hospital Information System
IS : Information Systems
IT : Information Technology
WAN : Wide Area Network
LAN : Local Area Network

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Time Stamp Based Cross Layer MANET Security Protocol

By Gaurav Kulkarni & Brajesh Patel
Shri Ram Institute of Technology, India

Abstract - Mobile Adhoc Network (MANET) is a wireless network where nodes communicate through other nodes without the aid of a base station. Security is a major challenge in MANET as the packets are prone vulnerability and eavesdropping in wireless environment. Generally MAC layer provides the security in such wireless network through encryption and authentication and the protocol is called WEP. Many authentication and encryption techniques are proposed to increase the security of the MANET. But stronger Security leads to more energy loss as mobiles have less energy and limited processing capability. In this work a Cross layer timestamp based network security technique is developed. The technique reduces the encryption packet overflow which is due to PKE or public key exchange, and derives the public key directly from the neighbor's table which is transmitted using routing information exchange. The simulation is performed with omnet++ simulator. Performance results demonstrate that the energy overhead due to encryption or performance compromise are very low in the proposed system. Further as the protocol is embedded in the network layer it is easily adoptable to any existing architecture without modifying the MAC or Physical layer standard or protocol.

Keywords : *AODV, cryptography, MANET, time stamp, wireless security.*

GJCST-E Classification : *C.2.2*

Strictly as per the compliance and regulations of:

Time Stamp Based Cross Layer MANET Security Protocol

Gaurav Kulkarni [α] & Brajesh Patel [σ]

Abstract - Mobile Adhoc Network (MANET) is a wireless network where nodes communicate through other nodes without the aid of a base station. Security is a major challenge in MANET as the packets are prone vulnerability and eavesdropping in wireless environment. Generally MAC layer provides the security in such wireless network through encryption and authentication and the protocol is called WEP. Many authentication and encryption techniques are proposed to increase the security of the MANET. But stronger Security leads to more energy loss as mobiles have less energy and limited processing capability. In this work a Cross layer timestamp based network security technique is developed. The technique reduces the encryption packet overflow which is due to PKE or public key exchange, and derives the public key directly from the neighbor's table which is transmitted using routing information exchange. The simulation is performed with omnet++ simulator. Performance results demonstrate that the energy overhead due to encryption or performance compromise are very low in the proposed system. Further as the protocol is embedded in the network layer it is easily adoptable to any existing architecture without modifying the MAC or Physical layer standard or protocol.

Keywords : AODV, cryptography, MANET, time stamp, wireless security.

I. Introduction

a) Mobile Adhoc Network

A mobile ad-hoc network (MANET) is a self-configuring network of mobile routers (and associated hosts) connected by wireless links—the union of which form an arbitrary topology. The routers are free to move randomly and organize themselves arbitrarily thus, the network's wireless topology may change rapidly and unpredictably. MANETs are usually set up in situations of emergency for temporary operations. These types of networks operate in the absence of any fixed infrastructure, which makes them easy to deploy, at the same time however, due to the absence of any fixed infrastructure, it becomes difficult to make use of the existing routing techniques for network services, and this poses a number of challenges in ensuring the security of the communication. MANET has greater security risks than conventional infrastructure networks, we adopt Adhoc on demand Distance Vector (AODV) [20] protocol for routing in MANET and embed the proposed security credentials over the protocol [24].

II. Problem Formation

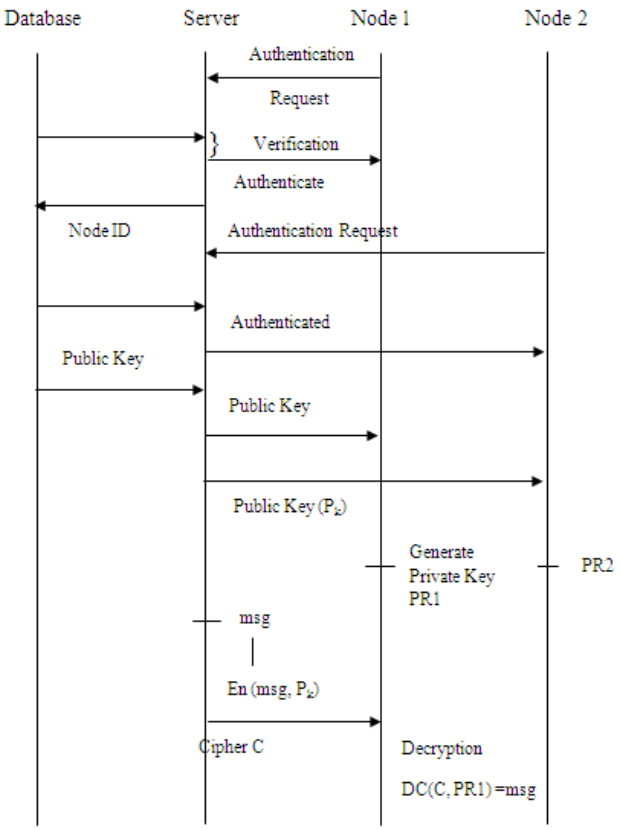

Figure 1 : Sequence diagram of conventional encryption technique

The most adoptable form of cryptography is as depicted in figure 1. It can be understood from the figure that the task of distribution of the key is the role of the server. Once server authenticates peers, then only it can distribute the key. Hence at the beginning security essentials must be exchanged. After the key is distributed amongst all the authenticated nodes, authenticated nodes use the public key to encrypt any message they want to transfer to the other peers and the encrypted message or the cipher is decrypted at the other end using the private key of the node. Further public keys can be changed in a subset called a group [16] and the common key is called a group key.

