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Highlights

Design and Implementation

Survey on Session Hijacking

Discovering Thoughts, Inventing Future

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State of the Art Survey on Session Hijacking

By Parves Kamal
Saint Cloud State University, United States

Abstract- With the advent of online banking more and more users are willing to make purchases online and doing so flourishes the online E-Business sector ever so more. Attackers are ever so vigilant and active now on web than ever to leverage the insecure web application and database that is out there on the internet to exploit. Today's internet as we see are heavily integrated with sophisticated network whether it's wired or wireless network. But the inherent compliancy to not integrating security while developing application leave it vulnerable to many attacks. One of the attack that has been prevalent now-a-days is: session hijacking.

Key Terms: *session-hijacking, CIA, spoof attack, CSS, SSL, captcha etc.*

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State of the Art Survey on Session Hijacking

Parves Kamal

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I. Introduction

There is various security threats that lurks around the internet. Especially in this age of Internet everything is connected to internet. Online E-Commerce heavily rely on online transaction for example bank provides users easy way of managing their account online. As the sensitive information passes around the internet the confidentiality, integrity and availability of such information become increasingly hard to protect. One needs to develop capable defensive mechanism to keep all the threats that poses threats to the CIA (Confidentiality, Integrity, and availability) of the information. Security threats like man-in-the-middle attack, sniffing, Denial-of-service attack, ARP spoofing, session hijacking are some of the most prevalent attack performed daily by numerous attackers around the world on the internet.

A recent study performed by company Stake (Owned by Symantec) shown that 31% of e-commerce applications are vulnerable to session hijacking [Morana, Marco]. In the paper below I will go details on the session hijacking attack by giving the literature review of this attack. Also I will simulate the attack methodology to understand the mechanism better and finally will provide the general protection strategies for mitigating such attack.

II. Literature Review

As we will be looking into the session hijacking let's get bit of background on what is session hijacking and how it works.

Session hijacking or Session Sidejacking both means taking over unauthorized already created trusted session in order to steal or compromise user's data. It's a well-known man-in-the-middle attack. A valid user who successfully logged into the webserver creates a session between him and the server. In session hijacking technique the attacker takes the control of the valid session from the user and replay packets to the server pretending to be the real user [Whitaker, A., & Newman, D. (2006)]. The advantage of such attack is that the attacker do not have to break into the defense of any firewalls, Intrusion detection system instead he/she can just listen to the network and take over any valid session.

One of the reason behind successful rake over such session is because of the way the server and the user authenticate themselves initially. In many cases only the server authenticate itself to the client in secure channel over HTTPS during the initial authentication phase and after the authentication the rest of the communication is done in clear plaintext.

Session hijacking are of three types:

- Active session Hijacking
- Passive session Hijacking
- Hybrid Session Hijacking

a) *Active session hijacking*

In active session hijacking the attacker tries take over active session between the user and the server by either putting off the valid user from the connection and start making connection to the server masquerading as the valid user. The way attacker put off the valid user is by putting the active user out of the connection via Denial of service attack. Before making the valid user out of the valid active session he/she captures data that is sent back and forth between the user and the server by putting himself in between the connection between the connections and sniffing the data by packet capturing tool like Wireshark. In the figure below we see the three packets highlighted which is TCP three way handshake packet that are used to authenticate client to the server during the initial authentication session as shown below:

