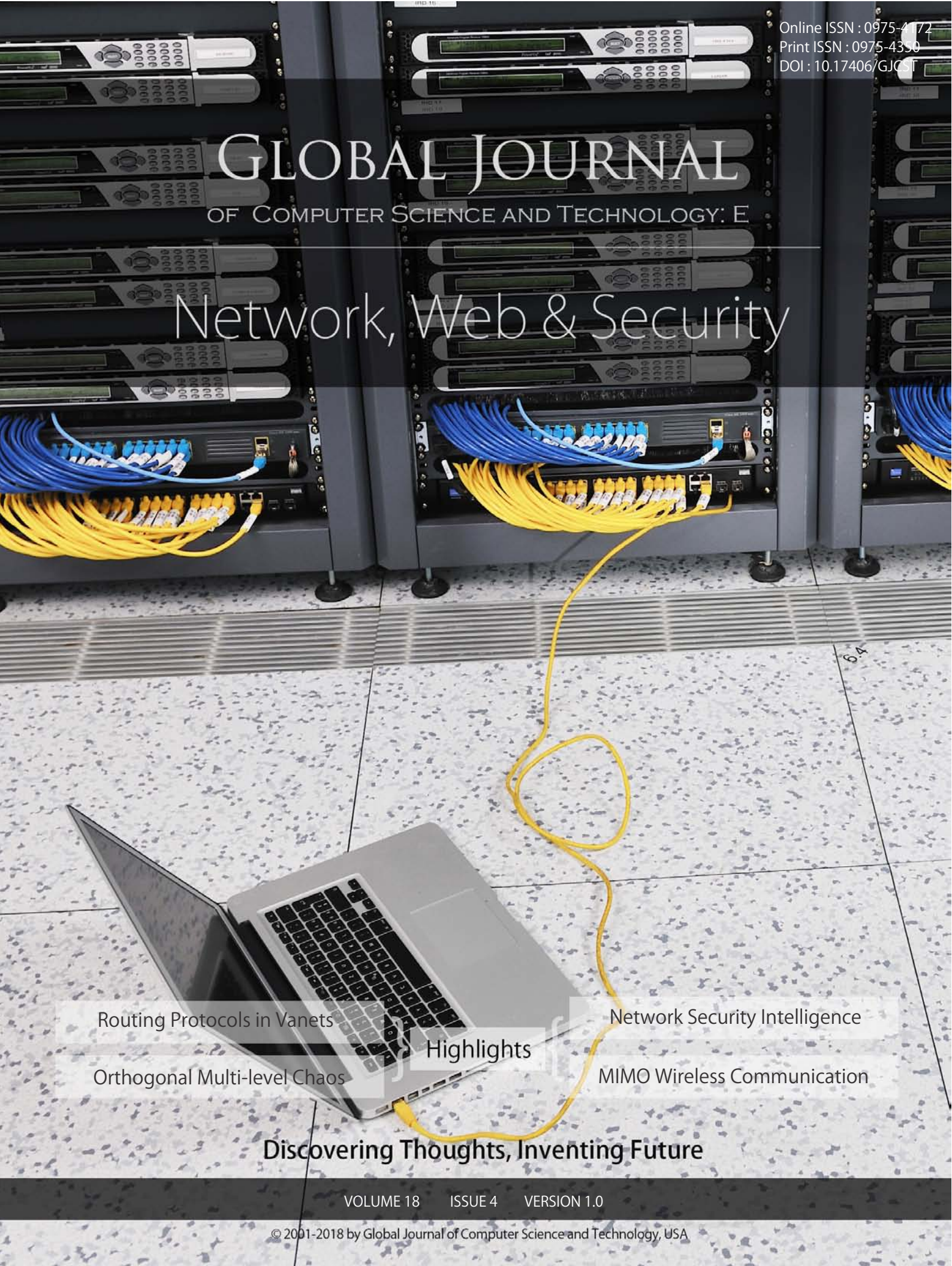
Online ISSN : 0975-4172
Print ISSN : 0975-4350
DOI : 10.17406/GJCST

Global Journal

of Computer Science and Technology: E

Network, Web & Security



Routing Protocols in Vanets

Orthogonal Multi-level Chaos

Highlights

Network Security Intelligence

MIMO Wireless Communication

Discovering Thoughts, Inventing Future

VOLUME 18 ISSUE 4 VERSION 1.0

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Volume 18 Issue 4 (Ver. 1.0)

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Contents of the Issue

Global Journal of Computer Science and Technology: E Network, Web & Security
Volume 18 Issue 4 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Network Security Intelligence for Small and Medium Scale Industry 4.0: Design and Implementation

By Dr. Ashok Koujalagi
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Abstract- The development of Internet of Things (IOT) technology became one of the proponents in the industrial revolution 4.0. Digital transformation began to be applied to the entire manufacturing industry, services, transportation and education which have slowly shifted utilizing IOT technology. The industrial revolution 4.0 has an impact on digital transformation and becomes a necessity that can change business patterns such as the ease of data interaction services between industries to customers that are also supported by ease of access and speed of decision making. However, in its development, stakeholders tend to focus on infrastructure and information systems, while the security of information systems is still a comfort zone for industries in the transformation to industry 4.0. The issue of information system security will be a challenge for the industry with open access to information systems, otherwise focus will hamper the business process of the industry. In this research will be discussed about the modeling and implementation of information system security with a combination of web-based security methods with port knocking firewall model and short message service gateway as a security medium with the concept of ease of access with safe and comfortable. The result of this research has been testing penetration testing using network tools.

Keywords: *industry 4.0, cyber security, port knocking, short message service gateway.*

GJCST-E Classification: *C.2.m*

Strictly as per the compliance and regulations of:

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I. Introduction

The current industrial revolution has grown to 4.0 which replaces industry 3.0. According to [1] and [2] that the basic principle in industry 4.0 is the incorporation of machines, workflows, and systems, by applying intelligent networks along chains and production processes to control each other independently. There are four aspects of the challenges of implementing the industry revolution 4.0 according to Wolter namely information technology security issues, reliability issues and stability of production machinery, lack of adequate skills, lack of motivation of stakeholders to change; and the loss of a lot of work as it turns into automation [3] and [4]. Support of the Internet of Things (IOT) became the most important in the industry revolution 4.0 with open access to information systems and automation changed the way business as its own competitiveness for each industry [5] and [6]

According to [7] and [8] security issues will be a challenge for each industry, sometimes for mature industries with adequate resources often overlooking security issues. For medium and small industries some have difficulty and lack of understanding of the security of information systems, stakeholders tend to focus on infrastructure and information systems as digital transformation in the speed of decision making. According to [8] the risks of information system security have an impact, among others, operational risks of Denial-of Service (DDOS) attacks, data theft, website hijacking and reputation risk of lack of trust of business colleagues followed by exposure through media about security vulnerabilities system. In addition, investment risk becomes the most perceived big losses that are large investments but the system is not integrated and the security system used is not in accordance with business needs.

IOT will lead to new problems related to information systems security management, namely the opening of connection lines. This is often used by hackers / hackers to steal data through the network. One of the most important components in an information security management system design is the use of firewalls [9]. The main role and task of a firewall is to filter and monitor in and out access to application communications connected to the intranet or internet network and communicate the network using TCP and UDP ports that are part of the transport layer of the OSI layer standard [10]. Through the path will appear communication between wide network / internet with internal network and vice versa. Information systems that are in the internal will open a certain communication path and can be reached.

From this background phenomenon in this research try to do design development of information system security with IOT support with model combination 2 authentication user / password and short message. The device used from the security model uses Raspberry PI devices, mikrotik Router as Firewall and SHORT MESSAGE gateway. The purpose of this

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research is as a model solution for the security of information systems with easy technical operation but with a high level of security and comfort with a safe and convenient operation techniques.

II. Review of Literature

a) Computer Network

A computer network is a system of computers designed to share resources, communicate and access information. The purpose of a computer network is to be able to achieve its purpose, any part of the computer network can request and provide services. Computer networks can also be interpreted as a collection of communication terminals located in various locations consisting of more than one interconnected computer. The purpose of building a computer network is to carry information precisely without any error from the transmitter side to the receiver side through communication media [3]; [4] and [5]. Computer networks can also be defined as a collection of different communication terminals in different locations consisting of more than one interconnected computer [7]

Two computers each have a network card, then connected via cable or wireless as a data transmission medium, and there are network operating system software will form a simple computer network. If you want to create a wider network of computers again reach, it requires additional equipment such as Hub, Bridge, Switch, Router, Gateway as interconnection equipment.

Based on the scalability of computer network classification is as follows [5]:

Local Area Network (LAN) is a network that is used for personal, whether within a building or in one campus area. Reach which can be reached by LAN up to several kilometers. LAN is used to connect private end devices to exchange data.

Metropolitan Area Network (MAN) is a network widely used to connect nodes located at a distance of 20-50 Km, this network is commonly used for inter-city by using radio pocket or telecommunication company facilities [11].

Wide Area Network (WAN) is a network of data communication systems that each node is located remote (remote location) with each other. WAN is also called the remote network / long distance network. A node is a point that can receive input data into a network or produce output information or both. Node can be either a printer or other print tool or a PC to a computer mainframe that has a modem [12].

b) Security Management using Web Knocking Port Technique

Knocking port is a technique or method of opening ports externally through a firewall by way of attempting to connect to a closed port with a predetermined connection attempt sequence [6]; [8] & [10]. In other words port knocking is a method for building a host-to-host communication with a computer device that does not open any communication ports freely.

The Web Knocking port is implemented by configuring a small program called a daemon to monitor the firewall log for connection requests and determining whether the client is registered on an approved IP address and has done the correct sequence. If the answer is yes, the firewall will open the associated ports dynamically. The main purpose of knocking ports is to prevent attackers from system scanners such as remote access SSH by doing port scanning [6] and [11]. If an attacker sends an incorrect sequence of beats, the protected port will not appear or open as shown in Figure 1 and Figure 2.

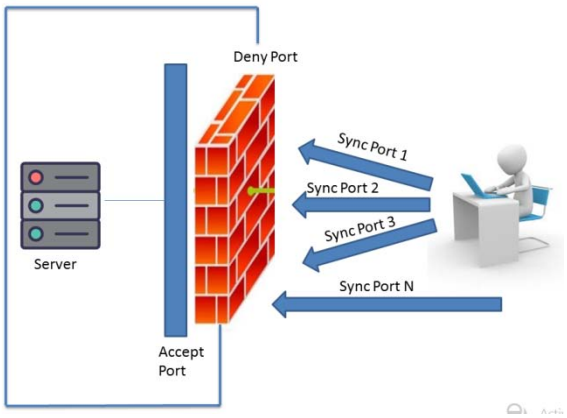

Figure 1: Knocking Port

c) Firewall Security Management

A firewall is a security system designed to prevent access or attacks from within and outside the network. Firewalls can be implemented in hardware and software, or a combination of both. Firewall implementations are generally used to control the access of users accessing private networks connected to the Internet, especially intranets. All incoming or outgoing activity traffic through the intranet network through the firewall will be controlled for users who do not meet certain security criteria will automatically be blocked [7] and [10].

The firewalls function as a controller, watching the flow of data packets flowing in the network. The firewall function organizes, filters and controls the data traffic that is allowed to access private networks that are protected, some criteria that the firewall does include: (a) the IP address of the home computer,(b) TCP / UDP port of origin to destination computer (c) IP address of destination computer TCP / UDP port destination data on destination computer Header information stored in data packet [9].

Specifically the firewall function is to authenticate the network access Figure 2.2 is a firewall implementation image

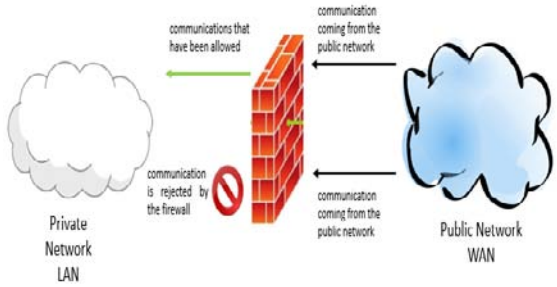

Figure 2: Firewall

How the firewall works in general to protect the internal computer network, among others:
Reject and block data packets that come based on unwanted sources and purpose [10].

Refuse and filter the data packets coming from interstitial network to the internet. His example when there are users of the internet network will access porn sites.

Reject and filter data packets based on unwanted content. For example, an integrated firewall on an antivirus will filter and prevent files that have been infected with a virus trying to enter the internal network.
Report all network activity and firewall activities.

d) Short Message Gateway

Short message gateway is an application system that serves short message submissions and receipts, widely used in business applications, both for the purpose of broadcast promotion, information services to users and dissemination of product or service content and so forth. Short message gateway is also an application, in which there is a SHORT MESSAGE feature that can be modified as needed. For example some of the features commonly developed in short message service apps

The gateway is a mass-shipping automated or scheduled tail cast message [3]. In addition, it plays an important role in sending short message service gateway called short message service center which is a mobile phone network that handles the sending of short message service center. So, when someone sends short message service center message through their mobile phone, the short message service center in charge sends the message to the destination number. If the destination number is not active, the short message service center will retain the message within a certain period of time. If the short message service still cannot be sent until the time period expires, then the short message service will be deleted from the short message service center storage. Gateway application can use the short message service center path for its operation.

e) Database

A database is a collection or complete operational data set of an organization that is organized or managed and stored in an integrated manner by using certain methods using a computer so as to provide the optimal information that the user needs [12]. While the database system is a system of arranging and managing records using computers to store or record and maintain complete operational data of an organization or company so as to provide optimal information that the user needs for the decision-making process [11].

According [11] and [13] Understanding Database is: "Collection of files that have links between one file with another file to form a data building to inform an agency company, within certain limits". The above conclusion is the database is a collection of data interconnected with each other, stored in a computer and used software to manipulate it.

f) PHP Programming Language

PHP is one of the scripting languages installed in HTML. Most of the syntax is similar to C, Java and Perl, plus some specific PHP functions. The main purpose of this language is to enable the web designer to write dynamic web pages quickly. PHP was written and first introduced around 1994 by Rasmus Lerdorf through his website to find out who has accessed his online summary [14].

PHP is a script-shaped language that is placed in the server and processed on the server PHP is a script-shaped language that is placed in the server and processed on the server. The result will be sent to the client, where the user using the browser. PHP is known as a scripting language, which integrates with HTML tags, is executed on the server, and is used to create dynamic web pages as well as Active Server Pages (ASP) or Java Server Pages (JSP). PHP is open source software. In particular, PHP is designed to form dynamic web. That is, it can form a view based on current demand. In principle, PHP has the same functionality as scripts such as ASP (Active Server Page), Cold Fusion, and Perl [14].

g) MikroTiks

Mikrotik is a small company headquartered in Latvia, adjacent to Russia, its formation initiated by John Trully and ArnisRiekstins. American John Trully immigrated to Latvia and met Arnis with Physics and Mechanics scholarship around 1995. In 1996 John and Arnis began to rout the world (Mikrotik's vision is to routing the whole world). Starting with Linux and MS DOS systems combined with the 2Mbps Aeronet Wireless LAN (W-LAN) technology in Moldova, Latvia's neighbor, and then serving five of its customers in Latvia, because their ambition is to create one reliable and deployed router software across world.

This is somewhat contradicted by the information that is on the web Mikrotik, that they have 600 point (customer) wireless and largest in the world [7]. Mikrotik is a computer network device in the form of Hardware and Software that can function as a Router, as a tool Filtering, Switching and others. The Mikrotik hardware can be a PC Router (which is installed on the PC) or a Router Board (already built directly from the company Mikrotik). While mikrotik software has known as RouterOS there are several versions. One of the well-known versions of RouterOS today is RB1100 [7]. One example of Router Board hardware can be seen in

Figure 3: Mikrotik RB450G [8]

Their basic principle is not to make Wireless ISP (WISP), but to make the router program that is reliable and can run all over the world. Latvia is simply the "place of experimentation" of John and Arnis, because now they have helped other countries including Sri Lanka serving about four hundreds of its customers.

h) Type of Mikrotik

Mikrotik has 2 products such as mikrotik OS and Mikrotik Router board.

(1) MikroTik Router OS is an operating system and software that can be used to make the computer become a reliable network router, covering various features made for ip network and wireless network, suitable for use by ISP and hotspot provider. For the installation of mikrotik is not required additional software or other additional components. Mikrotik is designed to be easy to use and very well used for the purposes of computer network administration such as designing and building a small to complex computer network system though.

(2) MikrotikRouter Board is an embedded router product from mikrotik.

Router board is like an integrated mini pc because in one board embedded processor, ram, rom, and flash memory. Router board using Router OS that serves as a network router, bandwidth management, proxy server, dhcp, dns server. All of them can also function as a hotspot server.

i) Mikrotik Function

The main function is to make a computer mikrotik as a network router (Routing). In addition, mikrotik also has a function to run applications, including: Application Bandwidth Access capacity, Application Firewall, Wireless Access Point (Wi-Fi), Backhaul Link Application, System Hotspot and Virtual Private Network (VPN) Server.

j) Router

Router is a computer network device that can serve to forward packets of data from one network to another network that is different in a computer network [7]. This router can be built using mikrotik. 3.3. GNS3 GNS3 is a graphical network simulator program that can simulate a more complex network topology compared to other simulators. This program can run on various operating systems, such as Windows, Linux, or Mac OS X [9].

k) Firewall

A firewall is a device that is placed between the Internet and the internal network. Information coming out or incoming must go through this firewall. A Firewall is a software (Software) or hardware (Hardware) that filters out all traffic data (traffic) between our computers, home or office computer networks with the Internet. Firewall in a network, will ensure that when things go wrong bad on one side of the firewall (such as the Internet) then the computer on the other side will not be affected.

The basic function of a firewall is

(1) *Packet Filtering:* All headers of data packets passing through the firewall will be checked, here the firewall makes a clear decision to allow or block each packet.

(2) *Application Proxy:* Firewall is able to check more than just the header of a data packet, this capability requires the firewall to be able to detect specific application specific protocols.

(3) *Monitoring and recording traffic:* Keeping track of what's happening in the firewall is very important, so it can help us to estimate the possibility of a security crashing or provide useful feedback about firewall performance.

l) Virtual Private Network (VPN)

VPN (Virtual Private Network) is a private network that connects one network node to another network node using the Internet network. The data passed will be encapsulated and encrypted, so that the data is guaranteed confidentiality. A VPN is a facility that allows remote connections using a public network for access to a Local Area Network (LAN) in an enterprise. VPN is a way to make a network private and secure by using public network such as Internet. VPNs can send data between two computers that pass through the public network so as if connected point-to-point. The data is encapsulated with a header containing the routing information to obtain a point-to-point connection so that it can pass through the public network and can reach its final destination.

m) VPN Development

VPN was developed to build an intranet with a broad reach through the Internet network. Intranet has become an important component in a company today.