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The basic problem with the existing protocol is extensive amount of data exchange for authentication and requirement of excessive processing power for strong encryption techniques. Both of these leads to bandwidth consumption and subsequently delay in initial packet transmission, and excessive energy [11] loss due to higher processing cycles for encryption. More security invariably increases the latency, where as less strong encryption mechanism results in more eavesdropping. In order to have a balance between the security and performance, generally either the quality of transmission is sacrificed or strength of the key is satisfied or the encryption mechanism is compromised. Moreover in any technique, it is suggested that the key used for encryption be refreshed periodically (at least once in every 30 minutes).

III. Proposed Technique

a) General Architecture of the System

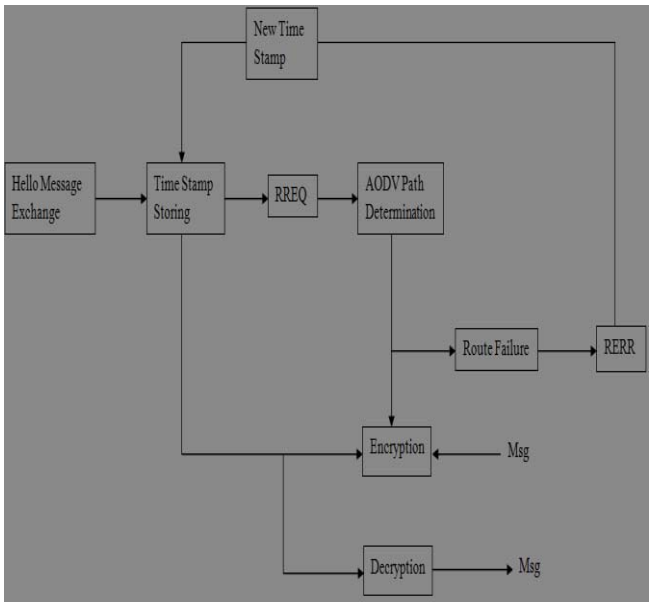

Figure 2 : Generalized Diagram of Proposed Technique

Figure 2 describes the architecture of the system. The MANET architecture is considered to be an autonomous topology without any base station or cluster head [18] [19]. Nodes set a future time when it is going to generate the hello message and stores that time value. This is propagated to all the neighboring nodes, they store the same value. Once the route is established every node in the route encrypts the message with the key generated from the time stamp of the next hop and so on. If there is a route error due to factors like the mobility or power issues a Route Error (RERR) message is generated. Once this is propagated to the source node, source node generates the RREQ message with the new time stamp and new sequence number. All the nodes receiving this RREQ further update the neighbors table along with the new time stamp value. Hence automatically the key is changed without any overhead of key refreshing [27]. Further after the hello interval is expired (which is typically 3 seconds) the hello messages are again exchanged between the nodes and the keys are further updated. The process is elaborated in more detail in the next subsection.

b) Functioning of Independent Sequences

1. The node exchange hello message at the start of the network or session to build the routing table or neighbor table.
2. We propose a new hello packet structure where a node appends transmission timestamp in the hello packet and broadcast the hello packet.
3. Each node notes down its transmission timestamp for the hello packet.
4. Once the hello packet is received by the node, it makes a routing table entry for the sender node. We device a time stamp based hash generation technique. Once all the nodes receiving the hello packets from the sender node, makes a table entry of the sender nodes id and the transmission time stamp. This time stamp acts like the public key between the sender and the receiving nodes. When the sender intern receives the hello packet from all these nodes which had received hello packet transmitted by the sender, sender also makes a table entry of these nodes and corresponding time stamps. Therefore in a session there is a single pair of base function for generating the key between any two nodes.
5. Now we assume that a node joins right at the middle of hello message exchange and acquires the time stamp values of the neighboring nodes. If this node is not an authenticated node, it will not be preloaded with the hash generation method and needs time for guessing the hash in the course of any data exchange between valid nodes. Hello interval in Adhoc network is generally kept at three seconds. Hence in every three seconds the base pair between any two nodes gets changed thus making it impossible for the intruder to guess the hash.
6. Another type of threat that might occur in the network is that an unauthenticated person gets access of a valid device of the network and hacks the data even being unauthenticated. In a centralized system this problem is solved through authentication protocol. In authentication protocol, the user enters his authentication information like username and password which upon matching with a central storage, the system authenticates the user and the device can subsequently take part in the communication. In a decentralized method such authentication scheme cannot be adopted. Hence we propose a unique technique of client side authentication. Whenever a wireless packet is

received by the device for the first time (Either a hello packet or a route request packet or a data packet, the device asks for authentication credentials. Once the credential is true, the device is self authenticated and is made part of the network. Authentication credentials are stored in the device itself when the user accesses the network for the first time by issuing "join network" command.