Author: BSc in Computer Security & Forensics MSC in Information Assurance Saint Cloud State University.
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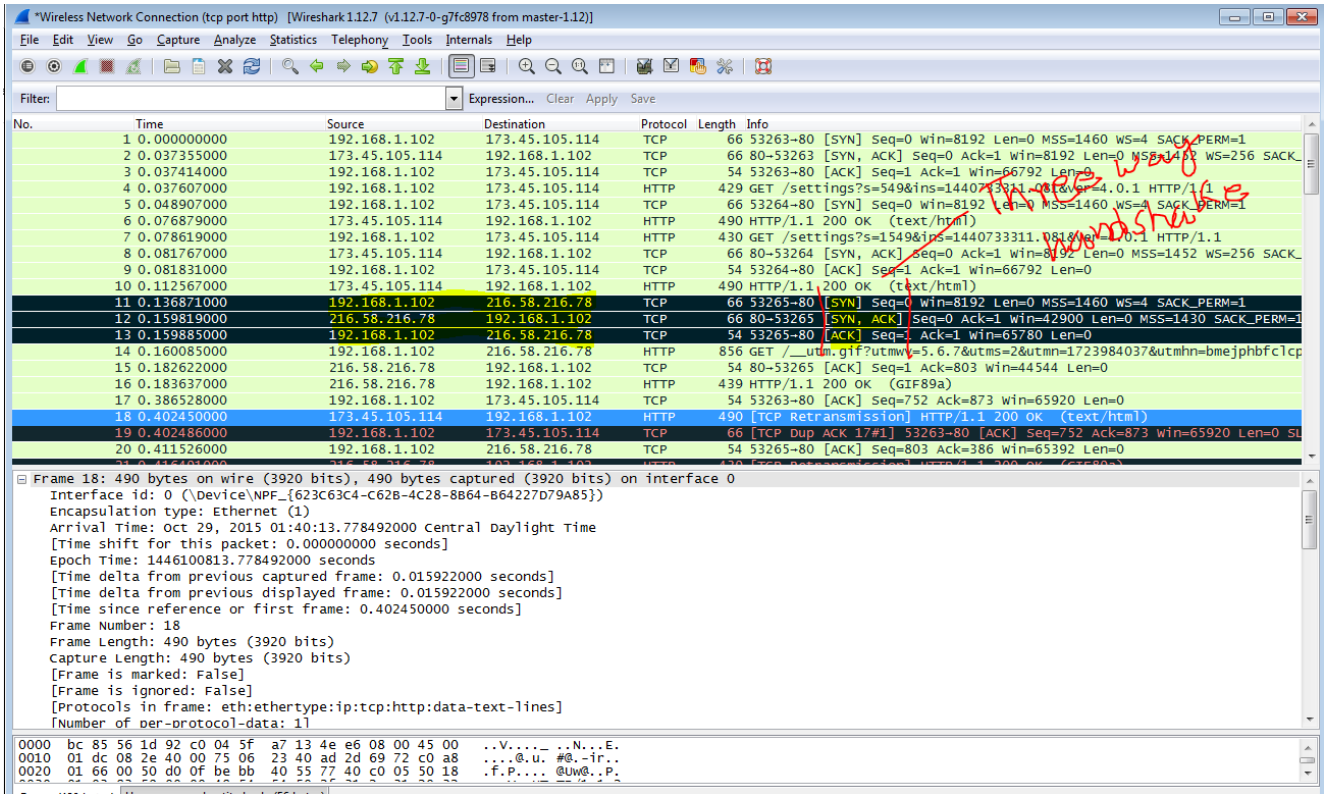

Fig. 1 : TCP-Three way Handshake packet Captureby Wireshark

The active session can be better illustrated as the diagram shown below:

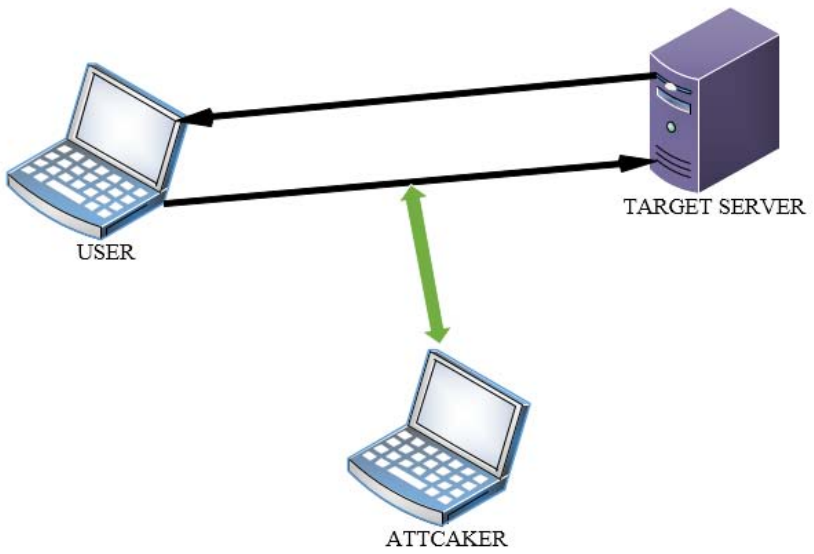

Fig. 2 : Active Session Hijacking

AS we can see from the figure above the attacker find himself in middle of the connection between valid session of the user and the server and monitoring traffic between them. As it sees fit, it puts off the valid user out of the session and takes over the session.