Intranet within the company can grow in accordance with the development of the company. In other words, the bigger a company should have wide bandwidth of the intranet. So the problem becomes more complex if a company has a branch office with a long distance. While on the other hand is always related, for example sending a data and data synchronization [4]. The rapid development of the Internet offers a solution for building an Intranet using a public network or the Internet. On the other hand, an industrial development also demands five needs within the Intranet: (a). Confidentiality, i.e. the ability to encrypt messages along unsafe networks. (b). Access control, which determines who is granted access to the network and what information and many people can accept. (c). Authentication, which examines the identity of two companies that make transactions (d). Integrity, i.e. ensuring that files do not change in transit. (e). Non-repudiation, i.e. preventing two companies from denying.

n) Raspberry Pi

Beginning with concerns over the decline in skills and the number of students wanting to study computer science, Eben Upton, Rob Mullins, Jack Lang and Alan Mycroft from the Computer Laboratory of Cambridge University, England, together with Pete Lomas and David Braben in 2009 founded a nonprofit foundation named Raspberry Pi Foundation. The main purpose of this foundation is to promote the basic learning of computer science in schools.

The name Raspberry Pi itself, then pinned on a credit card-sized minicomputer, was first released to the public in February 2012. Raspberry Pi, or often shortened to Raspy, is the type of Single Board Computer (SBC) the size of a credit card developed by the Raspberry Pi foundation, with a view to learning basic computer science at school. Raspberry Pi and Raspberry Pi 2, manufactured by several electronics manufacturing companies namely; Newark element14 (Premier Farnell), RS Components and Egoman. The hardware produced by some companies is the same with each other. Especially Egoman, this company produces for marketing in Tionghoa (China) and Taiwan. Egoman version can be distinguished on the color of his board is red.

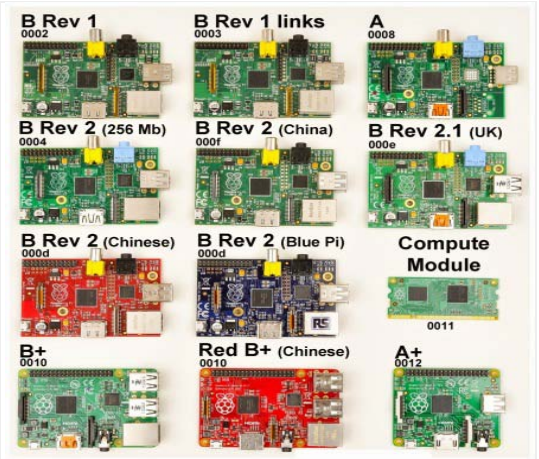

Figure 4: Type of Raspberry Pi

Raspberry Pi does not have a RTC (Real-Time Clock), so Raspi cannot save time when resources are turned off. Alternatively, we can create a script that runs during the first boot process to get the time from the NTP (Network Time Protocol) server. We can also add IC (Integrated Circuit) RTC like DS1307 with backup battery through I^2C channel (Inter-Integrated Circuit) in GPIO (General Purpose Input / Output).

o) Port Knocking

Port-knocking is the concept of hiding a remote service inside a firewall that allows access to the port only to know the service after the client has been successfully authenticated to the firewall. This can help to prevent the scanner from knowing what services are currently available on the host and also serves as a defense against zero-day attacks [4]. 3.5. Hacking is an intrusion activity into a computer or network system in order to abuse or damage existing systems. The definition of the word "misuse" has a very broad meaning, and can be interpreted as theft of confidential data, as well as inappropriate use of e-mail such as spamming or searching for possible network gaps to enter [10]. Inside the firewall all incoming and outgoing communications are controlled. Unnecessary ports can be blocked (closed) and important and dangerous ports can also be blocked, so only allowed parties can log in through that port. This is the most effective and widely used computer network security system. But sometimes blocking is often inflexible, when needed to establish communications with what's inside the network, firewalls do not allow it because it might be in an unauthorized area. Fire walls though are a tool communication [11]. It to be done is very important for the smooth work. For example connecting to the internet and needing to access the web server via SSH to fix the configuration, while the SSH port on the server is prohibited to be accessed from the internet by the firewall, of course this will be very inconvenient. To avoid this sort of thing, there is a very effective method that is by using port

knocking method. Port knocking is a method for building communication between computers from anywhere as long as each computer is connected in a computer network, with a computer device that does not open any communication port freely, but the device is still accessible from outside, using a configuration format an experimental tap port to transmit connections on the tap port

p) Benefit of Port Knocking

Port Knocking is a great method as a way of connecting to their computer devices. Port knocking is suitable for those who still want to strengthen their computer security system and network devices, while still wanting to have a personal connection to it continuously and can be done from anywhere. Personal communication means a connection that is not open to the public like SMTP or HTTP. Usually this personal communication is more administrative and uses services such as telnet, SSH, FTP, TFTP, and more. This personal communication will be very dangerous if it can also be done by others who are not eligible. By using Port knocking, these services will remain closed for public access, but can still be flexibly opened by anyone who has a combination of tap ports.

q) Port Knocking Implementation

Implementation or implementation of the knocking port can be implemented on several devices or operating systems that provide features or service firewall for example Linux and UNIX based operating system [9] and [10]. Port knocking on its basis can be implemented by custom-rule firewall rules that exist in each device or Operating system. Implementation of port knocking on Linux or UNIX based operating system, because in addition to open source firewall rules in the operating system can be modified in such a way that the use of firewall to be more effective in accordance with the interests.

III. Research Method

Stages in this research begin from the identification of needs, literature studies, design of information systems security management, VPN system development, testing, and implementation as Figure 5.

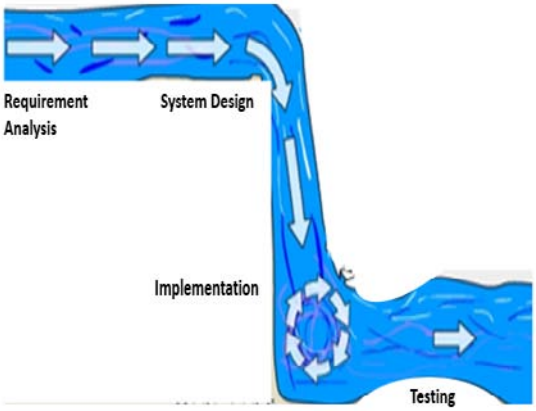

Figure 5: Research Design Stages performed in the study are

a) Requirement Analysis

At this stage the identification of problems to be solved based on the theory and practice of the application. Besides that, there is also a need analysis of system development, both from network aspect and its security as well as application development aspect. This identification needs to be done so that details of the development of information system security model can be tailored to the needs of its users.

b) System Design

Some of the literature referred to in this study discuss about network management, network connection, network security, user database, and programming is used to support the development of web knocking model in this research. References used from some similar research that has been done by other researchers also become an important reference in overcoming trouble shooting during development.

c) Implementation

The model will be based on the results of problem identification and needs analysis. The design of information systems security management tailored to the needs of users. Besides, the components and parameters that will be applied into the system both hardware and software are made in detail by considering the aspects of network security and user convenience. Models that have been made will be used as a reference in the manufacture of network security systems and web knocking based application system. Information system security management is based on the design of web knocking model that has been made in the previous stage. This security system must be able to ward off attacks by the parties who are not responsible (hackers). The enormous risk must be borne by the server owner and the admin system if an open network connection built can be attacked by a hacker. One of the risks is that hackers can retrieve / delete existing data on the server.

All connections to the server either through the local network (LAN) or via the Internet (WAN) network must be guaranteed security. Protection of server network security (firewall) can be done in layered. There are many ways to perform network security. In this research, network security model used is using knocking port. This server knock method is very well used to secure access to the server via a wide network (internet) because only registered users can login into the server. If the user is not recognized and tap the door is not allowed by the admin system, then the user cannot access the system information and if doing some login error it will be identified as hacker / hacker.

After system development on the network, the next step is to build a web-based application. The applications used for security connections are of some sort and usually the app is not user friendly. Development of web-based applications will facilitate the user when logged into the network system, which is just by typing a web address. After the user is allowed to enter through the process of entering account (login) in which will do knock the door firewall (knocking) automatically. After successful knocking identification is done, the server sends the token ID via short message service and asks the user to enter the token ID code on the web.

d) Testing

After the process of developing the network security system and application login system, the next step is to test. This process requires precision and accuracy by including various possibilities. This is done so that the weakness of the system (hole) that allows hackers to attack can be identified and can be repaired. The smallest possibility should be taken into account considering the open network created allows everyone to try to enter into the built system. The final stage is implementation and documentation. Implementation can be done in the form of socialization to the leaders, lecturers and employees who want access server STIE Perbanas Surabaya by using internet connection from home respectively.

e) Overview of Research Model

In Figure 6 an overview of the research model. Stages performed by users who will connect access system information using the Internet network with the condition of the system information server for port 80 (http) is still closed by the firewall, which is begun by logging access through the internet through the browser with web knocking techniques in it. After successful login the user will receive the token ID either via short message or email, the user will enter the token ID on the web. If successful then the Laptop / PC users can access the information system previously port 80 (http) and https (443) closed that cannot be accessed through public.

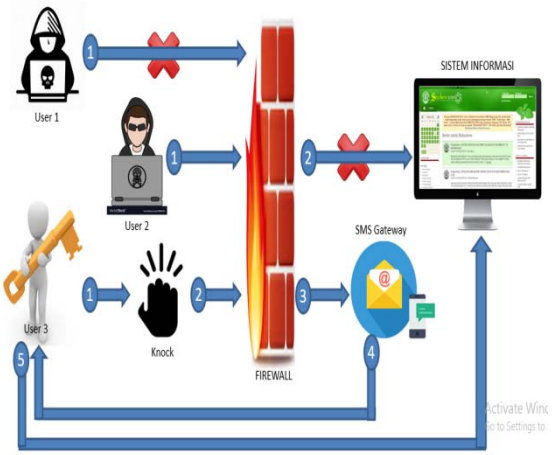

Figure 6: Systems Flow Security Intelligent

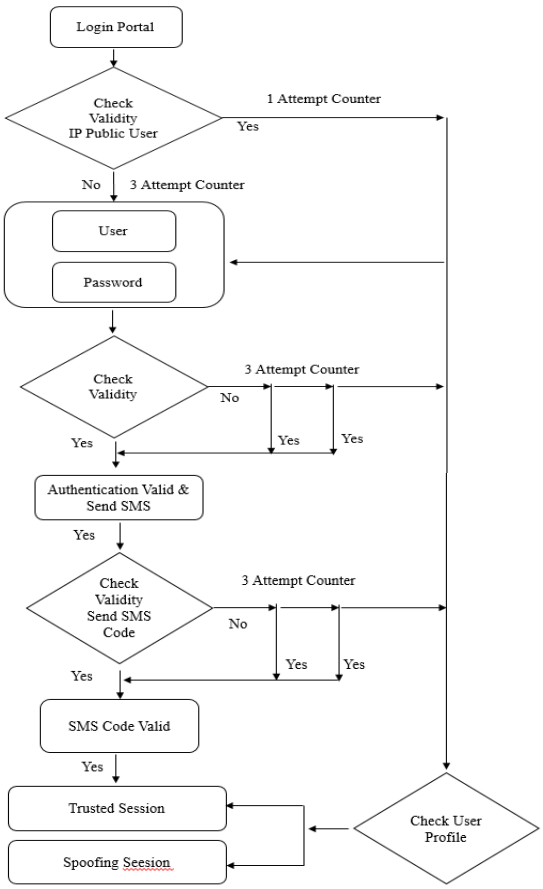

Figure 7: Flows of Login Mechanics

IV. Results and Analysis

a) Authentication Mechanism

At the stage of the security system, trusted users will be registered on the database such as user name, password and phone number are registered. After that the authentication process is developed through three layers that verify the user is trusted if the user and password are entered correctly then automatically included in it do knocking port to mikrotik

firewall and followed by entering the verification code sent via short massage to user's phone no user

b) Infrastructure Firewall Mechanism

The security system developed can be integrated with system or network infrastructure that has been available, with reference to the concept of security and ease of access. This security system model uses a mikrotik device as a firewall used to close all port access and block all access from the internet. Furthermore, raspberry PI uses Linux operating system which contains web server and database as storage media detail of trusted user data, public IP information and as a random code delivery media, from raspberry PI connected with modem shot message gateway as a random message delivery media sent to user via email or short message service. In Figure 8 is a network security infrastructure scheme that can be integrated on the available network, and the three devices are placed in the outermost position on the LAN network as a medium of network security of public access LAN network. This web-based security system with ssl encryption model can be accessed by the user via internet connection using laptop, PC or gadget.

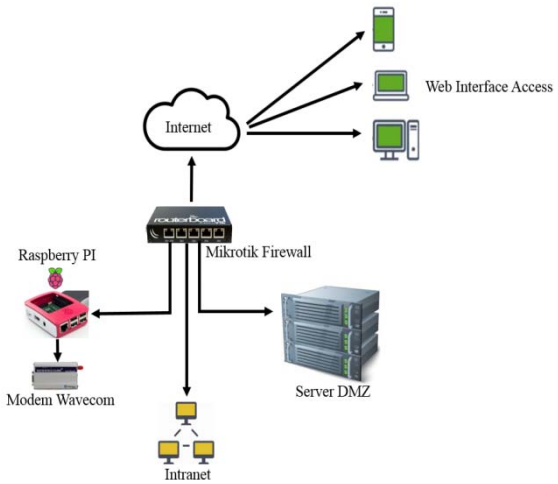

Figure 8: Web Knocking Network Infrastructure

c) Ip Public Verification

Public IP address checks on the database will be performed by the system when the user accesses on the web knocking page, if the IP address used by the user is included in the blacklist, then the user is only given 1 chance to login user, password and short message service code on the web knocking page, otherwise then the user gets 3 times a chance in the input on the web knocking page. The public IP entries in the Blacklist are obtained if a user encounters user login errors, passwords and random code 3 times, the IP address public blacklist will be stored in the database for 60 minutes and after that it will automatically be deleted on the database.

Algorithm 1: Public IP

1. Begin
2. Check IP Public
3. If IP Public = Blacklist Then
4. User_Alert> = 1
5. Else
6. If IP_Public = Whitelist Then
7. User_alert> = 3
8. Else
User_Auth_Knock
10. End If
11. End if
12. End

d) User Verification

Authentication users are gained by a trusted user after being registered in the database. The user access stage for the information system is done through the web https: //webknocking.xx.xx. After the user is registered by the network admin continued in the stages of the staged security system first stage is when checking the user, password and chaptha entered on the web then the system will verify on the database, if checking the user has made error> = 3 it will receive user information suspend, if not user will get chance 3 times input, if user make error> = 3 then user will disable and will be included in accumulated calculation of suspend user. If not then the system will make the process of knocking through the web server to the firewall and process proceed to the next stage of receiving random code via email / short message service. In anticipation of error 3 times login time on web knocking page available menu forgot password, before user input user and password if user hesitate or forgot password then user can do password reset by click forgot password by entering email address / telephone number registered in database, if the verification matches then the user will receive a password reset link code via email or the user will receive a random code and input a random code short message service for the creation of a new password.

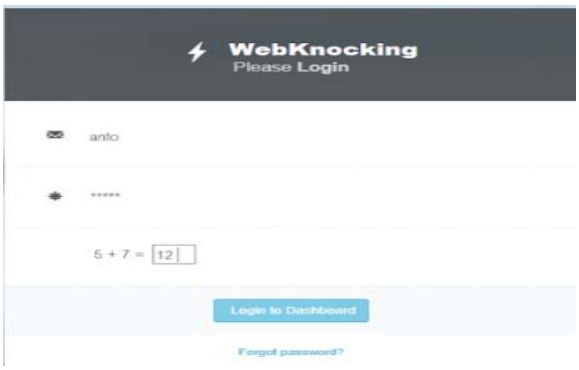

Figure 9: Web knocking page

Figure 9 is a web knocking portal page https: //webknocking.xx.xx. After checking Public IP used by

user and below is process user algorithm auth knock

Algoritm 2: User_Auth_Knock

1. User Input, Password, Chapcta
2. Begin
3. Check Dicttionary_Suspend_Count = 0
4. If Check Log_count_Error_login> = 3 Then
5. Suspend
6. Else
7. If User_Auth_Knock> = 3 Then
8. Block_Access
9. Else
10. Activity_Knock1
11. End If
12. End if
13. End

e) Knocking Port

Knocking port is a security mechanism that opens a closed firewall port by passing a tap to a firewall with a combination of ports already registered to the firewall. Mikrotik firewall has been integrated with PHP programming language using API.

The step is when the user and password pass the verification in the initial stages, then the web server will do a knock on mikrotik firewall to open a closed port. There are 2 stages of the first tap is the user and password and the second is done opening mikrotik firewall port is when the user passes the short message service code verification. Automatically on the second stage IP public user will be enrolled in white list firewall mikrotik to be allowed access to local network source or system information which by default is covered by firewall.

```
[admin@Mikrotik Firewall] /ip firewall filter> print
Flags: X - disabled, I - invalid, D - dynamic
 0   chain=input action=accept protocol=tcp src-address-list=LAN dst-port=8291,21,22,23,80,8728 log=no log-prefix=""

 1   chain=input action=add-src-to-address-list protocol=tcp src-address=192.168.0.124 address-list=ketuk1
     address-list-timeout=5m dst-port=9000 log=no log-prefix=""

 2   chain=input action=add-src-to-address-list protocol=tcp src-address=192.168.0.124 src-address-list=ketuk1 address-list=ketuk2
     address-list-timeout=5m dst-port=9100  log=no log-prefix=""

 3   chain=input action=drop protocol=tcp src-address-list=!free dst-port=8291,21,22,23,80,443 log=no log-prefix=""
```

Figure 10: Mikrotik Firewall

In Figure 10 is a mikrotik firewall configuration, line 1 is a combination of first-stage knocking ports to be able to get access knocking permission to the second stage, in the second line is a combination of knocking port to add IP Public user into the address list that can access the local network While on line the third is an access block for access to the local network unless the address list has been entered in the second stage.

Algorithm 3: Activity_Knock1

1. Begin
2. Activity_Knock1
3. If User_Auth_Knock = valid Then
4. Activity_knock1 = http: // ipFirewall: 9000
5. Else
6. Short message service_Code_Knock
7. End If
8. End

f) Short Message Service and Email Code

Short message service Code is the final verification stage for opening access of network resources of LAN / information system, system will send short message service code to user which is random code generated in auto generate system. At this stage every user who passes user verification, password and chapcha will receive short message service code and insert on the web nocking page, if the short message service code in the entry does not match the unique code in the database up to 3 times then the user will automatically be blocked and the error will be accumulated at database suspend user, if appropriate then the user system through web server do knocking to firewall and IP Public user will be given access permission to open firewall port. Automatically a trusted user will log on to the portal page and can access the LAN network.

Figure 10: Short Message Service Code Verification

In Figure 10 is the page to enter the verification code obtained by the user via short message service or email.

After successfully entering the short message service code in Figure 11 is the picture when the user has successfully logged on the system security, automatically users will also access system information that is on the network that by default is covered by the firewall.