7. Three attempts are given for the user to successfully enter the authentication credentials. After three attempts, the device is unauthenticated for a period of 15 minutes and the same process is repeated.
8. In the most common possible attack of this type, when the unauthenticated user tries to access the network for the first time, his authentication credentials are asked. This method cannot check is the user entering new credential is valid user or not. Hence the user whenever wants to join the network needs to get a key from the system administrator. This key may be provided as a scratch card or a "on the fly" number. This number is generated from the MAC address of the device and current time frame. A time frame of four hours is selected as the time interval frame for which this number will be valid. Thus the user can authenticate only this device and only within four hours of issuing of the number.
9. Hence there is no significant overhead in key exchange and authentication data exchange. The strength of the algorithm can be moderate as against the desired very strong encryption technique for other methods because key refresh rate is very high over here.

c) Time Stamp Based Mechanism

[7] Defines a time stamp based mechanism whereby the digital document is signed with a time stamp. The time stamp is either a local time stamp or a time stamp generated from a time stamp server. But as the authentication phase is not considered to be QOS [22] supportive in MANET environment, rather than signing the document with a time stamp, we propose a technique to generate a key from unique time stamp values. [2] Describes a mechanism for a security mechanism where a signature or hash is generated from two numbers on the basis of RSA algorithm.

1. Generate two large primes p and q and compute $n = pq$.
2. Choose a prime number e and an integer d such that $e.d \bmod (p-1)(q-1) = 1$.

Where e is the system public key, d is the corresponding private key, which should be provided to server in safe way.

3. Find an integer g, which is a primitive element in both GF (p) and GF (q) and the public information in the system.

In the proposed system the time stamp values is first converted into a long time format which is a unique long number. This number is converted into string and inversed. The inverted string is converted back into the number and a prime number is generated which is just bellow this number and just above this number. This two primes P and Q are unique. Now two keys d and e must be obtained such that it satisfies the condition as 2.

In a standard protocol e must be submitted to the server securely (a technique of key distribution is elaborated in [10]) because P and Q may be any random number. In case the key is lost due to bit errors in the channel they can be recovered using key recovery technique like [13]. Even though such techniques do not require modifying existing Secured Socket Layer (SSL) protocols, key recovery is time consuming and adds extra latency to packet transmission.

[15] suggest a way to enhance the security by generating new signature by aggregating the old signature values which requires old values to be stored and the mobility in the network makes it difficult for all the nodes to have same set of old signature in order to generate a new unique signature. Hence the fresh time stamp is considered and no aggregation is selected. But in the proposed system as P, Q are unique based on a specific time stamp, e is not needed to be transferred to any other node.

d) Comparison between Proposed Technique and Existing Technique

In order to reduce the authentication overhead conventional security mechanism like Secure Ad hoc On-Demand Distance Vector (SAODV) compromises on the authentication issues and concentrates only on the encryption technique. Therefore there is always the possibility of unauthenticated nodes joining the network at the time of key exchange and acquires the public key which then enables these nodes to hack the packet for the validity of a route life time. But the proposed system removes this option. Only the Nodes valid in the route and along the forward path get the key along with the Route acknowledgement. Another benefit of the proposed system is that no key is exchanged in actual transmission, rather they are locally generated from the time stamp value transmitted by the nodes. Therefore extra security for the keys is not required. Further no extra bandwidth is consumed for key transmission. The key generation base that is the time stamp values are embedded in the existing packet headers, reducing the bandwidth overhead due to cryptographic extension.

IV. Simulation and Results

a) Simulation Mechanism

The proposed system is simulated with omnet3.3 in windows environment. The parameters used in the simulation are listed in table 1. Randomly N nodes are placed over an area of 500x500 meters. MAC layer protocol is 802.11b with 11.2 mbps data rate. First for authentication purpose, unique authentication credentials must be generated for every node. Therefore a pool of 100 MAC addresses of 48 bit is configured in the network with MAC ID like 80:50:1b:48:b3:c1: 80:50:1b:48:b3:c100. For time stamp generation, current system time is converted into long unique integer and is used with the simulation time. Once the network starts, the network layer of each node schedules a HELLO event for sending the hello packets to its neighbors. The scheduled time is noted down by this node and is also embedded in the HELLO packets. The device ID and a unique number allocated by the network administrator to these nodes are also embedded in the packet. When a node receives the HELLO packet from its neighbors, it generates the required authentication credential from the device id, time stamp and the unique number and verifies if that is a valid authentication credential or not. In order to simulate this we use the last numeric value from the MAC address of the node and multiply this with the last numeric value of the unique number which is of form [A10b21]. The generated numbers must lie between 1 to 1000. Further it is divided by validation period of the key which is maximum four hours (i.e. 240 minutes). Therefore all the authenticated nodes must fall in the range of 0 to 5. Further to show the presence of unauthenticated nodes and the detection and rejection of such nodes in the course of simulation, we place N/3 nodes along with N valid nodes with MAC address not in the range of the valid MAC addresses for the network. Even if they generate their hello packet, neighbors reject the hello packet due to un-authentication and thus these nodes are never selected in the neighbor table. Hence they do not get any Route Reply Acknowledgment (RREP-ACK) with the actual time-stamp of the source node, as the RREP-ACK packets are uncased.

The primary simulation objective is to show that even by embedding security essential in the wireless network and extending the existing routing protocol with the proposed security enhancement, network performance remains acceptable and that there is no unnecessary overhead for packet transmission or no "over-energy" consumption issues are observed due to the security enhancements. Therefore simulation results are obtained for both Conventional AODV and proposed Technique.

b) Simulation Parameters over omnet.