b) Passive Session Hijacking

In passive session hijacking the attacker captures all the packet between the user and the server and it send out valid packet to the user masquerading as server and same way sending packet to server masquerading as user. It's also referred as session-replay attack where the attacker basically replaying packets captured from the user and sending it to the server. The disadvantage of such attack is that the attack is valid until there is valid session still in continuation. If for some reason the server resets the connection or user logs off from the server the session will be terminated.

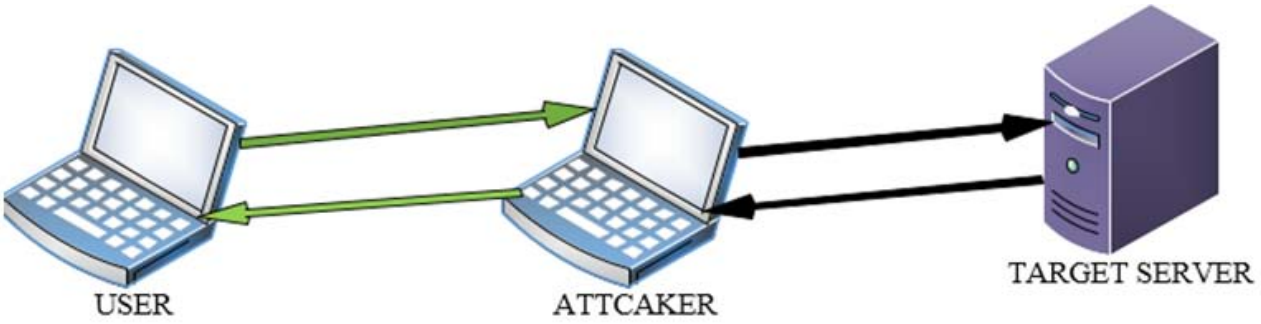

Fig. 3 : Passive Session Hijacking

As shown in the figure above the attacker is replaying packet between user and the server and it modifies the packet as it goes from user to the server.

c) Hybrid Session Hijacking

In hybrid session hijacking the attacker uses both passive and active mode to complete the attack.

The attacker monitors the traffic pattern between the user and the server and wait for the right session to take over.

This type of session hijacking relies on spoofing and it can be further categorized to two types:

- Blind Spoofing attack
- Non-Blind spoofing attack

d) Blind Spoofing attack

In blind spoofing attack the attacker attacks the target machine without tempering with the connection. It simply captures all the packets between the client and the server and it tries to guess the TCP packet sequence number so that it can authenticate with the server. The problem with this type of attack is it's very hard to guess the TCP sequence number as it can be very random number which makes it harder to guess. Also its time consuming and the attacker might need to wait long time to get success with this type of the attack.

e) Non-Blind spoofing attack

In non-blind spoofing attack the attacker can actually monitor the traffic between the user and the target server. This way it's easy for the attacker to guess the next packet in case if it wants to guess the TCP sequence number of the next packet. It's hard to implement in today's network as the administrator now turns off the broadcast packet transmission around the network so unless the attacker can make the networking devices like switch and router to restart itself so it can capture the broadcast packet or by poising the CAM table of the switch it can place itself in the routing table and reroutes packet to itself for packet capturing.

In application level the attacker hijack the session as well as tries to create new session with newly constructed session ID's which can be stolen or guessed or crafted in a such way that it validates the attacker with the target machine to take over existing session or create new session [Sans.org,. (2015)].