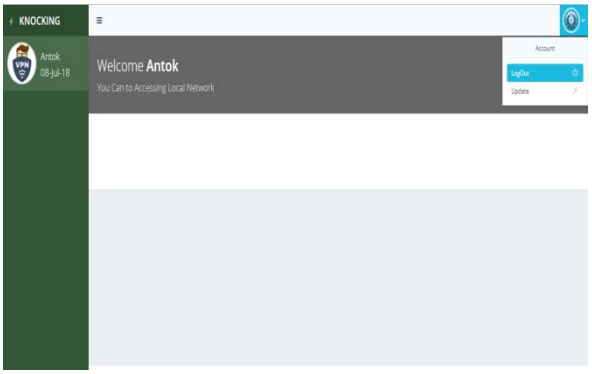

Figure 11: Portal Login Web knocking

1. Begin
2. Short message service_Code_Knock
3. If Short message service code = valid Then
4. Activity_knock2 = http://ipFirewall:9100
5. Trusted User
6. Else
7. If Alert Count>= 3 Then
8. Block connection
9. Else
10. Suspend
11. End If
12. End If
13. End

For suspended users can contact the network admin to reset the password so that the suspend user count will return to 0, the system if the suspend user status <= 2 will update to 0 if the user has successfully done 3 user login, password and short message service code without errors in different time periods. Here is the information of all user log actives in the database presented in table 1 and table 2, in table 1 it contains about checking public IP status used by user when accessing web knocking page, User status contains about enable, disable, new user Suspend error.

Table 1: User Log Activities

User	IP Public	User Status	Suspend Count	Error Alert Account	Alert Status	Next Alert
antok	Whitelist	Enable	0	1	Allow	Permited
User 1	Blacklist	Disable	6	2	Suspend	Not Permited
Yusuf	Blacklist	Enable	5	3	Suspend	Not Permited
Sumantri	Whitelist	Enable	0	1	Allow	Permited
Anton	Whitelist	Enable	0	1	Allow	Permited
Risky	Whitelist	Disable	2	2	Suspend	Not Permited
Nanang	Blacklist	Disable	3	2	Suspend	Not Permited
Next SMS Code						
antok	Whitelist	New	0	2	Block	Not Permited
Sumantri	Whitelist	Old	0	1	Allow	Trusted User
Anton	Whitelist	Old	0	1	Allow	Trusted User

While in table 2 is the log information of Public IP address of user, access date and user access time successfully access on portal page of knocking.

Table 2: Log Information of Public IP

No	User name	Source IP Address	Alert Date	Alert Time
1	Hariadi	202.xx.xx.xx	03/01/2018	05:10 am
2	User 1	110.xx.xx.xx	03/01/2018	08:15 pm
3	Yusuf	203.xx.xx.xx	20/11/2017	06:03 am
4	Sumantri	158.xx.xx.xx	25/11/2017	11:00 pm
5	Anton	118.xx.xx.xx	01/12/2017	02:15 am
6	Risky	110.xx.xx.xx	05/02/2018	09:10 am
7	Nanang	66.xx.xx.xx	10/05/2018	10:22 pm
8	Romi	118.xx.xx.xx	11/05/2018	08:35 am
9	Bisry	202.xx.xx.xx	22/06/2018	09:25 pm
10	Fuad	110.xx.xx.xx	18/06/2018	10:10 pm

g) Penetration Testing Webknocking

In this study the tests were conducted to test the vulnerability or vulnerability of the web or known as the penetration test (pentest) on webknocking pages. In pentest tools used is to use nmap port scanner to view the open port and use nikto tools to do web knocking vulnerability testing.

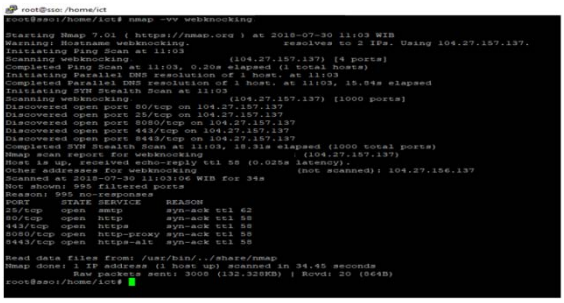

Figure 12: Port Scanning

Based on Figure 12, the port scaning results show an open port of 80 for web, 443 for https, 25 for smtp and 8443 for http-alt. Public IP used webknocking has been secured using proxy in cloudflare. From the analysis of the webknocking does not open the port used to perform the opening knock of the firewall on ports 9100 and 9200. So not visible when the scaning port from the internet.

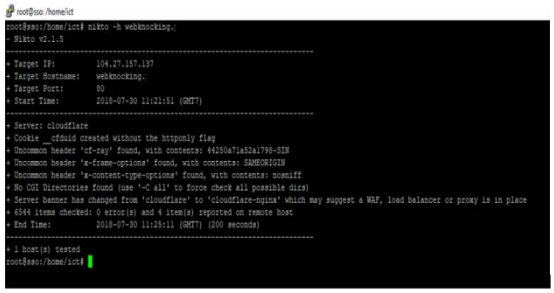

Figure 13: Vulnerability test

Based on Figure 13, the results of the analysis of vulnerability checking from web webknocking, from the web application nikto webserver web application aplication firewall (WAF) from cloudflare, so that if not found a dangerous vulnerability.

V. Conclution and Suggestion

Security issues will be a challenge for any industry, sometimes for mature industries with adequate resources often facing security issues. The purpose of this research is to develop and implement security intelligence for the industry with user-friendly system and can be integrated with existing network with relatively cheaper cost. So for some middle and lower industry that difficulties in the implementation of security in information systems can implement this security system with easy use.

This security system has been tested using security penetration test tools with results that have been as expected that no ports are open and little vulnerability is found. Perhaps in its development penetration test can use other tools.

VI. Future Scopes

The system can further be enhanced by providing various options. Adding advance intelligence security will be more given secure operating activities to organization. The development of intelligence security in services industries i.e. banking sector and hospitals were next opportunity to build and develop security information system. More effective and robust security intelligence becomes the next research challenge in the future.

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Global Journal of Computer Science and Technology: E Network, Web & Security
Volume 18 Issue 4 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Performance Evaluation of Encrypted Text Message Transmission in 5G Compatible Orthogonal Multi-level Chaos Shift Keying Modulation Scheme Aided MIMO Wireless Communication System

By Md. Omor Faruk & Shaikh Enayet Ullah
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GJCST-E Classification: C.2.1

Strictly as per the compliance and regulations of:

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I. Introduction

Differential chaos shift keying (DCSK) has low complexity receiver and shows excellent performance for time-varying multi-path fading channels among all chaos shift keying (CSK) modulations. The differential chaos-shift-keying (DCSK) scheme together with a non-coherent detector offers reasonably acceptable error performance over multipath channels. In perspective of low cost property, DCSK scheme is considered in multiple input multiple output (MIMO) system, wireless personal area networks (WPANs), power line communication systems and cooperative communication system [1, 2].

In 2017, Yang and et al. the authors proposed and designed a multi-carrier chaos shift keying (MC-CSK) modulation system based on multi-carrier transmission and multi-level chaos shift keying modulation. In their works, both analytical and simulation results confirmed that the MC-CSK system outperformed differential CSK (DCSK) and MC-DCSK systems in BER performance [3]. At[4] in 2017, Kaddoum and et al. proposed an SR-DCSK system that performed simultaneous wireless information and power transfer (SWIPT) with an exploitation of the saved time gained from the fact that reference signal duration of SR-DCSK scheme occupied less than half of the bit duration to transmit a signal. The authors demanded that with their simplified designed system, the results showed that the proposed solution saved energy without sacrificing the non-coherent fashion of the system or reducing the rate as compared to conventional DCSK. In 2018, Dai and et al. proposed a novel carrier index DCSK modulation system for increased energy and spectral efficiencies based on splitting all data bits into two groups carried by the chaotic signals and their Hilbert transforms. With their derived analytical bit error rate expressions over additive white Gaussian noise and multipath Rayleigh fading channels, the advantages of their proposed system were verified [5]. At [6] in 2018, Narang and et al. emphasized the improvement of security in Free Space Optical (FSO) communication system with the utilization of the Gamma-Gamma turbulence model and DCSK scheme. In their work, the performance of the proposed chaotic FSO system was studied with consideration of different turbulence conditions and derived an analytical expression of the probability of error.

In this present study, we have implemented a novel non-coherent multi-level DCSK modulation technique on secured text message transmission. Such scheme is based on both the transmitted-reference technique and multi-level orthogonal modulation, where each data-bearing signal is chosen from a set of orthogonal chaotic wavelets which is constructed by a reference signal [7].

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II. Signal Processing Techniques

In this section, an overview of different implemented signal detection and channel coding schemes is given.

a) MMSE and ZF Signal Detection

In $N_R \times N_T$ MIMO system, the signal model can be represented by

$$y=Hx+n \quad (1)$$

Where, H is a channel matrix with its $(j,i)^{th}$ entry h_{ij} for the channel gain between the i^{th} transmit antenna and the j^{th} receive antenna, j=1,2,.....NR and i=1,2,.....NT, $x=[x_1,x_2,.....x_{N_T}]^T$ and $y=[y_1,y_2,.....y_{N_R}]^T$ are the transmitted and received signals and $n=[n_1,n_2,.....n_{N_R}]^T$ is the white Gaussian noise with a variance of σ^2_n. Following the signal model presented in equation 1, the minimum mean square error (MMSE) weight matrix can be described as:

$$W_{MMSE}=(H^H H+\sigma_n{}^2 I)^{-1}H^H \quad (2)$$

And the transmitted signal is given by

$$\tilde{x}_{MMSE}=W_{MMSE}y \quad (3)$$

In the ZF scheme, the ZF weight matrix has been given by

$$W_{ZF}=(H^H H)^{-1}H^H \quad (4)$$

And the transmitted signal is given by [8]

$$\tilde{x}_{ZF}=W_{ZF}y \quad (5)$$

b) Cholesky Decomposition (CD) based ZF detection

In Cholesky Decomposition (CD) based ZF detection scheme, the matched filtering (MF) based detected signals using equation (1), can be written as:

$$\hat{x}_{MF}=H^H y=H^H Hx+H^H n \quad (6)$$

Where, H^H is the Hermitian conjugate of the estimated channel. In interference constraint scenarios, the more forwarded ZF detector has been required which operates on the MF data by,

$$\hat{x}_{ZF}=(H^H H)^{-1}\hat{x}_{MF} \quad (7)$$

Equation (7) has been written in modified form as:

$$\hat{x}_{ZF}=(H^H H)^{-1}\hat{x}_{MF}=(LL^H)^{-1}\hat{x}_{MF} \quad (8)$$

With onward and backward substitution, the identified signal in CD-based ZF detection could be [9]:

$$\hat{x}_{ZF}=L^{-H}L^{-1}\hat{x}_{MF} \quad (9)$$

c) Group Detection (GD) approach aided Efficient Zero-Forcing (ZF)

In Group Detection (GD) approach aided Efficient Zero-Forcing (ZF) signal detection scheme, Equation(1) can be reworded as:

$$y=\begin{bmatrix}\overline{H}_1 & \overline{H}_2\end{bmatrix}\begin{bmatrix}s_1\\ s_2\end{bmatrix}+n=\overline{H}_1 s_1+\overline{H}_2 s_2+n \quad (10)$$

Where, $\overline{H}_1 \in C^{N_R \times L}$ and $\overline{H}_2 \in C^{N_R \times (N-L)}$ are composed of first L and the remaining (N-L) columns of H respectively, N is the total number of columns of H. Similarly, $s_1 \in C^{L\times 1}$ and $s_2 \in C^{(N-L)\times 1}$ are the two sub-symbol vectors that are created by taking the first L rows and the remaining rows of x. Defining a weight matrix, $W_1=(\overline{H}_1{}^H \overline{H}_1)^{-1}\overline{H}_1{}^H$, where (•) H denotes Hermitian transpose operation. Multiplying each sides of the equation (10) by W_1, we obtain

$$W_1 y=s_1+W_1\overline{H}_2 s_2+W_1 n \quad (11)$$

Or equivalently, we can write

$$s_1=W_1 y-W_1\overline{H}_2 s_2-W_1 n \quad (12)$$

Substituting equation (12) into equation (11) and after some small manipulation, we get

$$y_2=\tilde{H}_2 s_2+n_2 \quad (13)$$

Where, $y_2 \in C^{N_R\times 1}$, $\tilde{H}_2 \in C^{N_R\times(N-L)}$, and $n_2 \in C^{N_R\times 1}$. The y_2, $\tilde{H}_2$ and n_2 can be reworded as:

$$y_2=(I-\overline{H}_1 W_1)y \quad (14)$$

$$\tilde{H}_2=(I-\overline{H}_1 W_1)\overline{H}_2 \quad (15)$$

$$n_2=(I-\overline{H}_1 W_1)n \quad (16)$$

Where I is the identity matrix. On the basis of estimated $\tilde{H}_2$, another weight matrix W_2 can be defined as $W_2=(\tilde{H}_2{}^H \tilde{H}_2)^{-1}\tilde{H}_2{}^H$ (17)

The sub-symbol vector s_2 is estimated using $\hat{s}_2=Q(W_1 y_1)$, where the symbol Q is indicative of quantization. The effect of s_2 is canceled out from y to get $y_1=y-\overline{H}_2\hat{s}_2$. The sub-symbol vector s_1 is estimated using $\hat{s}_1=Q(W_1 y_1)$. The transmitted signal vector x has been approximated as [10]:

$$\hat{x} = \left[\hat{s}_1^{\,T} \;\; \hat{s}_2^{\,T}\right]^T \quad (18)$$

d) Convolutional Channel Coding

Convolutional codes have been commonly specified by three parameters (n,p, q), where, n = number of output bits; p = number of input bits; q = number of memory registers. The quantity p/n is called the code rate, and it is a measure of the efficiency of the code. In this present study, ½ rated convolutional encoders are designed so that the decoding can be functioned in some structured and simplified way based on Viterbi decoding algorithm. The constraint length, L= (p(q-1)) represents the number of bits in the encoder memory that affect the generation of the n output bits. The currently deliberated convolutional channel encoder is specified with ½ coding rate, a constraint length of 7and code generator polynomials of 171 and 133 in the octal numbering system. The code generator polynomials G1 and G2 can be expressed as [11]

G1=x0+x2+x3+x5+x6=1 0 1 1 0 1 1=133 (19)
G2= x0+x1+ x2+x3+ x6=1 1 1 1 0 0 1 =171 (20)

e) LDPC Channel Coding

The low-density parity-check (LDPC) code was discovered by Gallager as early as 1962. An LDPC code is linear block code, and the parity-check matrix H of it contains only a few 1's in comparison to 0's (i.e., sparse matrix).Such LDPC codes have been graphically depicted by the bilateral Tanner graph. Its nodes have been combined into one set of n bit nodes (or variable nodes) and the other set of m check nodes (or parity nodes). Check node i has been connected to bit node j in the event of any elemental value of the parity matrix unity. The decoding operates alternatively on the bit nodes and the check nodes to find the most likely codeword c that satisfies the condition cHT = 0. In iterative Log Domain Sum-Product LDPC decoding under discretion of AWGN noise channel of variance σ2 and received signal vector r, log-likelihood ratios (LLRs) instead of probability have been defined as:

$$L(c_i) \triangleq \ln[P(c_i = 0|r_i)/P(c_i = 1|r_i)]$$
$$L(P_{ij}) \triangleq \ln[P_{ij}^{\,0} / P_{ij}^{\,1}) \quad (21)$$
$$L(Q_{ij}) \triangleq \ln[Q_{ij}^{\,0} / Q_{ij}^{\,1}) \; L(P_j) \triangleq \ln[Pj^0 / Pj^1)$$

Wherein (.) represents the natural logarithm operation. The bit node j is initially set with an edge to check node i: $L(P_{ij}) = L(c_i) = 2r_i/\sigma^2$ (22) In message passing from check nodes to bit nodes for each check node i with an edge tobit node j; L(Q ij) has been updated as:

$$L(Qij) = \prod_{j'} \alpha_{ij'} \phi[\sum_{j'} \phi(\beta_{ij'})] \quad (23)$$
$$(j' = 1,2.....n \text{ and } j' \neq j)$$

where, $\alpha_{ij} \triangleq \text{sign}[L(P_{ij})]$ and $\beta_{ij} \triangleq [L(P_{ij})]$. The ϕfunction is expressed as:

$$\phi(x) = -\ln[\tanh(x/2)] = \ln[(e^x + 1)/(e^x - 1)] \quad (24)$$

L (Pj) is updated from bit nodes to check nodes for every bit node j with an edge to check node ias:

$$L(Pij) = L(c_i) + \sum_{i'} L(Qij) \quad (25)$$
$$(i' = 1,2.....m \text{ and } i' \neq i)$$

Decoding and soft outturns: for j=1, 2, 3…,n; L (Pj) has been updated as:

$$L(Pj) = L(c_i) + \sum_i L(Pij) \quad (i = 1,2.....m) \quad (26)$$

$$c_i = \begin{cases} 1 \text{ if } L(P_j) < 0 \\ 0 \quad \text{else} \end{cases} \quad (27)$$

If $cH^T=0$ or the number of iterations reaches the maximum limit [12]

f). (3, 2) SPC Channel Coding

In SPC channel coding, the transmitted binary bits have been rearranged into very short code words consisting of merely two consecutive bits. In such coding, (3, 2) SPC code has been used with addition of a single parity bit to the message u = [u0, u1] so that the elements of the resulting codeword x = [x0, x1, x2] are given by x0 = u0, x1 = u1 and x2 = u0 ⊗u1
Where the symbol ⊗has been considered here to denote the sum over GF (2)

g). Repeat and Accumulate (RA) Channel Coding

The RA is a powerful modern error-correcting channel coding scheme. In such channel coding technique, all the extracted binary bits from the audio is arranged into a single block, and the binary bits of such block is repeated two times and rearranged into a single block containing binary data which is double of the number of input binary data [13].