Parameter	Value
Nodes	5-35
Sessions	5-20
Pause time(seconds)	50-300
Packet Rate(per second)	20packets/second
Packet length	4096 bits
MAC protocol	802.11b
Bandwidth	11.2 Mbps
BER	1x10 -6
Initial energy	1000 m Joules
Area	500x500 square meter
Routing Algorithm	AODV
Transmission power	5mWatt/Packet
Simulator	OMNET++
Control Message Length	1 byte Identity, 8 bytes time stamp
Hashing Technique	RSA Based

Table 1 : Specifications of constraints included in simulation

c) Algorithm to demonstrate energy transmission

Let N be number of nodes, S be the source and D be the destination. Et be the transmission energy for 1 m distance, Er be the received energy for 1m distance. Let P packets are to be transmitted.

```
K=0;
For i=1:1: N
Transmit HELLO packet along with time stamp.
K++;
End
handleHello:
for i=1:1:K
for j=1:1:N
Store Tj at i
Prepare neighbor table
end
end
// now source transmits RREQ packets
For i=1:1:N
handleRREQ:
for(j=1:1:length(Neighbour_Table))
Forward_RREQ to j
If j is destination,
Send RREP
If(j==source && j has received RREP)
Generate ACK; //where ACK is route acknowledgement
end
//Data transmission phase
// let message be MSG
for j=1:1: number of nodes in the path
if(i==1)
C=EN(MSG,Ti+1)
Send C
Else
If(i!=destination)
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D=DC(C,Ti)
C=EN(D,Ti+1)
Send C
end
end
end
end
Where EN and DC are encryption and decryption function.

V. Results

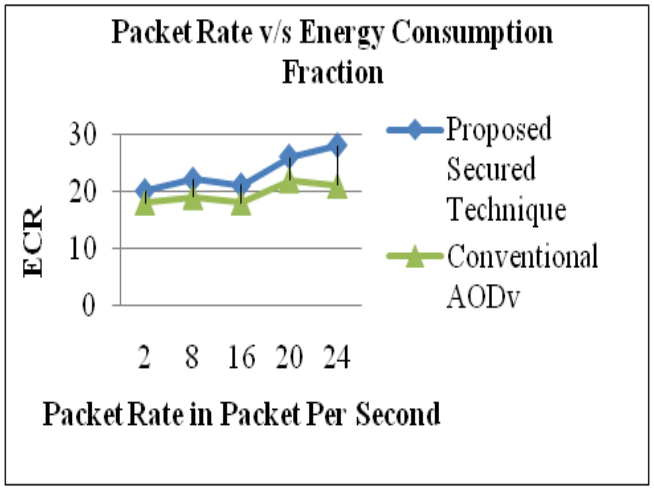

Figure 3 : Packet Rate v/s Energy Consumption Fraction

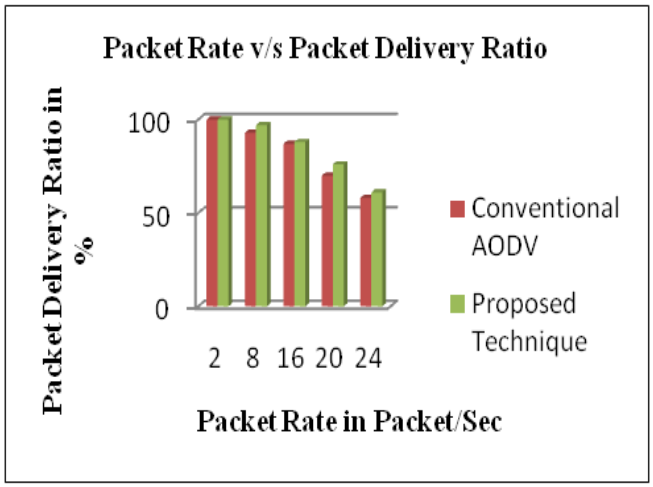

Figure 4 : Packet Rate v/s Packet Delivery Ratio

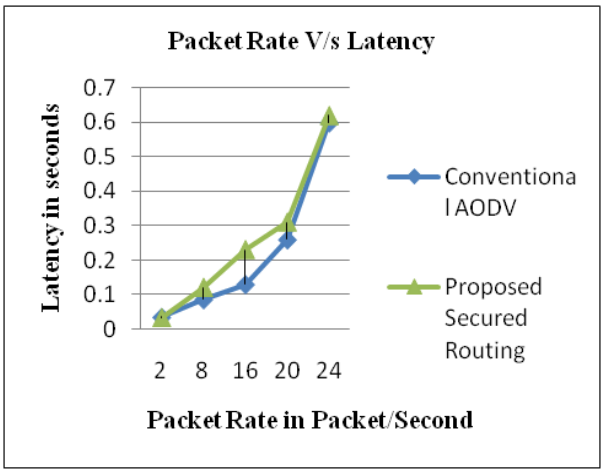

Figure 5 : Packet Rate v/s Average Latency

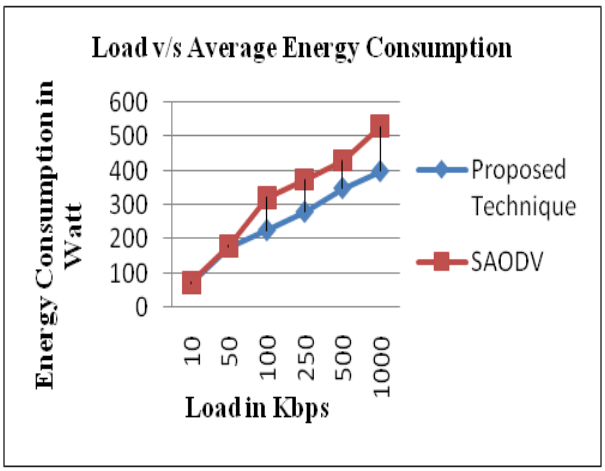

Figure 6 : Average Energy Consumption in SAODV and Proposed Technique

Average energy consumption is derived as (total energy of the nodes at the beginning of simulation –total energy of the nodes at the end of simulation)/total number of authenticated node.

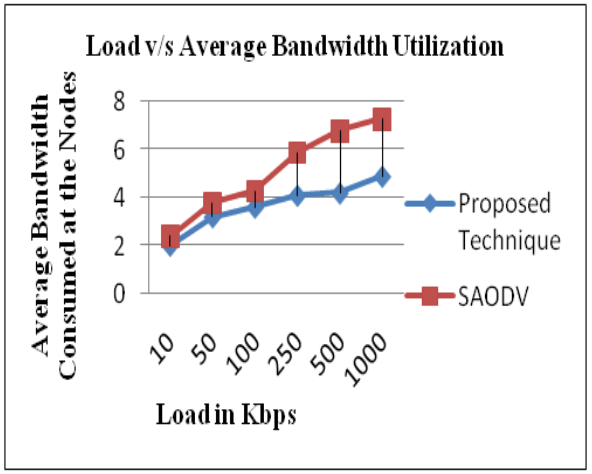

Figure 7 : Load v/s Average Bandwidth Utilization in SAODV and Proposed Technique

VI. Conclusion

The basic objective of the proposed technique is to show that even by introducing security features, quality of service is not compromised in the proposed method. Result 1, 2 and 3 shows that packet delivery ratio, latency and energy consumption fraction which is defined as the energy spend by control messages over energy spent by data messages are at par with the conventional technique and latency result is better in the presence of intruding nodes. This proves that the proposed technique can be adopted in AODV without any compromise on the QOS issues. The comparison between the most adopted SAODV and the proposed system is most encouraging and it clearly shows that because there are no periodic key exchange in the proposed system, the bandwidth improvement is significant and also the energy consumed at the nodes are also less due to processing of lesser packets in comparison to SAODV. Further the latency improvement also suggests that because there are no overhead in exchanging extra security credential, network layer delay is kept minimum. Further the technique can be improved by incorporating QOS metric which can obtain a path which meets the QOS requirement and then applying the encryption mechanism over the same protocol.

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SIR-Based Power Control Algorithms in CDMA Networks

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Abstract - This paper incorporates a comprehensive study about the distributed power control algorithm in cellular communication systems. The algorithm requires only interference power estimations and/or signal-to-interference ratio (SIR) estimations form the base station, and converge even in cases where limits on available power render the target SIR unattainable. Power control plays an important role to high demand for wireless communication services shows the need for technology to further increase the capacity of cellular communication systems. The capacity of the system is maximized if the transmitter's power control is controlled so that its signal arrives at base station with minimum required signal-to-interference ratio. Nash equilibrium power provides substantial power savings as compared to the power balancing algorithm and Foschini and Miljanic Algorithm while reducing achieved SIR only slightly. Simulations show that the benefit of the Nash equilibrium power control over the power balancing solution increases as receiver noise power or number of users in the cell increases.