The session ID's can be found in place like: [Ollman, Gunter]

- In the HTTP GET request that is made when clicking on the embedded link on the web page.
- When any HTTP post command issued typically with form that post data from client to the server. The session ID is hidden inside the form in the hidden field.
- Also the cookies are used to hold session ID's.

f) Obtaining Session ID's

There are number of ways anattacker can steal session ID'S. Some of the ways are described below:

g) Sniffing

One of the way the hijacker can steal session ID'S are by sniffing out the network traffic just like taking over TCP session. This way the attacker monitors traffic to see if there is any unencrypted packets traversing and by finding so it can redirect the traffic through a host that it can monitor. Unencrypted traffic often has session ID inside and attacker can easily get the session ID and use it to take over already established session or create new session.

h) Brute Forcing

Another way the attacker can get the session ID is either guessing the session ID's or by attempting different session ID until it gets the right one. It can be automatic attack where attacker sets up certain pattern and it looks through all the patterns until it finishes. This type of attack is particularly successful if the session ID number generation is not Random number and there is high chances the attacker will guess the session ID correct.

i) Misdirected Trust

Another form of attack where what attacker does is HTML injection or CSS (Cross Site Scripting) attack to misdirect valid traffic to the attacker. This way it can steal the session ID as the data is sent back from server to the host. This sort of attack relies heavily on the vulnerability of the web application on which this attack is performed since the success of the HTML injection and the CSS attack depends on the defensive mechanism of the web application it is attacking to.

j) Tools Used For Session Hijacking

Some of the tools used to steal session Hijacking are:

- Hunt
- T-Sight
- Juggernaut
- TTY Watcher
- Hamster and Ferret
- Wireshark
- Ethereal

III. Attack Methodology

Session attack methodology can be shown in following steps as shown below in the figure

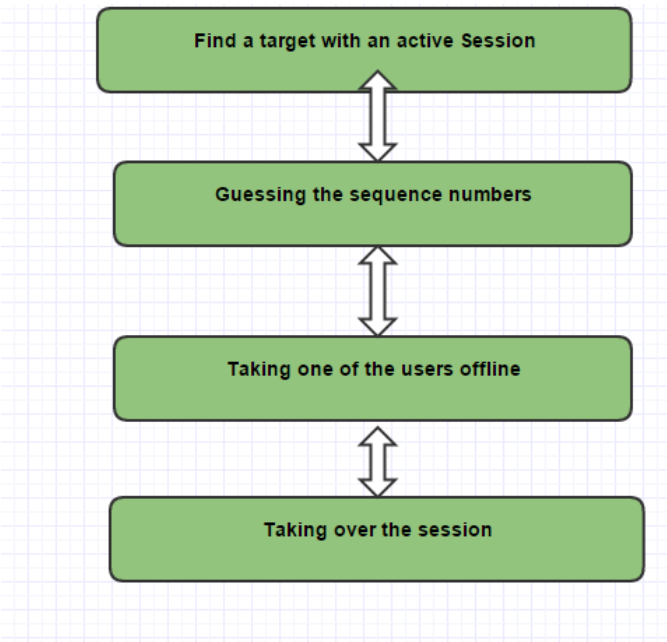

Fig. 4 : Session Hijacking Steps

We will be showing a session hijacking in a simulated environment in Virtual Environment where the set up will be as follows:

- Victim Machine (Windows 7 VM)
- Attacking Machine (Kali Linux VM)
- Sniffed Router/Switch

The Tool we will be using for carrying out the attack are as follows:

- Kali Linux
- Ettercap
- Hamster And Ferret

The kali Linux tool will be used as attacking machine to sniff out the traffic from victim machine which is windows 7 VM and Router.