III. System and Signal Models

The block diagram of the 5G compatible orthogonal multi-level chaos shift keying modulation scheme aided simulated MIMO wireless communication system has been depicted in Figure 1. In such a simulated technique, a text message has been converted into binary bit form and the extracted binary signal vector m∈(0,1) afterward it is channel encoded, interleaved and

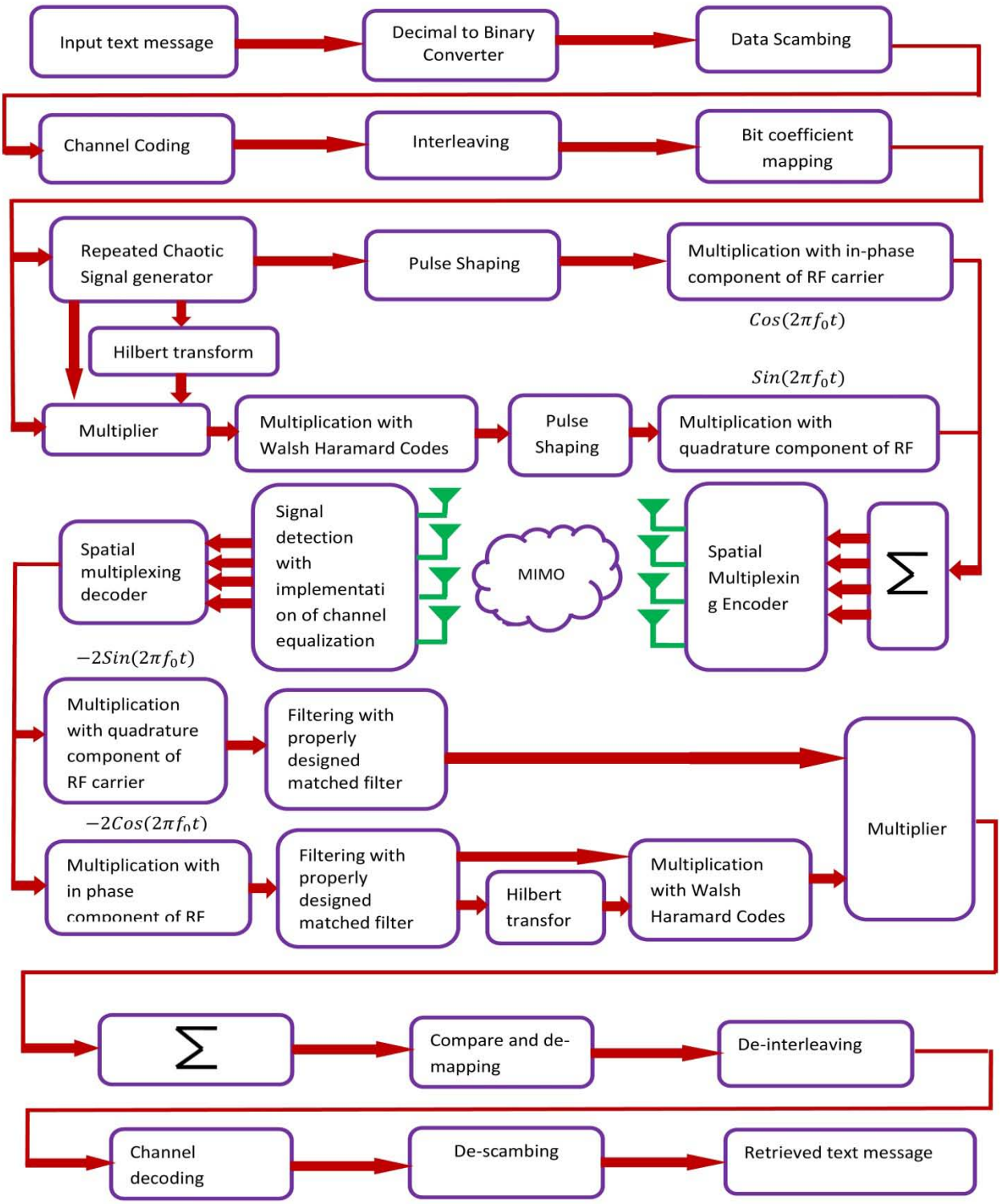

Fig.1: Block diagram of Encrypted text message transmission in 5G compatible Orthogonal Multi-level Chaos Shift Keying Modulation Scheme Aided MIMO Wireless Communication System

Subsequently processed for coefficient mapping using two consecutive binary bits in two-time slots (N=2). In every case, one of the coefficient values is one (1) and the remaining other values are zero. In first time slot (duration of a single bit), a repeated chaotic signal generator outputs straightly a chaotic

sequence$\{x_i\}_{nN\ \beta}^{nN\ \beta+\beta-1}$with the length of the series is of $\boldsymbol{\beta}$. Till the end of two consecutive bit duration, this sequence is then delayed and repeatedly outputted for one more time.

The originated chaotic sequence undergoes pulse shaping and can be described under consideration of chip time $\mathbf{T_c}$ and for a length of time $\boldsymbol{\beta}$-1 slot $\mathbf{T_s = \beta T_c}$.

$$x(t) = \sum_{i-0}^{\beta-1} x_n N\beta + i h_T(t - iT_C) \tag{28}$$

In case of considering $\mathbf{h_T(t)}$ as the impulse response of a pulse shaping filter with time duration of T_c, the reference signals in the n-th symbol duration can then be described as

$$y_r(t) = \sum_{k=nN}^{(n+1)N-1} x(t - kT_s) \tag{29}$$

And the data-bearing signal in the nth symbol duration is computed by

$$y_{d,t} = \sum_{m=0}^{N-1} \sum_{k=nN}^{(n+1)N-1} a_{n,m} w_{m,k} x(t - kT_s) + \sum_{m=0}^{N-1} \sum_{k=nN}^{(n+1)N-1} a_{n,m+N} w_{m,k} \hat{x}(t - kT_s) \tag{30}$$

Where

$$\hat{x}(t) = \sum_{i=0}^{\beta-1} x_n N\beta + i h_T(t - iT_c) \tag{31}$$

And $\hat{\mathbf{x}}_{\mathbf{nN\beta+i}}$ is the Hilbert transform of $\mathbf{x_{nN\beta+i}}$ and $\mathbf{w_{m,k}}$ are the four orthogonal Walsh Hadamard codes used for proper identification of individual signal. The reference signal in (29) and the data-bearing signal in (30) have been modulated onto a cosine and a sine carrier, respectively, so that they could be delivered via the in-phase and quadrature channels.

Finally, the transmitted signal in the nth symbol duration has been obtained as:

$$s_n(t) = y_r(t)\cos(2\pi f_0 t) - y_d(t)\sin(2\pi f_0 t), \quad nNT_s \le t < (n+1)NT_s \tag{32}$$

Where $\mathbf{f_o}$ is the frequency of the sinusoidal carriers, such that $\mathbf{f_o}$is a multiple of $\mathbf{1/T_C}$. Satisfying $\mathbf{f_o \gg 1/T_C}$

In an AWGN and Rayleigh fading channel H, the obtained signal has been corrupted by stationary Gaussian noise with zero mean and power spectral density of $\mathbf{N_o/2}$.

The received signal can be described by

$$r_n(t) = H \times s_n(t) + n(t) \tag{33}$$

The obtained signal has been passed through a signal detection technique and fed into a spatial multiplexing decoder and for producing a signal channel data vector,

$$\hat{r}_n(t) = \hat{s}_n(t) + n(t) \tag{34}$$

This $\hat{r}_n(t)$ signal is multiplied with both in-phase and quadrature components of RF signal and filtered with properly designed matched filters. The outputs of the matched filters can be defined as;

$$y_{r,i} = x_{k\beta+i} + \varepsilon_{k\beta+i} \quad nN\beta \le k\beta + i < (n+1)N\beta) \tag{35}$$

$$y_{d,i} = \sum_{m=0}^{N-1} W_{m,k}(a_{n,m}x_{k\beta+i} + a_{n,m+N}\hat{x}_{k\beta+i}) + \eta_{k\beta+i}, \quad nN\beta \le k\beta + i < (n+1)N\beta \tag{36}$$

Where $\varepsilon_{k\beta+i}$ and $\eta_{k\beta+1}$ are two independent Gaussian random variables and both with zero mean and variance N_o.

From the format of the signal in OM-DCSK, it can be simply inferred that in (35) and (36) as follow;

$$x_{k\beta+i} = x_i, \quad 0 \le i < \beta \quad nN \le k < (n+1)N \tag{37}$$

$$\hat{x}_{k\beta+i} = \hat{x}_i, \ 0 \le i < \beta \quad nN \le k < (n+1)N \tag{38}$$

The output of the mth correlator (presented figure number 2 of [14]) has been obtained then as:

$$Z_m = \begin{cases} \sum_{k=nN}^{(n+1)N-1} w_{m,k} \sum_{i=0}^{\beta-1} y_{r,i} y_{d,i} & 0 \le m < 2 \\ \sum_{k=nN}^{(n+1)N-1} w_{m-N,k} \sum_{i=0}^{\beta-1} \hat{y}_{r,i} y_{d,i} & 2 \le m < 4 \end{cases} \tag{39}$$

By comparing all the correlator outputs, the coefficient $a_{m,n}$ associated with the greatest correlator outturns will be laid to one, while the remaining are zero.

Finally, the data bits can be recaptured based on the reversed version of the mapping rule (Table 1 of [14]). The estimated coefficient values have been converted into binary form, de-interleaved, channel decoded, binary to integer converted and the text message has been retrieved after decryption.

IV. Result and Discussion

Hereafter, a series of simulation results have been depicted in terms of BER to illustrate the impact of the system performance in Orthogonal Multi-level Chaos Shift Keying Modulation Scheme aided MIMO Wireless Communication System.

The performance of the system is illustrated by using MATLAB Ra2017a based on the simulation parameters are demonstrated in the following Table-1.

Table 1: Summarization of the Simulated Model Parameters

Text message with number of binary bits	1400
Signal detection techniques	MMSE, ZF, Cholesky Decomposition and Group Detection (GD) approach aided Efficient Zero-Forcing (ZF)
Channel coding	Half rated Convolutional, (3,2) SPC, LDPC, and Repeat and accumulate (RA)
Length of orthogonal Walsh Hadamard code	64
Pulse shaping filter with Rolloff factor	Raised cosine with 0.25
Bit rate	1Gbps
No of samples generated in Chaotic signal, β value	64
No. of transmitting/ Receiving antennas	4/4
Channel	MIMO fading channel
Signal to noise ratio (SNR)	-5 to 5 dB

It is critically noticed that the result of the system provides comparatively better performance under the implementation of MMSE signal detection technique from the graphical illustration presented in Figure 2 to Figure 5.

In Figure 2, the performance of the system is highly well defined under various implemented signal detection and ½-rated convolutional channel coding techniques. For a typically presumed SNR value of -4 dB, in the aspect of ZF, MMSE and Cholesky Decomposition and Group Detection (GD) approach aided Efficient ZF signal detection techniques, the approximated BER values are found to have values of 0.1880, 0.0315, 0.1412 and 0.1458 respectively which effectively ratifies system performance improvement of 7.76 dB, 6.52 dB and 6.65 dB in the aspect of MMSE in comparison with to ZF, Cholesky decomposition and Group Detection (GD) approach aided Efficient Zero-Forcing (ZF) signal detection techniques respectively. At 5% BER, SNR gain of 2.10 dB has been achieved in MMSE as compared to the GD approach aided Efficient ZF and 1.90 dB in MMSE as compared to Cholesky decomposition.

Under the identical consideration of SNR value (-4 dB), it is noticeable from the Figure-3 that the estimated BER values are 0.1613, 0.2014, 0.2027 and 0.2246 in case of MMSE, Cholesky decomposition, ZF and GD approach aided Efficient ZF signal detection technique respectively. In such cases, the system performance improvement of 0.96 dB and 0.99 dB have been achieved in MMSE as compared to Cholesky decomposition and ZF signal detection techniques. At 10% BER, SNR gain of 0.65 dB and 0.72 dB have been obtained in MMSE as compared to Cholesky Decomposition and GD approach aided Efficient ZF signal detection.

In Figure 4, it has been observed that the system performance is well segregated in the different scenario at low SNR region (-5dB to -2dB). For a typically presumed SNR value of -4 dB, the approximated BER values are 0.0407 and 0.0754 respectively in case of MMSE and ZF signal detection techniques which ratifies a system performance improvement of 2.68 dB. At 2% BER, SNR gain of 1.45 dB obtains in MMSE as compared to ZF.

It is keenly noticeable from Figure 5 that the system performance is not well segregated in all signal detection techniques excepting MMSE. For a typically considered SNR value of -4 dB, the approximated BERs are found to have values of 0.0301 and 0.0861 in case of MMSE and ZF which is indicative a system performance of 4.56dB. At 2% BER, a low SNR (-3dB) is required for MMSE. On the other hand, comparatively, a high SNR (-1.5dB) is required for the GD approach aided Efficient ZF signal detection technique.

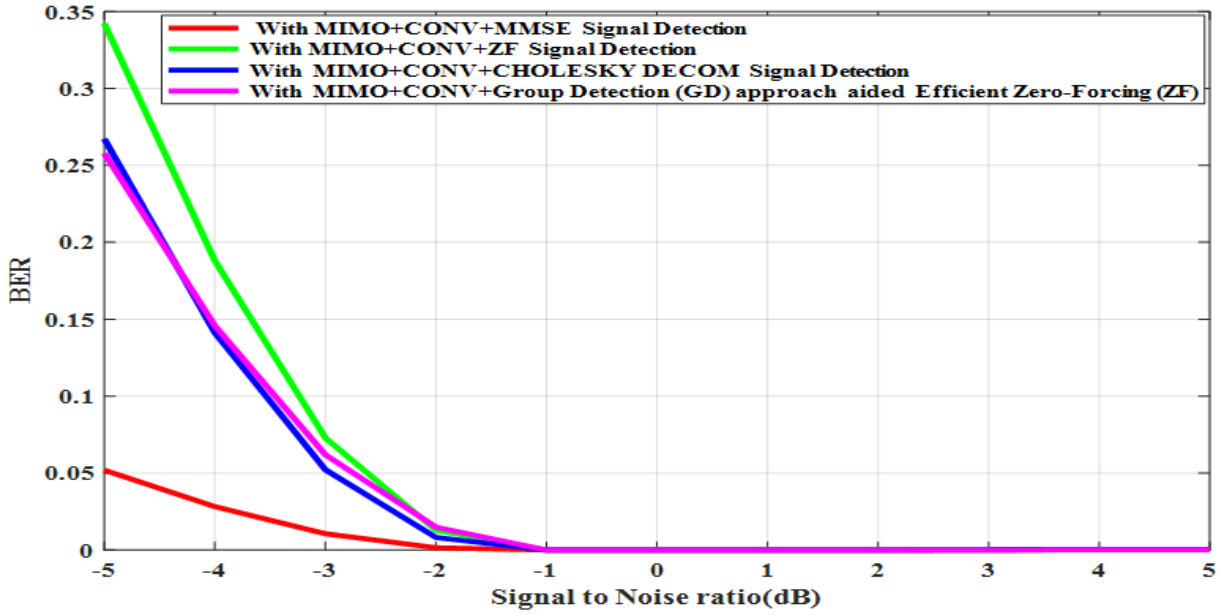

Fig. 2: BER performance of encrypted text message transmission through ½-rated convolutional channel encoded multi-level CSK modulation scheme aided wireless communication system under implementation of MMSE, ZF, Cholesky decomposition and Group Detection (GD) approach aided Efficient Zero-Forcing (ZF) signal detection techniques.

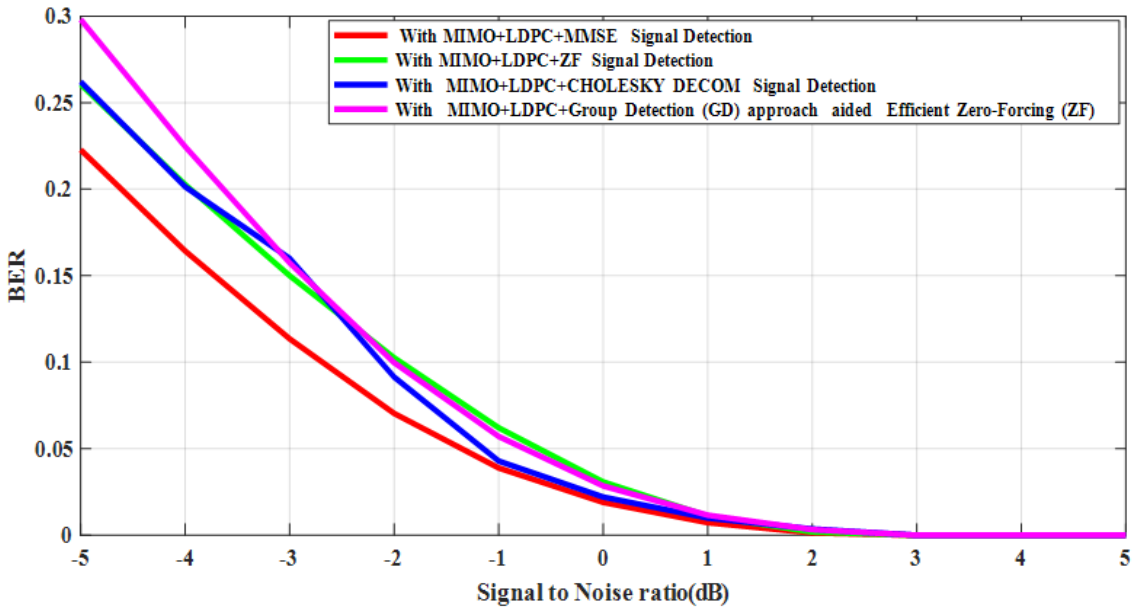

Fig.3: BER performance of encrypted text message transmission through LDPC channel encoded multi-level CSK modulation scheme aided wireless communication system under implementation of MMSE, ZF, Cholesky decomposition and Group Detection (GD) approach aided Efficient Zero-Forcing (ZF) signal detection techniques.

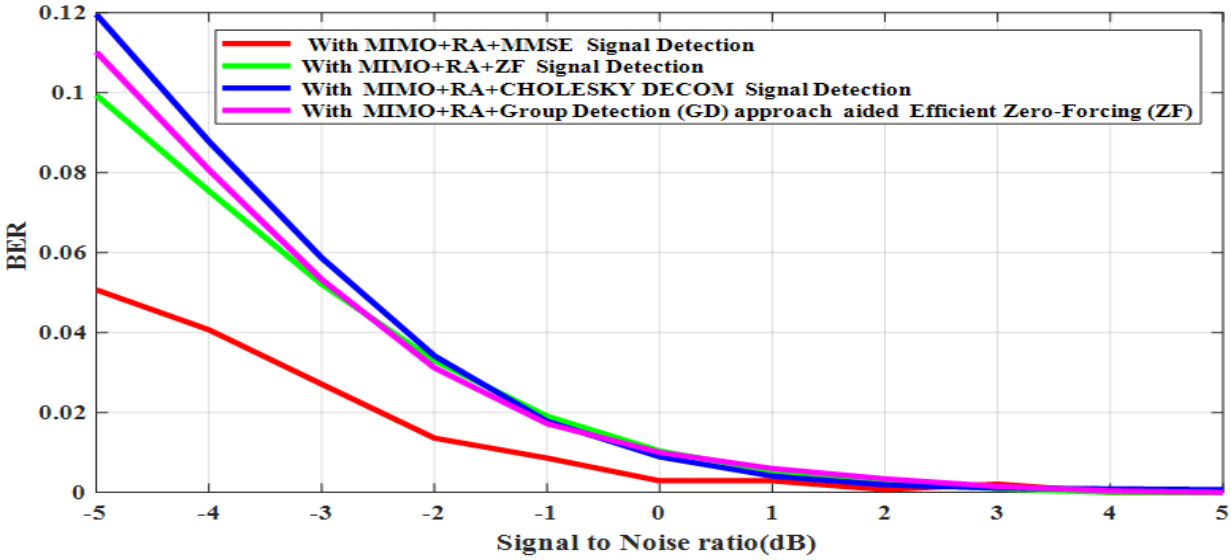

Fig. 4: BER performance of encrypted text message transmission through Repeat and Accumulate channel encoded multi-level CSK modulation scheme aided wireless communication system under implementation of MMSE, ZF, Cholesky decomposition and Group Detection (GD) approach aided Efficient Zero-Forcing (ZF) signal detection techniques.