Keywords : *power control, CDMA, nash algorithm, power balancing algorithm, foschini and miljanic algorithm.*

GJCST-E Classification : *C.2.5*

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I. Introduction

The demand of communicating each other, whatever places the receiver may be, wireless technology started to emerge. By the recent years, the wireless communication become so popular that it is now facing a great challenge to meet the demand to have different types of service in a cost effective way. To support the demand a way variety of research is going on worldwide to find out a solution of the ever increasing wish of mankind using the limited resource. Generally, the high speed quality, high capacity and lower power consumption are major goals in cellular radio communication systems. Power control is one of the several techniques used to achieve these goals. Power control regulates the signal strength to reduce the overall interference [1]. In CDMA the system capacity is maximized if each mobile transmitter power level is controlled so that its signal arrives at the cell site with the minimum required signal-to-interference ratio [2]. the high speed quality, high capacity and lower power consumption are major goals in cellular radio communication systems. Power control is one of the several techniques used to achieve these goals. Power control regulates the signal strength to reduce the overall interference [1]. In CDMA the system capacity is maximized if each mobile transmitter power level is controlled so that its signal arrives at the cell site with the minimum required signal-to-interference ratio [2].

A tradeoff must be made if a mobile signal arrives at the cell site with a signal that is too weak and often the weak user will be dropped. If the received power from a mobile user is too great, the performance of this mobile unit will be acceptable but it will add undesired interference to all other users in the cell. A block diagram illustrating the power control structure [3] is shown in Fig. 1.

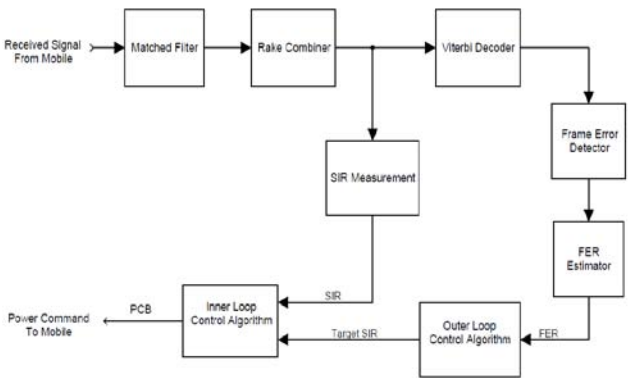

Figure 1 : Block diagram for implementation of power control in CDMA systems

II. Review of the Literature

One of the most common approaches to closed-loop power control in wireless communication networks is SIR balancing, also called power balancing. The SIR balancing solution was originally derived for satellite communications by Aein [4] and Meyerhoff [5], and adapted for wireless communications by Nettleton [5] and Zander [6] and [7]. Variations on the SIR balancing algorithm have replaced the target SIR by functions incorporating minimum allowable SIR [8], SIR's of other mobiles [9], and maximum allowable power [10] among others. Variations have been developed to incorporate call admission and handoff [11], base station assignment [12], and economic

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tradeoffs .SIR balancing algorithms (SBA's) are simple and most can be implemented distributively, but have the disadvantage that convergence can be slow and is guaranteed only if every mobile's target SIR is feasible. To address the convergence issue, a number of algorithms have been developed that shape the dynamics of the controlled power or the convergence of the algorithm [13]. Another class of algorithms seek to solve a static optimization problem. The well known distributed constrained power control (DCPC) algorithm maximizes the minimum attained user SIR subject to maximum power constraints. Other algorithms minimize power consumption in the presence of large-scale fading or over a set of discrete available power levels. Dynamic optimization has been used to minimize power consumption by formulating power control for log-normal fading channels in a stochastic framework as well as to adaptively optimize