Our simulated Attack looks like following below:

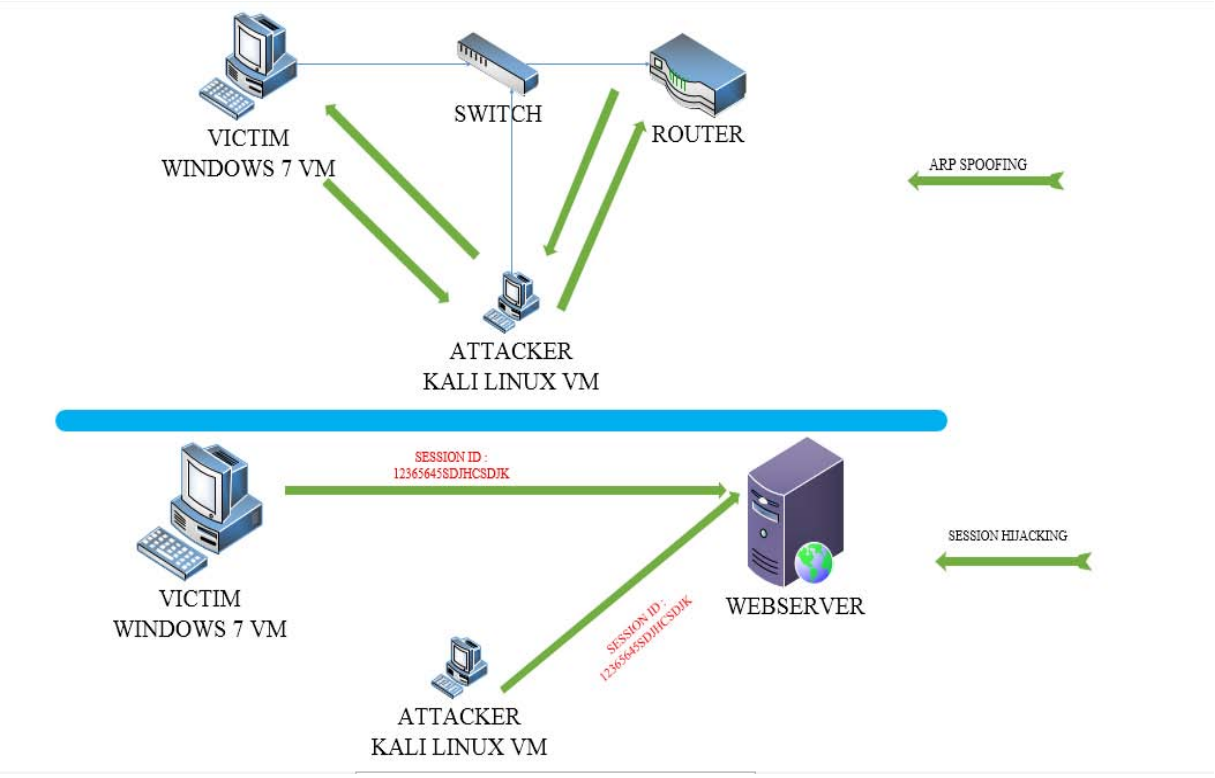

Fig. 5 : Simulated Attack Diagram

We will be stealing HTTPS connection from The VICTIM to get the USER Login and Password he/she put in.

For our demonstration purposes the IP network configuration is as follows:

The attacker machine and the Victim machine is set up in Virtual box and they were in private IP address subnet 192.168.1.0

a) IP Address

Attacker IP Address: ***192.168.1.108 (KALI LINUX)***

Victim's IP Address: ***192.168.1.107 (WINDOWS 7)***

Router/ gateway Address: ***192.168.1.1***

Local Loopback address: ***127.0.0.1***

b) Setting up Attacker Machine

We need to at first set up Attacker machine Kali Linux the Men in the middle between the router and the victim machine Windows 7.

We at first check our connectivity from Attacker machine to the Victim machine by pinging our victim machine as shown below:

```
root@kali:~# ping 192.168.1.107
PING 192.168.1.107 (192.168.1.107) 56(84) bytes of data.
64 bytes from 192.168.1.107: icmp_seq=1 ttl=128 time=0.789 ms
64 bytes from 192.168.1.107: icmp_seq=2 ttl=128 time=0.583 ms
64 bytes from 192.168.1.107: icmp_seq=3 ttl=128 time=0.537 ms
64 bytes from 192.168.1.107: icmp_seq=4 ttl=128 time=0.739 ms
64 bytes from 192.168.1.107: icmp_seq=5 ttl=128 time=0.484 ms
64 bytes from 192.168.1.107: icmp_seq=6 ttl=128 time=0.971 ms
64 bytes from 192.168.1.107: icmp_seq=7 ttl=128 time=1.03 ms
64 bytes from 192.168.1.107: icmp_seq=8 ttl=128 time=0.527 ms
64 bytes from 192.168.1.107: icmp_seq=9 ttl=128 time=0.467 ms
^C
--- 192.168.1.107 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8002ms
rtt min/avg/max/mdev = 0.467/0.681/1.033/0.200 ms
root@kali:~#
```