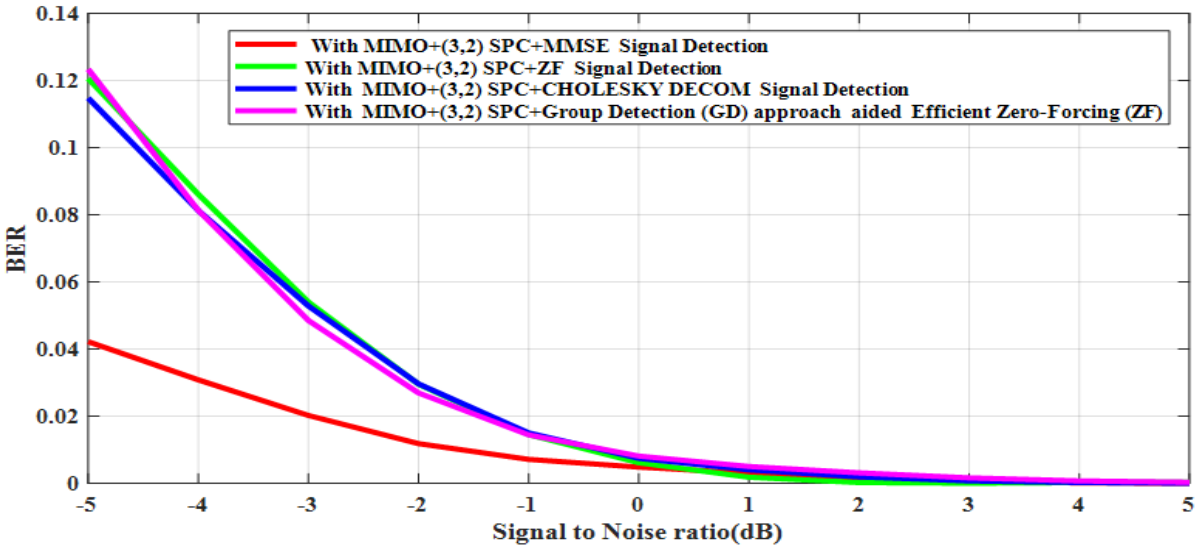

Fig. 5: BER performance of encrypted text message transmission through (3,2) SPC channel encoded multi-level CSK modulation scheme aided wireless communication system under implementation of MMSE, ZF, Cholesky decomposition and Group Detection (GD) approach aided Efficient Zero-Forcing (ZF) signal detection techniques.

In Figure 6, Transmitted and retrieved encrypted text messages in 5G compatible orthogonal multi-level CSK modulation scheme aided MIMO wireless communication system are presented.

- **Original transmitted text message:**

The large available bandwidth and high spectrum efficiency certainly makes mmWave massive MIMO a promising choice to significantly improve overall system throughput for future 5G cellular networks.

(a) Retrieved text message at -1dB:

The large available bandwidth and high spectrum enfmciency$certainly makes mmWave massive M MO a promising choice0vo significantly imprnve overall syst%mthroughput for future 5G cellular network{.

(b) Retrieved text message at 1dB:

The0large available bandwidth and high spectrum efficiency certalnly makes mmWavemarsive MIMO a promising"choice to significantly kmprove overall system throughput for future 5G cellular networks.

(c) Retrieved text message at 2dB:

The large available bandwidth and high spectrum efficiency certainly makes mmWave-assiveMIMO a promising choice to significantly improvu overall system throughpwt for future 5G cellular networks*

(d) Retrieved text message at 3dB:

The large available bandwidth and high spectrum efficiency certainly makes mmWave massive MIMG a prolisingchoice to significantly improve overall system throughput for future 5G cEllularnetworks.

(e) Retrieved text message at 4dB:

The large available bandwidth and high spectrum efficiency certainly makes mmWave massive MIMO a promising choice to significantly improve overall system throughput for future 5G cellular networks.

Fig. 6: Transmitted and retrieved encrypted text messages in 5G compatible orthogonal multi-level CSK modulation scheme aided MIMO wireless communication system

V. Conclusions

In this present work, we have tried to accomplish various signal detection and channel coding techniques for making a fruitful investigation on the performance of orthogonal multi-level CSK modulation scheme aided MIMO wireless communication system. From the simulative study, it has been observed that the system provides robust performance in retrieving data at negligible SNR value region with proper utilization of MMSE signal detection technique under execution of (3, 2) SPC channel coding scheme.

However, based on the simulative study, it can be concluded that the orthogonal multi-level chaos shift keying modulation scheme is suitable in IoT applications or 5G/B5G wireless communication networks.

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Global Journal of Computer Science and Technology: E Network, Web & Security
Volume 18 Issue 4 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

A Survey on Topology based Reactive Routing Protocols in Vanets

By Pavan Kumar Pagadala & Dr. N.M Saravana Kumar
Anna University

Abstract- VANETS comes under the shadow of MANETS. It provides a prominent approach to the intelligent transport system. In this paper, we have explained the different number of topology-based reactive routing protocols for the smart transport system. Vanets provides many applications with its infrastructure less topology like traffic information, vehicle safety etc. Designing a new and efficient routing protocol for all the applications of vanets is very difficult so we have compared all the protocols with a detailed analysis so that we may find the best among them after that we may improve the routing process by considering the different types of parameters. At first, we will discuss about the basics of vanets and its characteristics later we will discuss the categories of routing protocols and their comparative analysis.

Keywords: routing, topology-based routing protocols, vanets, vehicle safety.

GJCST-E Classification: C.2.2

Strictly as per the compliance and regulations of:

A Survey on Topology based Reactive Routing Protocols in Vanets

Pavan Kumar Pagadala[α] & Dr. N.M Saravana Kumar[σ]

Abstract- VANETS comes under the shadow of MANETS. It provides a prominent approach to the intelligent transport system. In this paper, we have explained the different number of topology-based reactive routing protocols for the smart transport system. Vanets provides many applications with its infrastructure less topology like traffic information, vehicle safety etc. Designing a new and efficient routing protocol for all the applications of vanets is very difficult so we have compared all the protocols with a detailed analysis so that we may find the best among them after that we may improve the routing process by considering the different types of parameters. At first, we will discuss about the basics of vanets and its characteristics later we will discuss the categories of routing protocols and their comparative analysis.

Keywords: routing, topology-based routing protocols, vanets, vehicle safety.

I. Introduction

Vehicular Ad-Hoc Networks (VANET) are a particular kind of Mobile Ad Hoc Network, (MANET), in which vehicles act as nodes and each vehicle is equipped with transmission capabilities which are interconnected to form a network. The main intention of delve into VANETs is the enhancing the vehicle safety using inter-vehicular communication (IVC). VANETs have several different aspects compared to MANETs, in that the nodes move with high velocity because of which the topology changes rapidly. VANETs pretence many challenges on expertise, protocols, and refuge, which increase the need for research in this field.

The communication in these types of networks are in between vehicles to roads and vehicles to vehicles and inters road communication is used for improving the safety and to reach the goals of vanets. The following figure gives the idea of communication in vanets.

a) *Types Communication in VANETS*

Fascinatingly the applications of WSNs were emerged drastically, Such as accessing internet through vehicles; sharing of information among vehicles, traffic information etc. So efficient routing protocol should be used to avoid delay, packet drops and reduce frequent link breaks. Now a day's vehicles on roads are heavily increased, due to the vibrant nature of VANETs links between two vehicles would remain for a short time due to this communication would get delay which decreases network performance. Existing approaches used E-TX, link expiration time, rate estimations and flooding methods for establishing a reliable route between source and destination. But considering only expiration time and rate factors could not yield better results because if a node with high expiration time with minimum stability will not establish a proper communication.

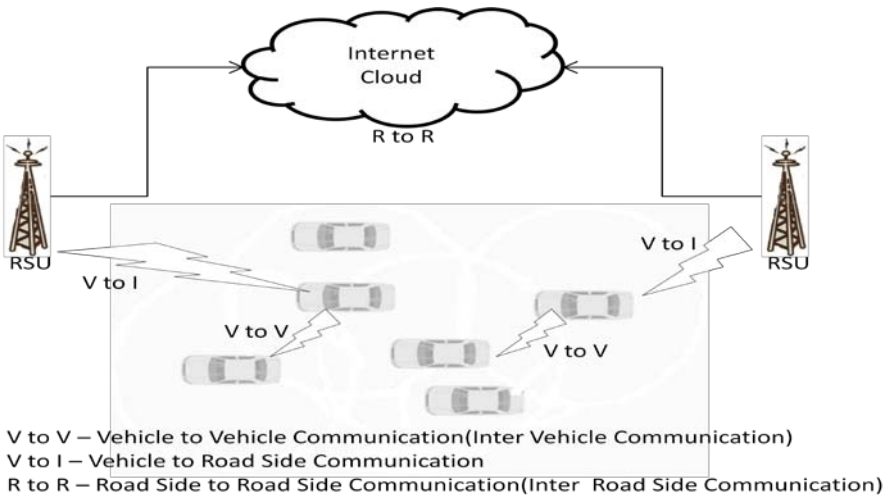

Fig. 1: Architecture of VANET

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The following are the different characteristics of VANETs which are similar to MANETs [3], but there are some specific kinds which can be categorized as follows:

(1) Highly dynamic topology
(2) Frequent disconnected network
(3) Mobility modeling and Prediction
(4) Communication Environment
(5) Hard delay constraints
(6) Interaction with onboard sensors,
(7) Unlimited Battery Power and Storage

II. Overview of Routing Protocols in Vanets

Routing is the process of transmitting the data among the nodes from one place to another here from one vehicle to another vehicle. Routing occurs at Layer 3 (network layer) of the OSI model. In VANET, The routing protocols are broadly categorized into many types [4]. Depending upon the topology, transmission strategies, position, delay tolerant, Cluster-based, Geo cast, Multicast etc. We have a vast number of routing protocols in VANETS. In this paper, we will discuss topology-based reactive routing protocols under VANETS. It comes under the category of Routing Information based Routing. Under that we have two types they are Topology based and Position based techniques.

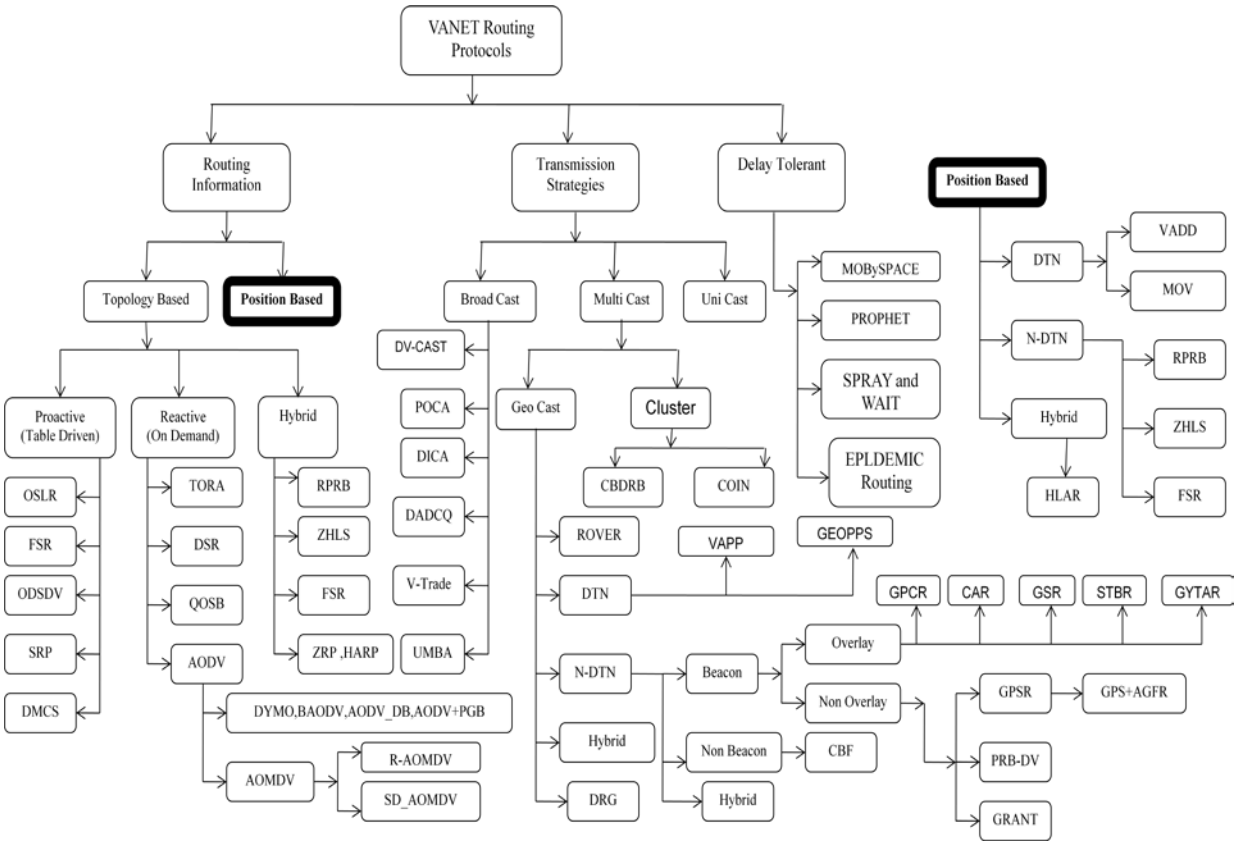

Fig. 2: Categories of Routing Algorithms

III. Topology-based Routing Protocols

These types of routing protocols use the link information that exists in the set of connections (network) to perform packet forwarding. They discover the route and retain it in a Routing table before the sender starts transmitting data. They are additional at odds into reactive, proactive and hybrid protocols. These steering Protocols are standards and used for transfer the data in the Networks. Efficient Routing protocols make dynamic routing decisions in network. Topology Based Routing schemes generally require additional node topology information during the routing decision process.

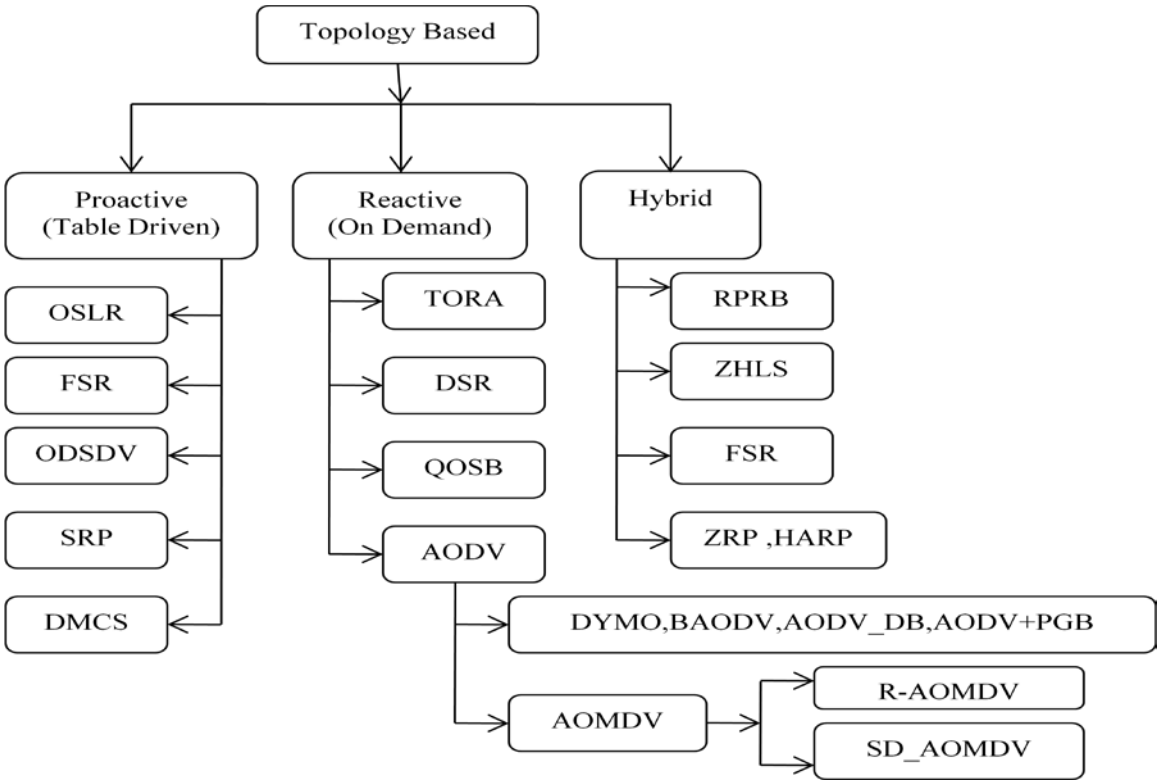

Fig. 3: Topology based routing algorithms

a) Proactive routing protocol

The proactive routing means that the routing information, like next forwarding hop is maintained in the background irrespective of communication requests.

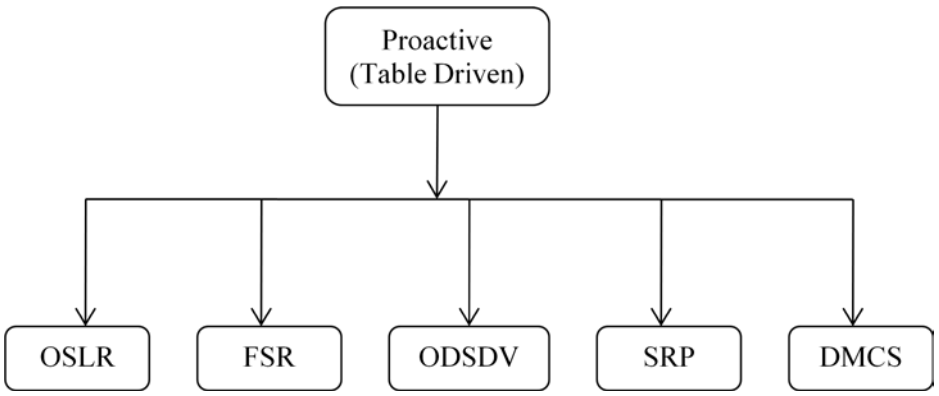

Fig. 4: Proactive routing algorithms types

- The benefit of proactive routing protocol is that there is no route detection since the destination route is stored in the backdrop, but the inconvenience of this protocol is that it provides low latency for real-time application. A routing table is constructed and maintained within a node. It also leads to the preservation of idle data paths, which causes the lessening in the available bandwidth. The proactive routing protocols care for the tables representing the topology. In these protocols the tables updating frequently and sends the information from one node to another. Proactive routing protocols also called the table driven protocols due to its nature. There are two types of updating available in proactive protocols periodic update and triggered update due to broadcast the update tables they waste power and bandwidth in the network [8].

b) Reactive routing protocols

Reactive routing opens a route only when it is necessary for a node to communicate with another node. It maintains only the routes that are currently in use, thereby reducing the burden on the network.