quantization of feedback SIR. An alternative framework for developing power control algorithms is based on game theory or economic formulations requiring the specification of a utility or cost function. The use of pricing to promote efficiency and fairness has been discussed extensively. Alpcan et al. [14] recently proposed a Nash game formulation of the SIR-based power control problem in which each mobile uses a cost function that is linear in power and logarithmically dependent on SIR. They establish the existence and uniqueness of the Nash equilibrium solution and consider the effect of various pricing schemes on system performance.

III. Power Control Algorithms

Power control for either the uplink (reverse link) or the downlink (forward link) can be considered. In the former case, a desirable property for a power control algorithm is the sufficiency of measurements available at the mobile for computing the power updates. Such algorithms can be implemented without reliance on communication with either the base station or other mobiles and hence are called distributed. Note that, it has been shown that the same problem formulation can be applied to various types of both uplink and downlink scenarios so our discussion here is not exclusively applicable to uplink power control. The goal in the power control of wireless systems is to ensure that no mobile's SIR γ_i falls below its threshold γ_i^{tar} chosen to ensure adequate QoS, i.e. to maintain.

$$\gamma_i \geq \gamma_i^{tar}, \forall_i, \tag{1}$$

Where the subscript i indexes the set of mobiles. In IS-95, this threshold is calculated for the individual mobile to maintain a satisfactory frame-error rate (FER). From the mobile's perspective, however, whether the other users meet their QoS requirements is irrelevant. For this reason, the framework of non-cooperative game theory [37] is well suited for analyzing and solving the power control problem. Considering the uplink for a single cell CDMA system with N users, we designate the transmitted power and SIR for the *i*th user by p_i and γ_i, respectively. We denote the background (receiver) noise power within the user's bandwidth by η_i is treated as constant. We use a "snapshot" model, assuming that link gains evolve slowly with respect to the SIR evolution. In the problem formulation, the SIR of the ith mobile is

$$\gamma_i = \frac{h_i p_i}{\sum_{j \neq i} h_j p_j c_{ij} + \eta_i} \tag{2}$$

Where h_j is the attenuation from the *i*th mobile to the base station and c_{ij} is the code correlation coefficient. The attenuation is calculated from the distance r_i between the mobile and base station to be $h_i = A/r_i^{\alpha}$ in the absence of shadow and fast fading. A is a constant gain and α is usually between 3 and 6. We will provide realistic values for these constants in the simulation section, Section III. The code correlation coefficient c_{ij} is computed from the signatures s_i and s_j to be $c_{ij} = (s_j^T s_i)^2$. We note that this model is consistent with the general power control problem for wireless communication systems in which the SIR of mobile i is given by

$$\gamma_i = \frac{g_{ii} p_i}{I_i(p-i)} = \frac{g_{ii} p_i}{\sum_{j \neq i} g_{ij} p_j + \eta_i} \tag{3}$$

with the interference given by

$$I_i(p-i) := \sum_{j \neq i} g_{ij} p_j + \eta_i. \tag{4}$$

We have used the subscript *"-i"* to indicate that the interference depends on the powers of all users except the *i*th. If we define a power vector *p* having its element p_i, and an interference vector I having ith element $I_i(p\text{-}i)$, the subscript indicates that the *i*th element of the interference vector depends on all but the *i*th element of the power vector. Comparing (3.10) and (3.11) we see that for CDMA uplink power control,

$$g_{ij} := \begin{cases} h_i & j = i \\ h_j (s_j{}^T s_i)^2 & otherwise \end{cases} \tag{5}$$

So g_{ij} denotes an effective link gain from the *j*th user to the base station that specifies the *jth* user's contribution to the interference affecting the signal of the *ith* user. We will also define an effective gain matrix G having (i.j)th element g_{ij}. Note that in contrast to the case in which background noise power is neglected and the diagonal elements of the gain matrix are set to zero, we cannot write the interference as the product of the gain matrix and power vector, *i.e.* $I \neq Gp$. The Nash algorithm will run in real time with measurements potentially

updated every step of the algorithm. This algorithm iteratively updates power according to

$$p_i^{(k+1)} = \begin{cases} \frac{\gamma_i^{tar}}{g_{ii}} I_i^{(k)} - \frac{b_i}{2c_i}\left(\frac{p_i^{(k)}}{\gamma_i^{(k)}}\right)^2 & \text{If positive} \\ 0 & \text{otherwise} \end{cases} \quad (6)$$

Where $p_i^{(k)}$ is the power of the i the mobile and $I^{(k)}_i$ the measured interference experienced by the *i* th mobile at the *k*th step of the algorithm. Recall that $I_i^{(k)} = \sum_{j \neq i} g_{ij} p_j^{(k)} + \eta_i$. In implementation, of course, power cannot become negative so there is an implicit assumption that whenever this expression is negative, the assigned power will be zero. The power balancing (also called SIR-balancing) algorithm (PBA) iteratively updates power according to

$$p_i^{(k+1)} = \left(\frac{\gamma_i^{tar}}{\gamma_i^{(k)}}\right) p_i^{(k)} \quad (7)$$

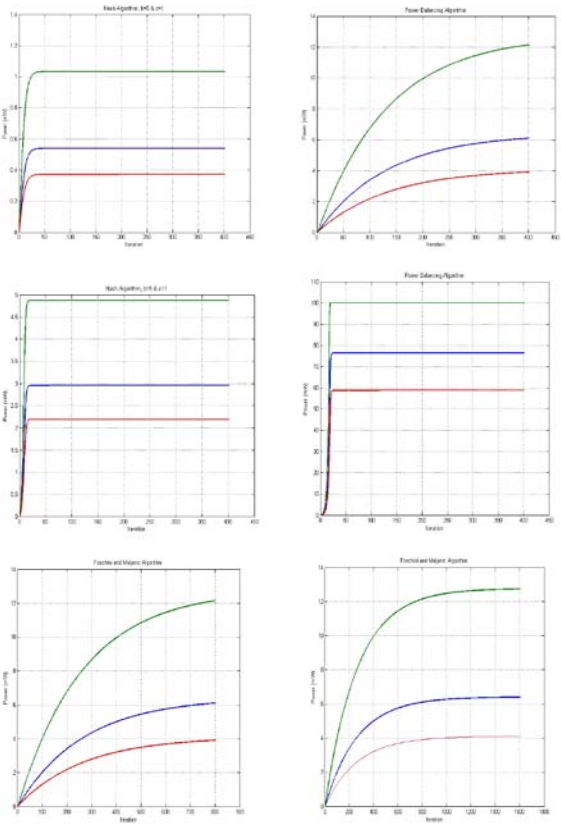
And the Foschini and Miljanic Algorithm (FMA) iteratively updates according to

$$p_i^{(k+1)} = (1-\beta_i)\, p_i^{(k)} \left(1 + \frac{\beta_i}{(1-\beta_i)} \frac{\gamma_i^{tar}}{\gamma_i^{(k)}}\right) \quad (8)$$

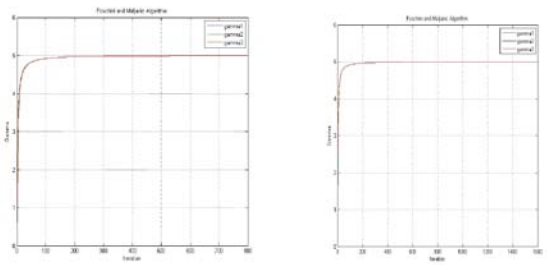
Where β_i is an algorithm parameter, $\beta i \in (0, 1]$. The above FMA algorithm converges to optimal solution even in case of asynchronous updates of the transmission powers.

IV. Results and Discussion

We used Matlab simulation with $\gamma^{tar} = 5.0$ and b = 5 $(mw)^{-1}$ and c = 1 for random configuration for Nash algorithm and $\gamma^{tar} = 5.0$ for random configuration for power balancing algorithm of 3 users and noise power was $\eta = 0.01$. Our initial power for all mobiles was $p_i^{(0)} = 0$ for Nash algorithm and $p_i^{(0)} = 2.22e\text{-}16$ for power balancing algorithm and $p_i^{(0)} = 0.001$ mW for Foschini and Miljanic Algorithm. The average power $\bar{p}_i^{Nash} = 0.6482$ mW and SIR, $\bar{\gamma}_i^{Nash} = 4.6451$ as opposed to 5.0 for Nash algorithm and power $\bar{p}_i^{PB} = 7.382$ mW and SIR, $\bar{\gamma}_i^{PB} = 4.9981$ as opposed to 5.0 for power balancing algorithm and by running the Foschini and Miljanic algorithm for 800 and 1600 iterations we have obtained the following results P = [6.1053 12.1529 3.9117] and γ = [4.9981 4.9981 4.9981] and P = [6.3988 12.7377 4.0989] and γ = [4.999 4.999 4.999] respectively. The power balancing algorithm converged very slowly compare with Nash algorithm but the total power consumption is not very high as shown in Fig. 2. When we increased the target SIR, $\gamma^{tar} = 7.0$ and b = 5 $(mw)^{-1}$ and c = 1 for Nash algorithm, the Nash algorithm converged very fast (mainly after 24 iterations), as shown in Fig 2. The average power for Nash algorithm $\bar{p}_i^{Nash} = 3.304$ mW and SIR, $\bar{\gamma}_i^{Nash} = 5.2$ as opposed to 7.0. And the target SIR, $\gamma^{tar} = 7.0$ for power balancing algorithm, the total power consumption is very high but the algorithm converged very fast. The average power for power balancing algorithm $\bar{p}_i^{PB} = 78.441$ mW and SIR, $\bar{\gamma}_i^{PB} = 5.6482$ as opposed to 7.0.



The average power $\bar{p}_i^{Nash} = 1.9741$ mW and the average SIR, $\bar{\gamma}_i^{Nash} = 4.8988$ as opposed to 5.0.



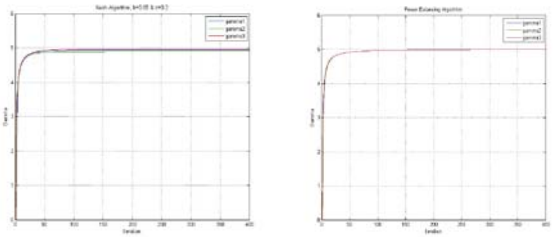


Figure 2 : Power Control algorithms (Nash,PBA,FMA) for 3 users with $\gamma^{tar} = 5.0$ and $\gamma^{tar} = 7.0$ for all mobiles

We used the Nash algorithm for gamma with $\gamma^{tar} = 5.0$ and $b = 0.5\ (mw)^{-1}$ and $c = 1$ for random configuration of 3 users and noise power was $\eta = 0.01$. Our initial power for all mobiles was $p_i^{(0)} = 0$ for this algorithm. The Nash algorithm converged not very fast (after 176 iterations), as shown in Fig. 3. By running the Nash algorithm for 400 iterations we have obtained the following results P = [1.6334 3.2205 1.0684] and γ = [4.9170 4.8334 4.9460] and by running the Foschini and Miljanic algorithm for 800 and 1600 iterations we have obtained the following results γ = [4.9981 4.9981 4.9981] and γ = [4.999 4.999 4.999] respectively.