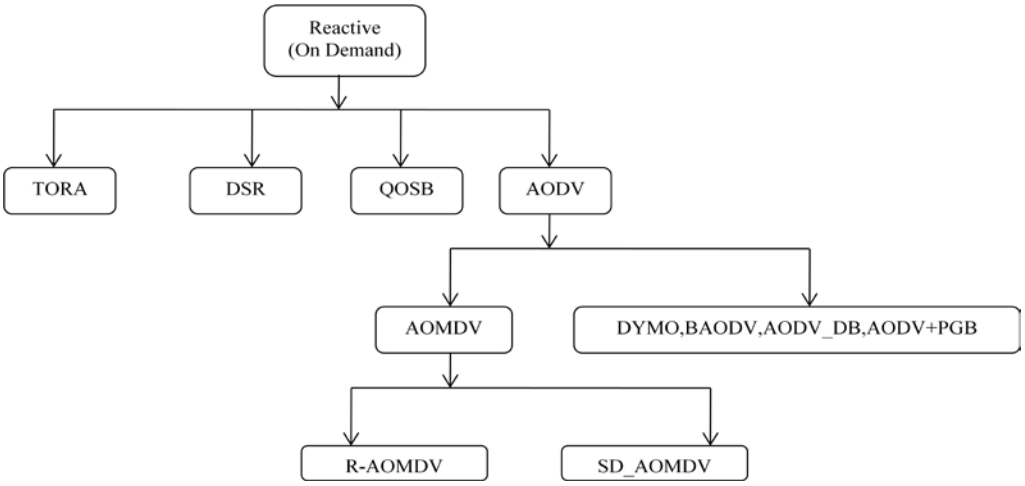

Fig. 5: Reactive routing algorithms types

Information Engineering and Applications in which the query packets are flooded into the network for the path search and this phase completes when route is found. These protocols are called as on-demand routing protocols as they periodically update the routing table, when Reactive routing consists of route discovery phase g Protocols for VANET, Journal of some data is there to send. The various types of reactive routing protocols are AODV, DSR and TORA.

i. *Temporally ordered routing algorithm*

The Temporally Ordered Routing Algorithm (TORA) is an algorithm for routing the data across the different types of Networks like Wireless Mesh Networks, Wireless Sensor Networks, Mobile Adhoc Networks and Vehicular Adhoc Networks etc. It attempts to achieve a high degree of scalability using a "flat", non-hierarchical routing algorithm.

TORA constructs and maintains a Directed Acyclic Graph (DAG) rooted at a destination with a principle of No two nodes may have the same height.

Here the information is transferred or flows from the nodes which are having the highest metrics to the nodes which are having the lowest metrics. So here the data transmission is only 'down-hill'. So, it achieves loop-free multipath routing, as the data cannot flow 'up-hill' and so cross back on itself. It mainly operates on the following three basic functions. They are:

1. Route creation
2. Route maintenance
3. Route erasure

At the time of the route creation and maintenance phases, the nodes use the height as a parameter to establish a directed acyclic graph (DAG) rooted at destination [1]. After that links are assigned based on the relative height metric of neighbouring nodes. During the changing of the nodes if the DAG is broken and the route maintenance unit comes into the picture to re-establish a DAG routed at the destination. Timing is the most important factor for TORA because the height metric is dependent on the logical time of the link failure. TORA's route erasure phase is essentially involving flooding a broadcast clear packet (CLR) throughout the network to erase invalid routes. The algorithm [1] is described as follows.

Algorithm:

If (failure of link)
Generate reference level
Else If (all neighboring nodes are not at same reference level)
Propagate reference level
Else If (reference bit ==0)
Reflect Reference Level
Else If (Reference Level created by the user)
Clear Reference Level
Else
Generate Reference Level

ii. *Dynamic Source Routing*

The Dynamic Source Routing protocol (DSR) is a unproblematic and well-organized routing protocol intended specifically used for multi-hop wireless ad hoc networks of mobile nodes and also it was implemented for routing in vehicular networks too[5].

It allows the set of Connections (Network) to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is bonded with the two mechanisms of Route Discovery and Route Maintenance [5], which work jointly to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network.

Route Discovery is the method by which a node or a *Source vehicle* (S) wishing to send a packet to a destination node or *Destination vehicle* (D) obtains a source route to D. Route Discovery is used only when S attempts to send a packet to D and does not already know a route to D.

Discovery Process:

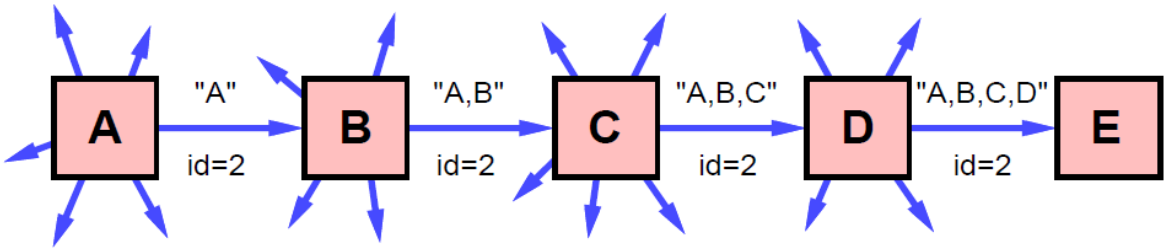

Figure 1: Route Discovery example: Node **A** is the initiator and node **E** is the target

Route Maintenance is the method by which node **S** is able to sense, while using a source route to **D**, if the network topology has transformed such that it can no longer use its route to **D** since a link along the route no longer works. When Route Maintenance indicates a source route is out of order, **S** can attempt to use any other route it happens to know to **D**, or can invoke Route Discovery again to find a new route. Route Maintenance is used only when **S** is actually sending packets to **D**.

Maintenance Process:

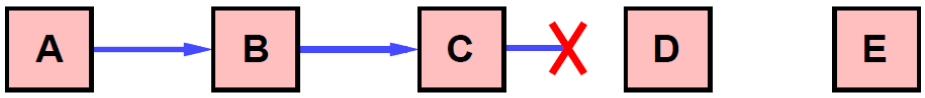

Figure 2: Route Maintenance example: Node **C** is unable to forward a packet from **A** to **E** over its link to next hop **D**

c) *Hybrid routing protocols*

Hybrid routing protocols is combination of reactive routing protocols and proactive routing protocols which reduce the control overhead of proactive routing protocols and decrease the initial Route discovery delay in reactive routing protocols. E.g. Zone Routing protocol (ZRP), Hybrid Routing Protocol (HARP) etc. The protocols under the Hybrid Routing are as follows.

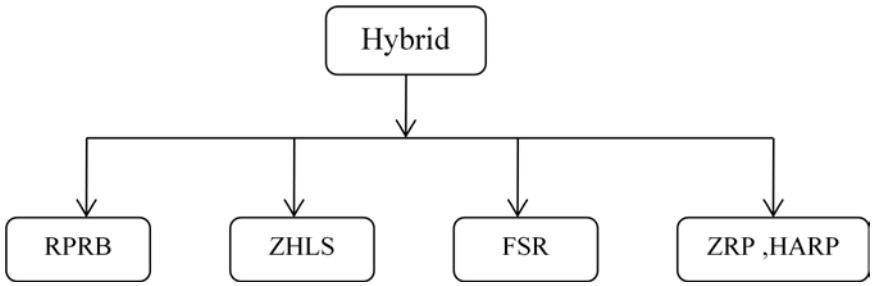

Fig. 6: Hybrid routing algorithms types

COMPARISON:

Here we have compared the protocols depending upon the following different types of parameters and the results are furnished given below.

1. Forwarding Method
2. Digital Map Requirement
3. Infrastructure Requirement
4. Realistic Traffic Flow
5. Recovery Strategy
6. Area

Table 1: Comparison of topology based Reactive routing protocol vs others protocols

Protocols	Proactive Protocols	Reactive Protocols	Position based Greedy Protocols	Delay Bounded Protocols	Cluster Based Protocols	Broadcast Protocols	Geo Cast Protocols
Prior Forwarding Method	Wireless Multi Hop Forwarding	Wireless Multi Hop Forwarding	Heuristic Method	Carry & Forward	Wireless Multi Hop Forwarding	Wireless Multi Hop Forwarding	Wireless Multi Hop Forwarding
Digital Map Requirement	NO	NO	NO	NO	YES	NO	NO
Visual Infrastructure Requirement	NO	NO	NO	NO	YES	NO	NO
Realistic Traffic Flow	YES	YES	YES	NO	NO	YES	YES
Recovery Strategy	Multi Hop Forwarding	Carry & Forward	Carry & Forward	Multi Hop Forwarding	Carry & Forward	Carry & Forward	Flooding
Scenario / Area	Urban	Urban	Urban	Sparse	Urban	Highway	Highway

IV. Conclusion

In this paper we have studied about the introduction of Vehicular ad-hoc networks and its Routing Protocols especially we have studied topology-based Reactive Routing Protocols. And we had given a table which includes the principles and techniques of different types of algorithms used in the respective category.

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Global Journal of Computer Science and Technology: E Network, Web & Security
Volume 18 Issue 4 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 0975-4172 & Print ISSN: 0975-4350

Designing a Front-Back End Solution for the Issuance of Drivers' License by FRSC in Nigeria

By Ogbeide Oluwatosin Lara & Akingbesote Alaba.O
Adekunle Ajasin University

Abstract- The Nigeria drivers' license is that document needed by citizen and non-citizen to drive automotive engine in Nigeria. For example, motor cars and motor cycles. Issuance of this license manually has posed so many challenges. These include delay, corrupt practice and others. Because of the indiscriminate ways adopted during the cause of license issuance, this has constituted to the high accident rate on our highway. To resolve this, the Nigeria government introduced the Federal Road Safety Corps that liaises with other units on the issuance of license. The present Internet based methods adopted by FRSC is a forward end based approach. In this approach, clients still need to interact with other units directly before a final submission and collection are done. This approach is still opening for corrupt practices as a result of the direct link between clients and various units involved. To resolve this issue, a front-back end solution approach is proposed. This method uses the back end automated engine as the link between the front and other units involved. A prototype demonstration of this research is carried out using some quality of service metrics. A comparison of this work with the existing one is carried out. The results of this work perform better than the existing methods based on the used metrics.

Keywords: *FRSC; driver's license, automated engine, server.*

GJCST-E Classification: *J.1*

Strictly as per the compliance and regulations of:

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I. Introduction

A driver's license or driving license is an official document permitting a specific individual to operate one or more types of motorized vehicles, such as a motorcycle, car, truck, or bus on a public road. In 1901the idea of introducing drivers' license to motor users started[1].The purpose for the introduction was to ensure the proper use of motor vehicles on our roads. This was achieved by the use of manual system. See detain in [2][3]. This purpose of issuance of license was defeated as reported in [4]. Among the reasons given include the corrupt practice by the Licensing unit and the VIO, also that of delay and others. With the spread of ICT to most cities in Nigeria in early 80s, the idea of automating the Licensing unit came up. This allows the usage of computers for information storage and retrieval[5][6][7]. With the use of this basic ICT tools, report reveals that accident in Nigerian roads are increasing on daily basis. For example, in 1985 the accident was 30% above the previous year as reported in [8][9]. One of the root causes of this is due to indiscriminate and non challant attitude of most drivers on Nigerian roads [10]. This could be traced to the corrupt Licensing unit officials that issue license to drivers without undergoing the due process [4].As stated in [11][12], see Table 1,most road users in the country do not learn driving from the driving schools accredited by government rather they pay their way through to get a driving school certificate to commence their application for the driving license.

Table 1: Source:[12] Road transportation and traffic law Enforcement in Nigeria

Responses		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Driving School	39	26.7	26.7	26.7
	Private Lesson	37	25.3	25.3	52.1
	Through a member of family	34	23.3	23.3	75.3
	Through a friend	34	23.3	23.3	98.6
	Others	2	1.4	1.4	100.0
	Total	146	100.0	100.0	

Examining the above table, we realize that 80% of the individuals operating vehicles on our roads did not learn driving skills through the Driving Schools. They end up driving with little knowledge on the appropriate use of road. Another is that of delay in the issuance of this license which in turn gives room for unqualified drivers who cannot wait to pass through the training in a driving school. They take law into their hands and acquire a driving school certificate through the wrong procedure. These are the types of drivers that lack the knowledge of proper road use and drive recklessly[13][10]there by increasing the rate of

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accidents. To reduce the problem of accident on Nigerian roads, the Federal Government of Nigeria introduces the Federal Road Safety Corps (FRSC). Among the works given to this unit is that of issuance of Nigerian Driver's License to Nigerian road users[3].

In pursuance of this goal, the FRSC introduces a front end application management system[5][14]. This application is a web based system designed using PHP. The home page consists of several important links. Some of these links are non-functional for example the accredited driving schools link, the payment link etc. These links, involved some vital steps which were not properly considered in the FRSC slated application procedure. These loopholes give room for extortion of the applicants by the officials of the Licensing unit. One of the main reasons of this front end system was to be sure that all the processes involved are undergone by the applicants. That is passing through the nine steps as reported in[15] . Secondly, to reduce the rigor or some of the bottle necks involved. For example, going to queue for license form collection and submission etc. Another is that of eradicating the direct payment of cash to all the processing units involved. The first and the third points are very important because these will play a very significant role in accident reduction and corrupt practices in Nigeria. With the introduction of this mechanism, report still shows that the accident rate is increasing. For example, the report by National Bureau of Statistics (NBS) in August 2018 reveals that no fewer than 1,331 perished in road accident across the nation in the second quarters of 2018. The statistics is depicted in Fig 1.

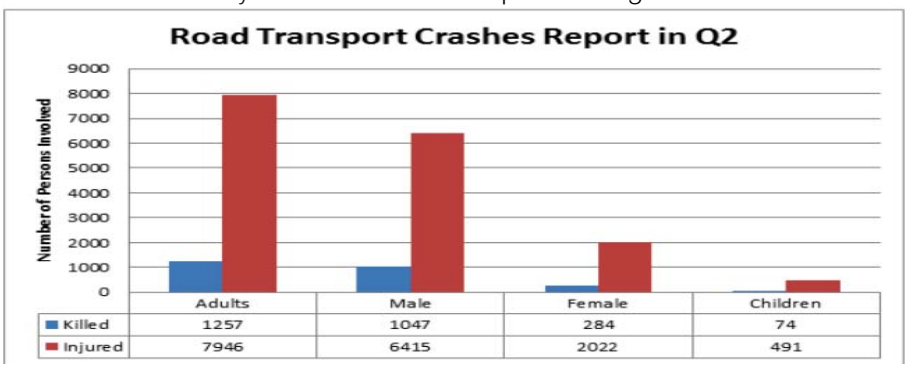


Figure 1: Road accident in second quarter 2018 in Nigeria

Source:https://www.pmnewsnigeria.com/2018/08/28/1331-nigerians-die-in-road-crashes-in-second-quarter-nbs/

This front end system has been able to achieve partial success in tackling the second problem, but that of the first and third are yet to be addressed. That implies that this front end mechanism has not been able to tap into the full potential of modern information technology to improve services delivery, efficient and accountability[16]. Our findings from scholars reveal that most people in Nigeria do not undergo the various processes. For example, in [4], the author as depicted in Table 1 itemized various means through which some Nigerians use in learning how to drive.

In addition to this is the issue of the payment system that has no link to the driving school of the applicant or other various units. After the FRSC payment, the applicant will have to go and pay to the account of other units involved. This is because the FRSC has not set procedure for ensuring that the applicants have actually attended one of the accredited Driving Schools that are listed on the FRSC Driver's license Official Website. This is a bottle neck and sometimes the applicant may just pay and get certificate without undergoing any test. That implies that with the current existing system, it is possible for applicant to apply in two days, complete the whole process and be awaiting license. Therefore, a mechanism is needed to be put in place to link all processing units involved. The mechanism should be able to monitor all the processing units, does the payment transaction from the main source to all processing units and others. This will be able to reduce the aforementioned problems. This is the focus of this research.

This research proposes a front-back end mechanism that addresses the issue of on driver's license issuance in Nigeria. This research introduces the concept of back end mechanism to the existing front end. This method uses the back end automated engine as the link between the front and other units involved. A prototype demonstration of this research is carried out using some quality of service metrics which are response time, size of job and processing cost. A comparison of this work with the existing one is carried out. The results of this work perform better than the existing methods based on the used metrics.

The remainder of this paper is organized as follows. Section II discusses the related work. Section III introduces our model description. In Section IV, we have our results and discussion and we have the conclusion in Section V.

Related works

The history of issuance of driving license in Nigeria dated back to 1920.Traffic laws and regulations were inherited from the colonial administration and it

was stated in the Road Traffic Ordinance Of Lagos Colony and Southern Protectorate of Nigeria which was applied to the operation of all motor vehicles until the country was demarcated into regions[17].Thereafter, each region was empowered to promulgate its traffic regulations. Regions were later subdivided into States. Each States were empowered to enforcement their own road traffic regulations Issuance of the license at that time was done through the manual process as discussed in [18]. Also see[2][19][7]. Because of the problems highlighted in[5] which include production of different types of driver's license as the number of States in the Federation, lack of centralized National Driver's License Database and others. The idea of using modern information technology was introduced. The utilization of modern information technology in the driver's license application management system is to enhance the efficiency, transparency and accountability in the procedure of acquiring a driver's license in this country[5]. There exist a handful of published research articles that uses the adoption of information technology both in the driving test and Motor licensing system in this country. See for example[16][19][20][21][22] .

Adewale, et al[21] in their work titled "An Analytical Framework for Vision Testing in Driving License Allocation in Nigeria" proposes an automated licensing test technique and vision screening measures. This is against the standard visual acuity testing for assessing all drivers as proposed in[23][24]. The use of AMP (Apache, My SQL, and PHP) as implementation tools is proposed. The idea of the authors is to identify the major factors responsible for poor driving culture in Nigeria. The authors also discusses on the crude vision testing system being used. They concluded that in the process of acquiring the driver's license, an automated vision test must be conducted before the driving test. The strength of this work is the improvement in vision screening of all driver's license applicants and renewals, also, the provisioning of software that allows retesting of disqualified drivers before regaining their licenses. While these authors have contributed to the body of knowledge with the use of these tools to achieve their objectives, however, the fact remains that vision screening test can't be relied on to provide the same results as a comprehensive eye and vision examination[25] . For example, if the screening indicates a vision problem then they are referred for further evaluation. Also, the revelation from scholars for example[25][23] has shown that the vision screening test has little effect on the present state of the driving license application management in Nigeria.

In [18], the author adopted Wireless Sensor Network and the multi sensor fusion detection mechanism proposed in [17]. The idea of this author was to apply this mechanism in the context of driving license test. The proposed system works by allotting the test vehicle for test drive with the number of embedded sensors connected. The Global Positioning System (GPS) and ZIGBEE devices are used as a gateway sending data for processing. The decision making process of this mechanism was based on the use of Bayesian logic classification algorithm and feature extraction algorithm. The result was obtained by invoking the data mining technique. The proposed mechanism has been able to contribute to knowledge through the adopted mechanism. However, the issues of security and resources limitations are major challenges[26][27].

Gopinath, et al[28] proposed a system of automating driving License test with Android Application. The concept of the work was to test the driving skills of a new driver while giving a driving test hereby generating real time results. In addition, the work also made provision for measurement of the result of driver in multiple parameter like reverse time, lane cutting etc. The authors use the automated testing machine integrated with Android. The strength of the work is the increases the level of transparency in the driving skill test process and also decreases the rate of corruption in the process of issuing the driving license. However, the results of an android device are not reliable as there may be an interruption in the connection of an android device hereby resulting in inaccurate results at the end of the driving test[29]. Also, the use of an android device in driving test has little effect on improving the present state of the driving license application management system[30].