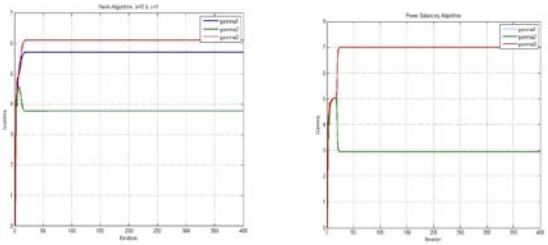


Figure 3 : Target signal to interference ratio (SIR) of Power Control algorithms (Nash, PBA, FMA) for 3 users with $\gamma^{tar} = 5.0$ and $\gamma^{tar} = 7.0$ for all mobiles

We have seen from the above Figures the Nash algorithm converged in fewer iterations than the power balancing and Foschini and Miljanic Algorithm (FMA). When we increased the target SIR's γ^{tar} the Nash algorithm converged very fast as well as the total power consumption slightly increased. We also changed the value of b and c; they were very effective because the total power consumption increased sharply. We have seen from the power balancing algorithm the target SIR's achieved. Foschini and Miljanic algorithm converged very slowly after 800 iterations but after the 1600 iterations the algorithm converged.

V. Conclusion and Future Improvement

With our algorithm, we obtained lower individual powers with comparable or faster convergence by compromising slightly on SIR values. Exploiting this tradeoff, the proposed algorithm was able to handle many more users than the power balancing algorithm and to produce the Nash equilibrium in cases where the power balancing problem has no solution. The algorithm can easily be implemented in a distributed manner, and has the advantage that mobiles choose whether or not to transmit based on their own valuations of the trade-offs between power usage and QoS as represented in their cost functions. We have also demonstrated that the suboptimal controller strategy outlined above has the potential to power and improve quality of service. An interesting topic for future research is the development of efficient algorithms for use by the base station in identifying when to drop calls and which mobile's calls to drop.

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Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

Structure

All manuscripts submitted to Global Journals Inc. (US), ought to include:

Title: The title page must carry an instructive title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) wherever the work was carried out. The full postal address in addition with the e-mail address of related author must be given. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining and indexing.

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

Tables, Figures and Figure Legends

Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

Preparation of Electronic Figures for Publication

Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Color Charges: It is the rule of the Global Journals Inc. (US) for authors to pay the full cost for the reproduction of their color artwork. Hence, please note that, if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a color work agreement form before your paper can be published.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

6.1 Proof Corrections

The corresponding author will receive an e-mail alert containing a link to a website or will be attached. A working e-mail address must therefore be provided for the related author.

Acrobat Reader will be required in order to read this file. This software can be downloaded

(Free of charge) from the following website:

www.adobe.com/products/acrobat/readstep2.html. This will facilitate the file to be opened, read on screen, and printed out in order for any corrections to be added. Further instructions will be sent with the proof.

Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

As changes to proofs are costly, we inquire that you only correct typesetting errors. All illustrations are retained by the publisher. Please note that the authors are responsible for all statements made in their work, including changes made by the copy editor.

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- 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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- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

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Topics	Grades		
	A-B	**C-D**	**E-F**
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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