Oliji[16] designed and presented the implementation of an online motor vehicle licensing system. He identified the basic problems facing motor vehicle licensing system in the Nigeria as follows: lack of proper security in the system that creates avenue for fraud and manipulation of stored data in the system and poor performance of the system during information retrieval due to inefficient storage of data. He developed software that created interaction on the computerization and implementation of the motor licensing authority at the three levels of organization; Vehicle Inspection Office (VIO), Federal Road Safety Corps (FRSC) and the Board of Internal Revenue

This system employed the use of Java as the Software Design tool, the My SQL as the Database tool and ODBC (Object Database Connectivity) Data Source to supports all database relation with the object-oriented programming language. The strength of this work was the enhancement of database but there was no mechanism provided for feedback between the various levels in the motor licensing authority. This poses a big question on how accountable the various levels of organization involved in issuance of motor licenses in this country are.

The works of these authors have given us the opportunity to make our contributions. For example, our argument for using the front-back end model was born

out of the work of[16][22]also the work of [31] helps us to further forge ahead by viewing the front end as networks of units. However, our opportunity to contribute is due to certain observations we noticed in some of these works. For example, in the work of [22], the issues of security and resource limitation are yet to be addressed. Also, the work of [16][19] focuses on identification of the basic problems facing motor vehicle licensing system in the Nigeria. These include fraud, manipulation of stored data in the system and poor performance. However, how these problems could be tackled to reduce accident rate was never addressed. The work of [19] focuses on testing the driving skills of a new driver. The idea is to increase transparency. However, this work concentrated on only one of the units involved in processing of drivers' license. The other units that address the issue of payment of the amount stipulated by the Federal Government of Nigeria to the right destination accounts of each organization involved were not discussed. The current web-based system designed by FRSC is a front end system similar to that of [14]. It gives room for obtaining and filling form online. While this has achieved to a degree of making sure that all the processes involved are undergone by the applicants. The issue of reducing the rigor or some of the bottle necks involved and eradicating the direct payment of cash to all the processing units involved is yet to be addressed.

The research proposes a front-back end mechanism that addresses the issue of on driver's license issuance in Nigeria. This research introduces the concept of back end mechanism to the existing front end. This method uses the back end automated engine as the link between the front and other units involved.

This work is differentiated from others in that the proposed system:

- Ensures that all the processes involved are undergone by the applicants.
- Reduces the rigor or some of the bottle necks involved. For example, going to queue for license application form collection and submission etc.
- Eradicates the direct payment of cash to all the processing units involved.

Addressing these three main challenges will surely play a part in areas of accident reduction, proper accountability, transparency and efficient monitoring of various driver licensing units. This to the best our knowledge is yet to appear in the literature.

II. Proposed Architecture

The architecture of our model is depicted in Fig.2 below

This is a three layered architecture comprising of the application layer, Front end unit and the back end layer. The application layer takes care of applicants who want to apply for drivers' license. This applicant is expected provide information as proposed in the work of[31]. The second layer architecture is the front end layer. This is a web based unit that allows the applicant layer to communicate with it. The information is needed by this unit. These include applicant name, email address, phone number, current address, permanent address etc. See https://www.nigeriadriverslicence.org/ for detail. One additional thing we have added in this unit is to allow the direct online payment to be done as against the going to bank syndrome that was introduced by the existing system. The important part of this work is in the third layer which is the back end layer. The back end comprises of various units. These include the VIO unit, Driving School unit. Details are depicted in Fig 2.

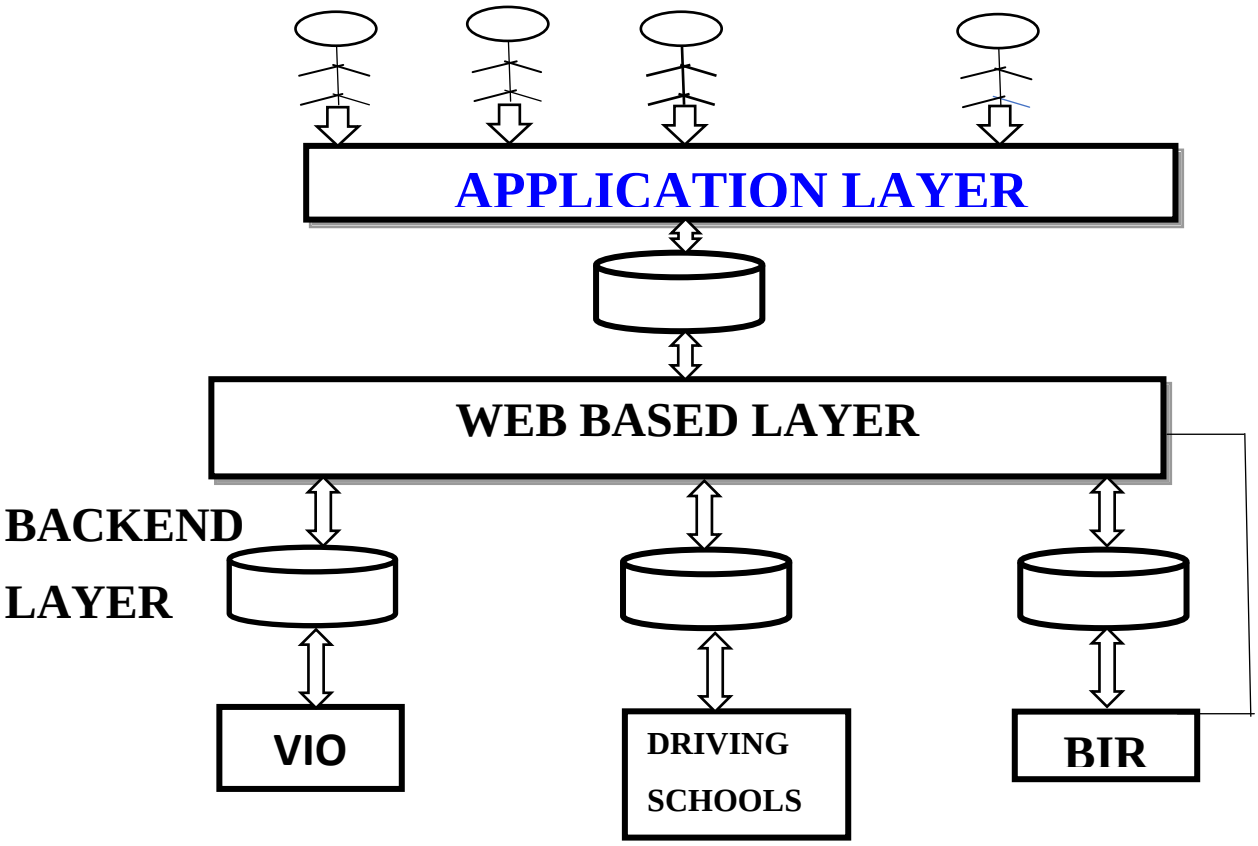


Figure 2: The front-backend driving License application management system Architecture

The back end receives information from the front end and link with the necessary units under it. For example, if applicant fills the online form and payment is made, the percentage of the amount to be made to various units is done through the back end engine. This will reduce the rigor of applicants going to various banks for transaction. In addition the back end does other works which include:

- Link with Driving school to set three months' time table for applicants
- Link the driving school with the VIO for testing of applicant after the expiration of the three months provided the applicants meet the attendance requirement
- Inform the applicants' the driving test day via the GSM or email

Various algorithms are developed to solve this problem. For example the algorithm below represents the procedure for the application from payment in the driving Schools to the end of training

```
If R>2500
    Demand for refund before further processing
Else if R = 2500
Get applicants' name, others
Set time table for applicants'
Return
Else
  Write "unable to accept amount"
Return
End If
Do
    Check date
    Write applicant on date
If applicant attend
    Get applicant Biometric info
   Send info and date to backend
END
Till the end of application
```

This will ensure that all the processes involved for the issuance of drivers' license to applicants are undergone through our proposed automated back end engine. This is against the already existing method that is not automated. The procedure for acquiring Driver's license goes thus:

When an applicant opens the Front-backend driver's License portal, there are several options on the page. An already existing user Login directly with his/her email address and password by clicking on the User login option on the Index page has shown below:

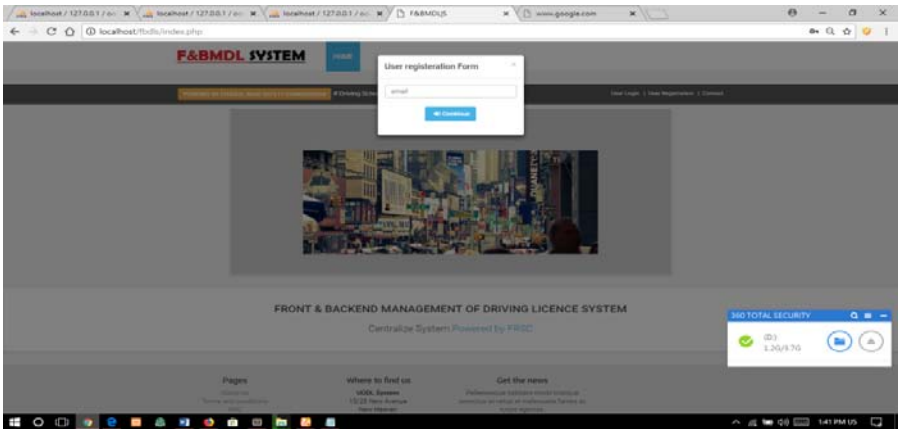


Figure 3: Index page of the system

Step 1: Click on the User registration option on the index page.

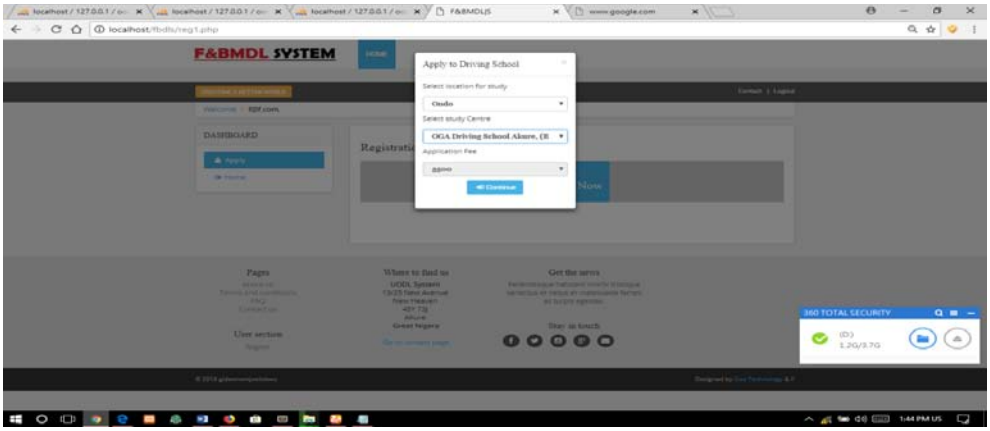


Figure 4: Driving School Selection Page

Step 2: The user's homepage is opened and the user will then select the Driving School of their choice. The fee of the chosen driving school is displayed.

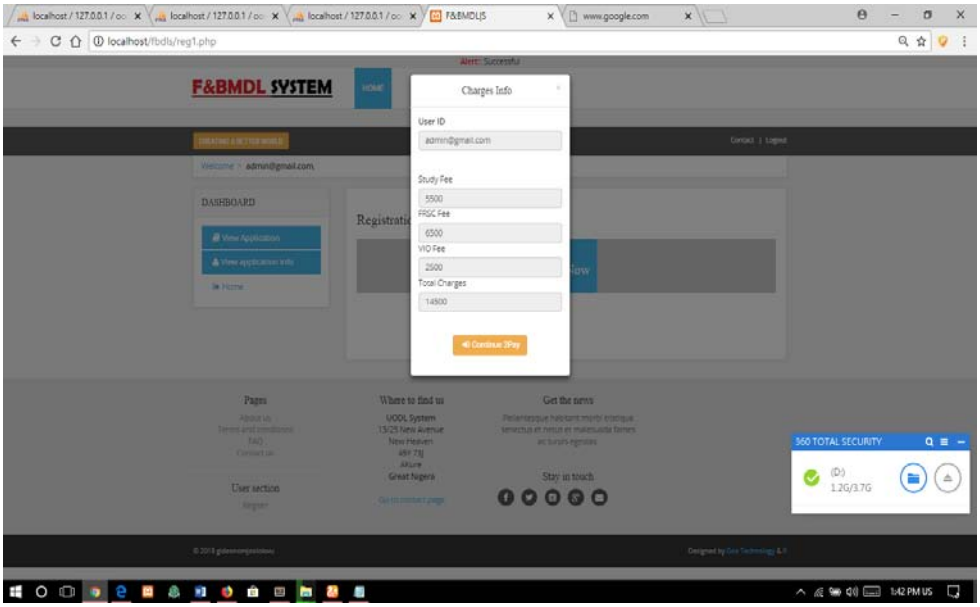


Figure 5: Page for display of Total Charges

Step 3: The breakdown of the amount to be paid and the total charges is displayed on this page.

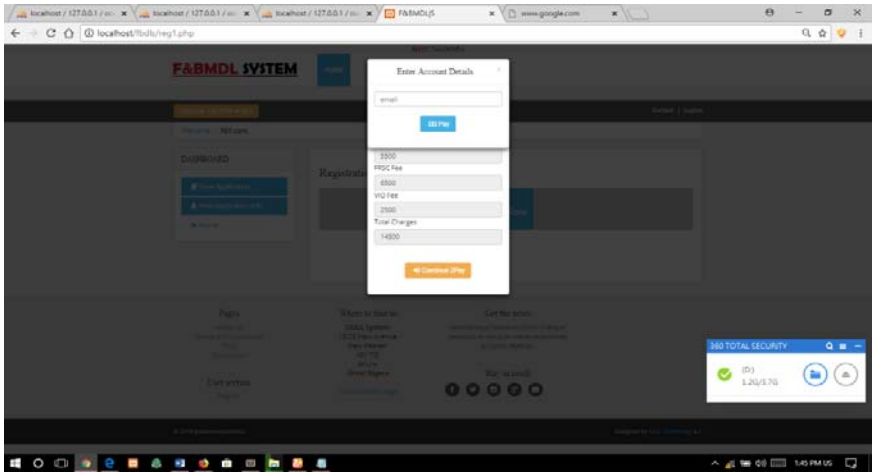
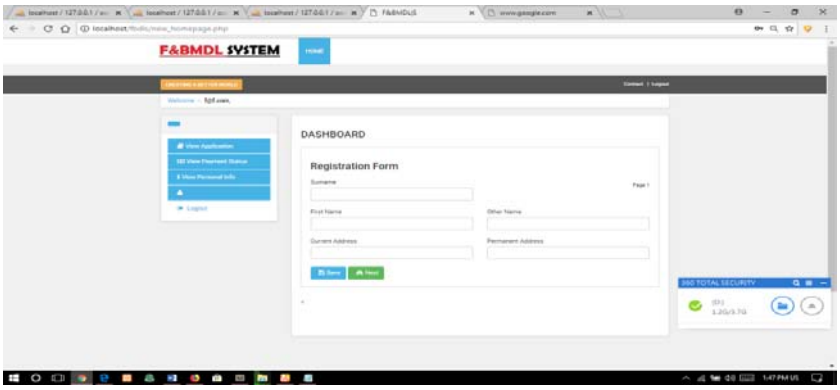


Figure 6: Payment transaction page

Step 4: The applicant enters his or her account details



Step 5: On this page is the User's bio data registration.

A new applicant gives the necessary information required in the form and submits the form. After these, the applicant's personal page is automatically displayed. This page enables the applicant to view his/her application status with the VIO, the FRSC, the Board of Internal Revenue and the Driving school. At the Administrator level, this page displays the necessary information about the Applicant's status.

On the other hand, each of the stakeholders involved in the processing possess there means of access to view their account status as shown below:

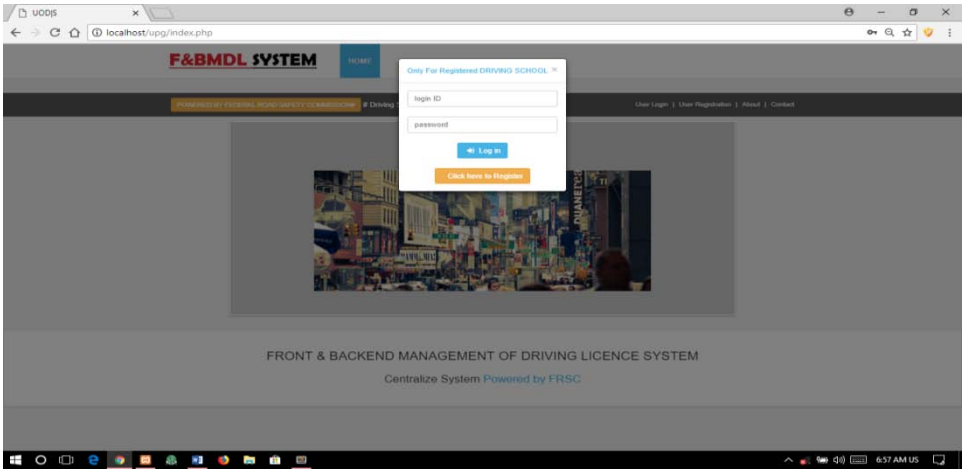


Figure 7: Driving School Login Page

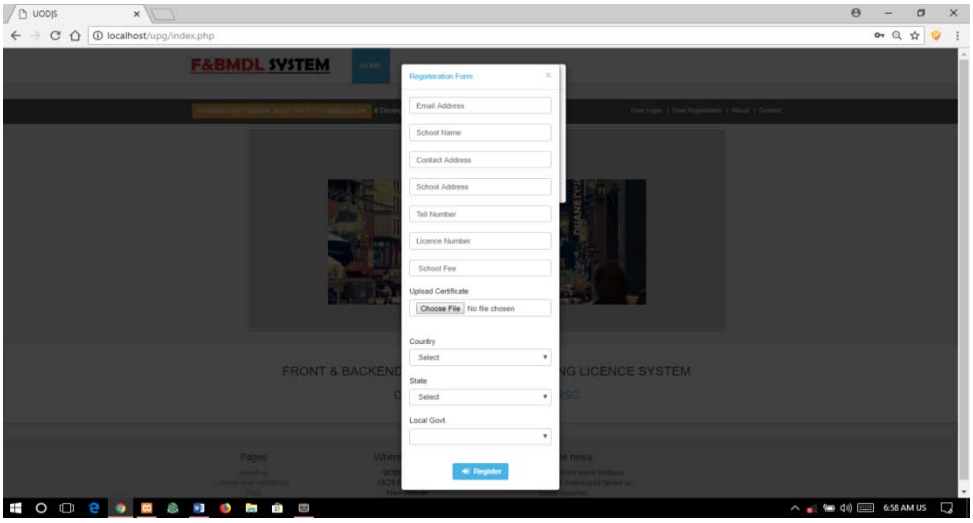


Figure 8: Driving School Registration Page

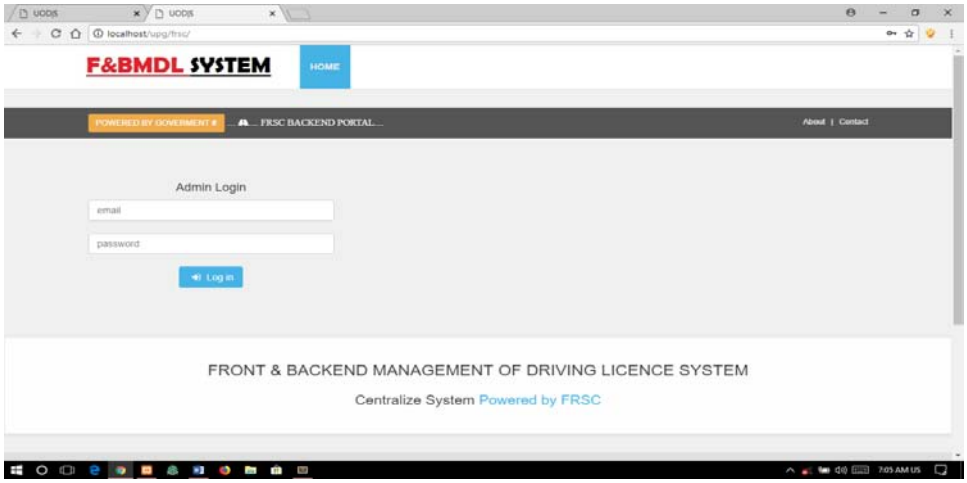


Figure 9: FRSC login page

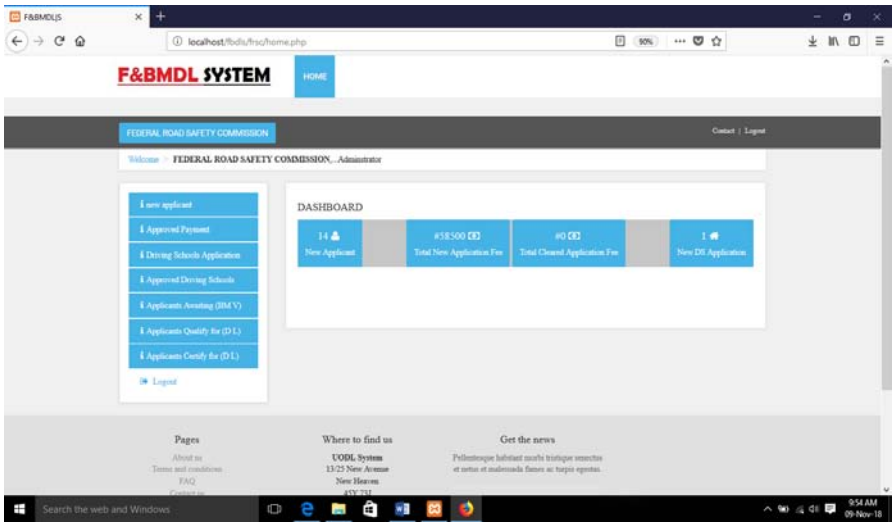


Figure 10: FRSC Dashboard page

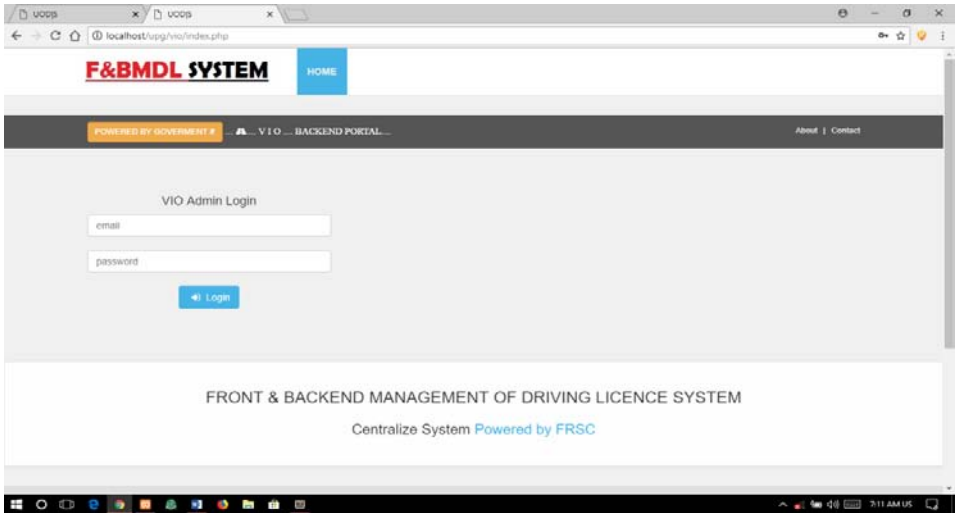


Figure 11: VIO login page

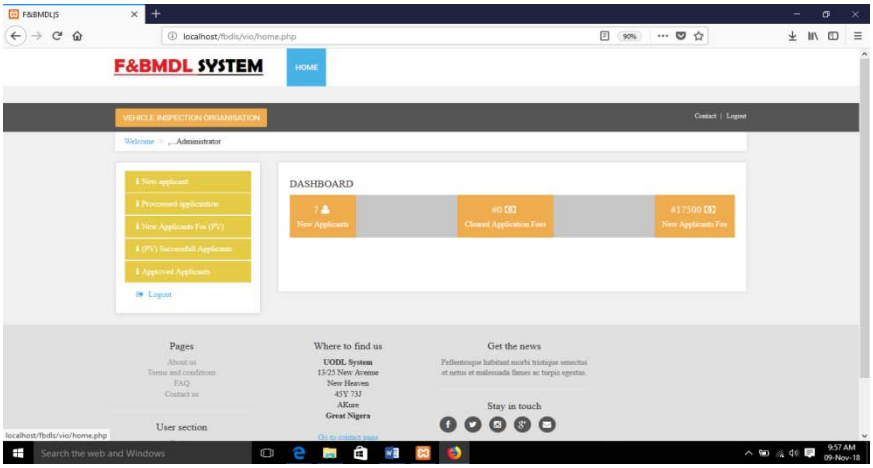


Figure 12: VIO Dashboard page

III. Results and Discussion

In our work, we made use of PHP because PHP is flexible for database connectivity. It is an open source coding language. It provides plenty of scalability and gives developers the ability to create the applications easily.

We had a prototype demonstration of implementation with some applicants under our work. We used the same number of applicants for the existing front-end. We used the Response Time, Size of Job and Processing Cost as our performance metrics for the two systems. The existing system was subjected to the same conditions with our developed model.

At first, we tested both the developed system and the existing system using response time i.e. time spent from the applicant's date of application to Date of acquisition of Driver's License. An interview was conducted using 10 people and discovered that the inconsistency in the time taken for the acquisition of Driver's license using the existing model is highi.e the highest response time was 330days while the least response time was 60 days. This is depicted in the Table 2 below

Table 2: Performance evaluation of the existing system and the developed model in days

Applicants	Frontend	Front-backend
1	270	97
2	240	104
3	60	102
4	210	97
5	300	111
6	240	101
7	330	94
8	90	118
9	300	97
10	210	104

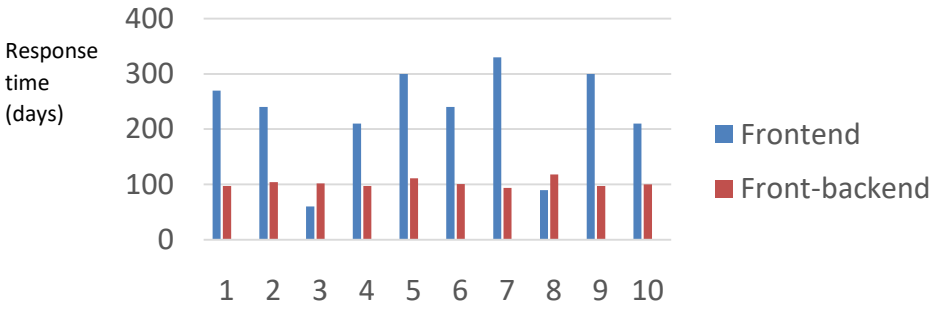


Figure 12: Performance of front end and front-backend mechanism represented on a chart

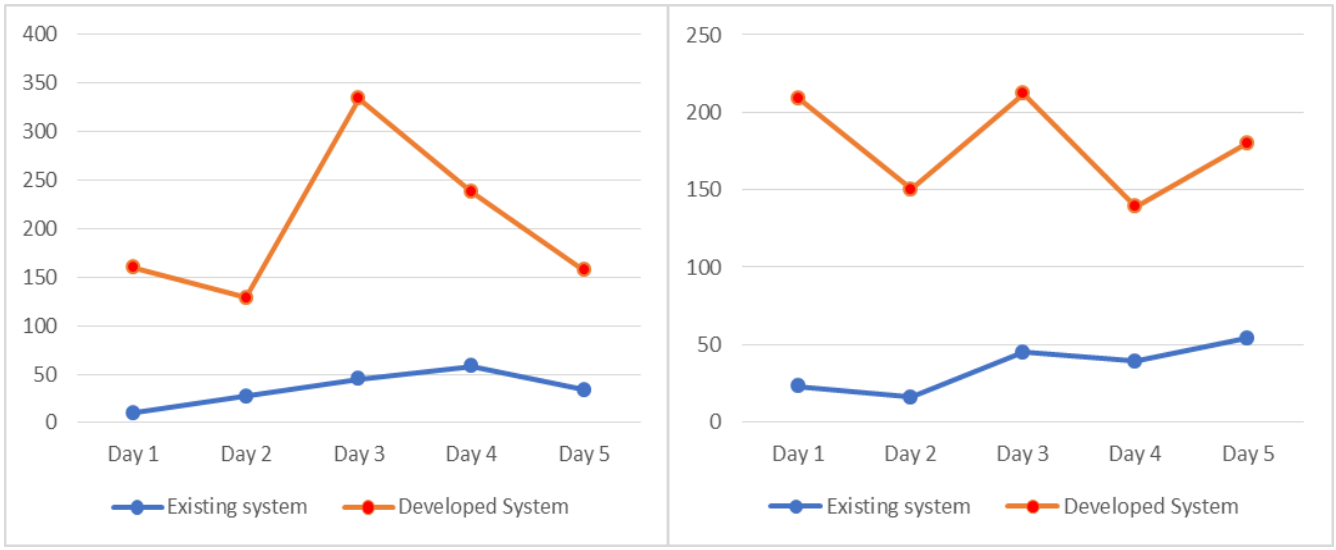
In the developed system, the variation in time taken is minimal, the maximum response time was 118 days while the least response time was 94 days

Also, in order to evaluate the performance of both the existing system and the developed system. Research was conducted on the size of job i.e size of application processed per week over a period of one month at the Driver's license centre using the DLC at Ikare as a case study. The acquired data is as follows:

Table 3: Performance Evaluation of the existing system and developed system using Size of Job

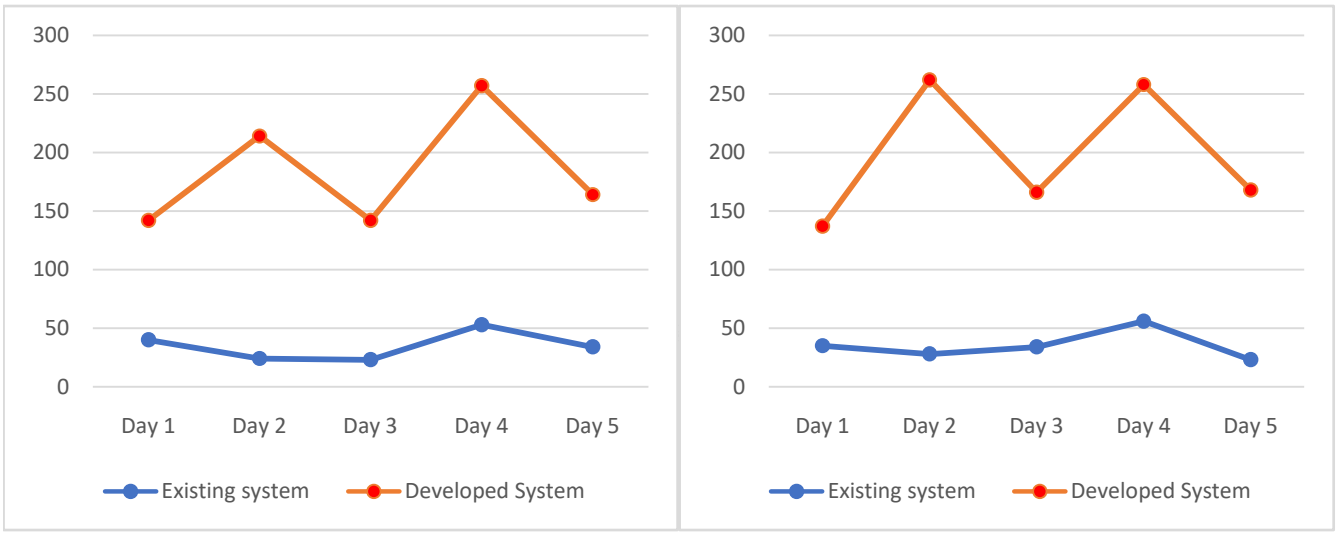
First week	Existing System (size)	Developed system (size)	Second week	Existing system(size)	Developed system(size)
Day 1	10	150	Day 1	25	195
Day 2	27	102	Day 2	16	100
Day 3	45	289	Day 3	52	234
Day 4	58	180	Day 4	40	200
Day 5	34	123	Day 5	38	153

Developed system	Fourth week	Existing system	Developed system
102	Day 1	35	102
190	Day 2	28	234
119	Day 3	34	132
204	Day 4	56	202
130	Day 5	23	145



First week Second week

Figure 13: Performance of the frontend and front-backend using cost



Third week Fourth week

Figure 14: Representation of the frontend and front-backend on a graph

Furthermore, the processing cost was also used in comparing the performance of the existing system and the developed model. Interview was conducted using 20 applicants in order to determine the variation in cost of processing using the Existing system and the developed model. The data acquired is shown in the following Table:

Applicants	Existing System	Developed System
1	20,000	6,500
2	21,500	7,500
3	22,000	6,500
4	21,000	8,500
5	20,000	6,500
6	25,000	6,500
7	21,500	7,500
8	26,200	6,500
9	27,000	6,500
10	21,500	6,500
11	23,000	6,500
12	23,200	6,500
13	22,000	6,500
14	20,000	6,500
15	20,500	6,500
16	24,000	8,500
17	22,500	8,000
18	21,000	7,500
19	23,000	8,500
20	22,500	7,500

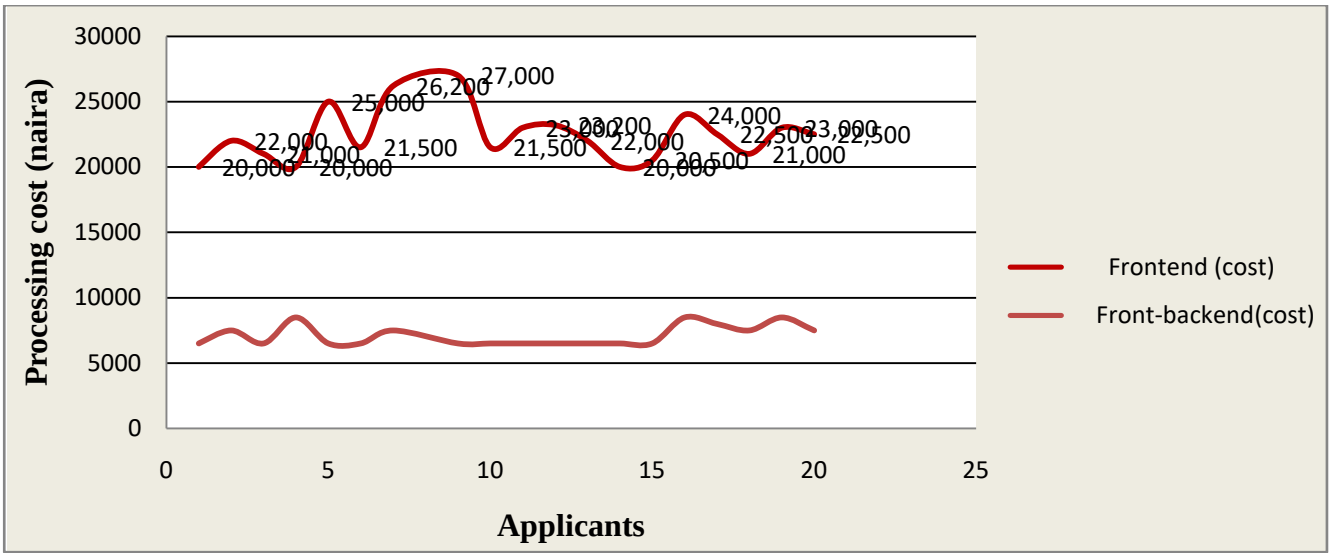


Figure 14: Representation of the frontend and front-backend on a graph

In comparison of the performance of the two systems using the response time, size of job and the processing cost, we can deduce the following:

- The variation in response time of the developed system is minimal.
- Increase in the size of Job processed per week using the developed system
- Processing cost has been considerably minimized

IV. Conclusion

The indiscriminate ways adopted in the procedure of acquiring driver's license in Nigeria has become a major cause of accident on our roads. The present Internet based methods adopted by FRSC is a forward end based approach. In this approach, clients still need to interact with other units directly before a final submission and collection are done. This approach is still opening for corrupt practices and delay as a result of the direct link between clients and various units involved.

[32][32][31][31][30][30][30] The need for an efficient and optimum Driver's License Application Management system in a society cannot be overemphasized .It's contribution as a significant impact on the growth of such society due to the fact that it positively ensures the provision of efficient and safe transportation The developed system offers some varieties of advantages over the existing one among which are elimination of delay in response time, increase in size of job processed per day and minimized processing cost through the elimination of all forms of direct payment to agents. This system ensures that the right amount is paid to the right authorities involved at each stages in the process. This front-backend

mechanism is therefore recommended for adoption and implementation. It will provide improvement over the current method especially for the reduction of stress, easy implementation and it will give room for transparency and accountability.

Also, the back end automated engine serves as the link between the front and other units involved which inturns makes it easier to monitor the application status of applicants and to keep the applicants records in the Driver License Application Management system. This work is a step towards developing a robust backend portal/mechanism which is adoptable by the relevant authorities for the stated purpose. As of now, we still believe that this work is still open for further improvement.

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The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

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Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative 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) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

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

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning 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 a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be 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. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). 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: Authors are advised 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. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Computer Science Research Paper

Techniques for writing a good quality computer science research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. 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.

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

4. Use of computer is recommended: As you are doing research in the field of computer science then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

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

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

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10.Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. 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 for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

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

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

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

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon 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 for 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 of 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 criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to 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 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 avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

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

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite 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 approaches 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. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a 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 limit the initial two items to no more than one line each.

Reason for writing the article—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 for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity 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 of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets 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 for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory 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 soundly written procedures segment allows a capable scientist to replicate 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 to give the least amount of information that would permit another capable scientist to replicate 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 section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show 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:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the 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—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and 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 as 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. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give 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 manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit 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 section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an 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 implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully 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 the prospect, and let it drop at that. Make a decision as to whether each premise is supported or 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 an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of 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 other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

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Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

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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ISSN 9754350