Fig. 6 : Checking Connectivity between Attacker and the Victim machine

Now in order to crack HTTPS connection we need to have SSL strip in the attacker machine. So we type in the following command in our attacker machine and Press Enter after each command above:

SSLstrip Download Code:

cdcurl http://www.thoughtcrime.org/software/sslstrip/sslstrip-0.9.tar.gz > sslstrip-0.9.tar.gz

tarxzf sslstrip-0.9.tar.gz

cd sslstrip-0.9

Now we need to forward the Traffic generated in HTTP by forwarding the IP traffic by NAT forwarding in our Attacker Machine.

We do that by uncommenting the **net.ipv4.ip_forward=1**line inside the**/etc/sysctl. conf** file.

We do that by following command

cp /etc/sysctl.conf /etc/sysctl.conf.bak

vi /etc/sysctl.conf

We find the**net.ipv4.ip_forward=1 line** and uncomment it. Then we save the file CONTROL+X and save it.

Now we need to set up IP tables Rule in the command prompt of the attacker machine as follows:

iptables -t nat -A PREROUTING -p tcp --destination-port 80 -j REDIRECT --to-port 8080

iptables -t nat–L

We see from following figure the output of the iptables we configured above

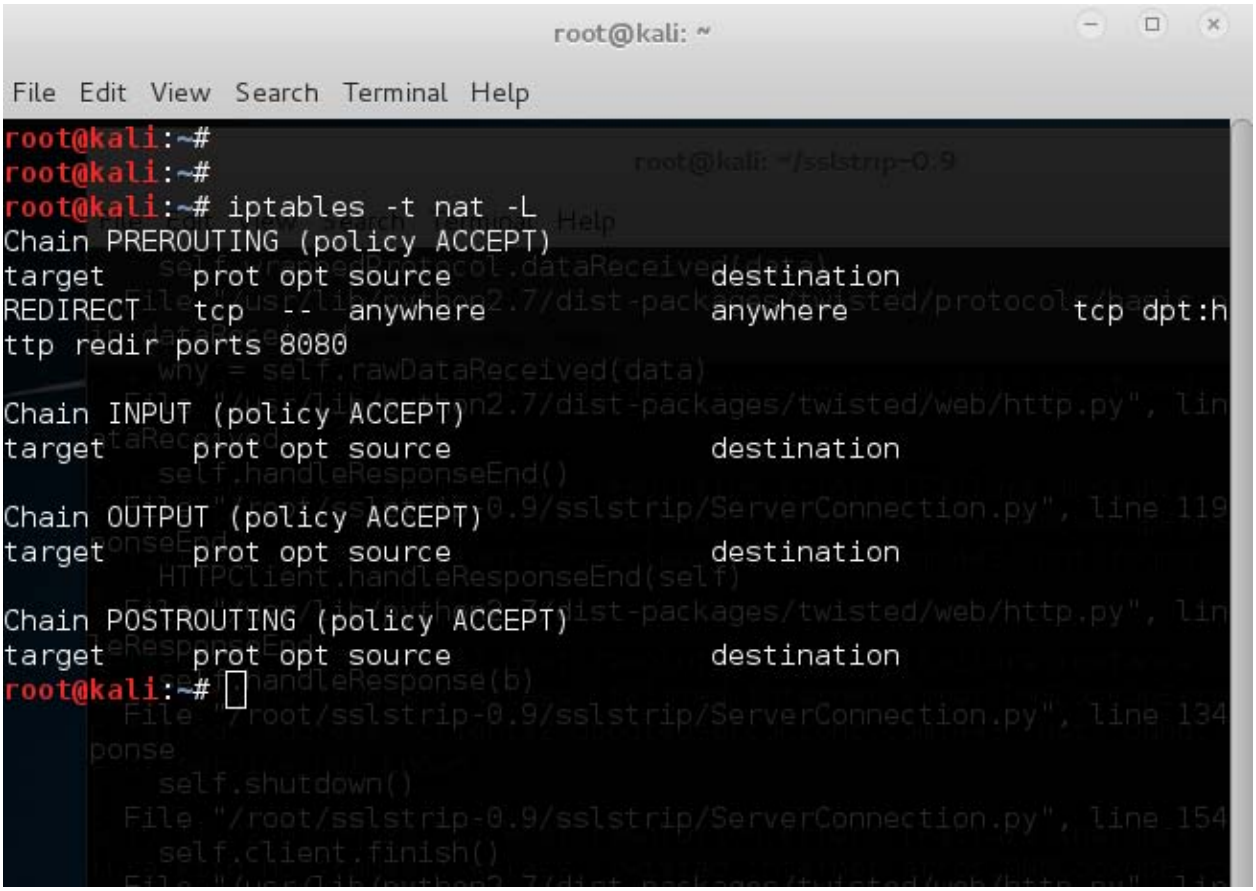

Fig. 7: IP forwarding

Now we need to set up SSLtrip to act as sniffing between victim and the attacker machine to strip any HTTP connections from the victim machine.

On the attacker machine we type in the following command to install the ssstrip

Cd sslstrip-0.9

python sslstrip.py -p -l 8080

We need to keep the windows open as it will generates traffic as the victim machine browse to any webpages with its browser:

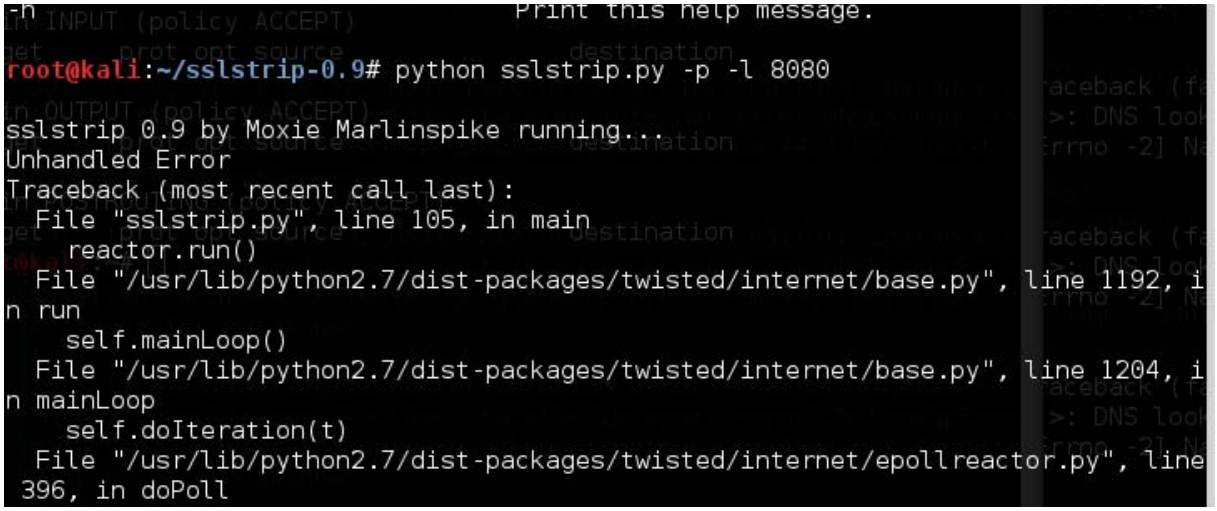

Fig. 8 : sslstripsetup

Now the sslstrip will generate its traffic captured from the victim's machine and save it to its logfile. So we need to monitor its logfile in order to capture information.

On the attacker machine we type in following command to open the log file and keep it open to monitor capture traffic from the victim's machine as shown below:

cd

cd sslstrip-0.9

tail -f sslstrip.log

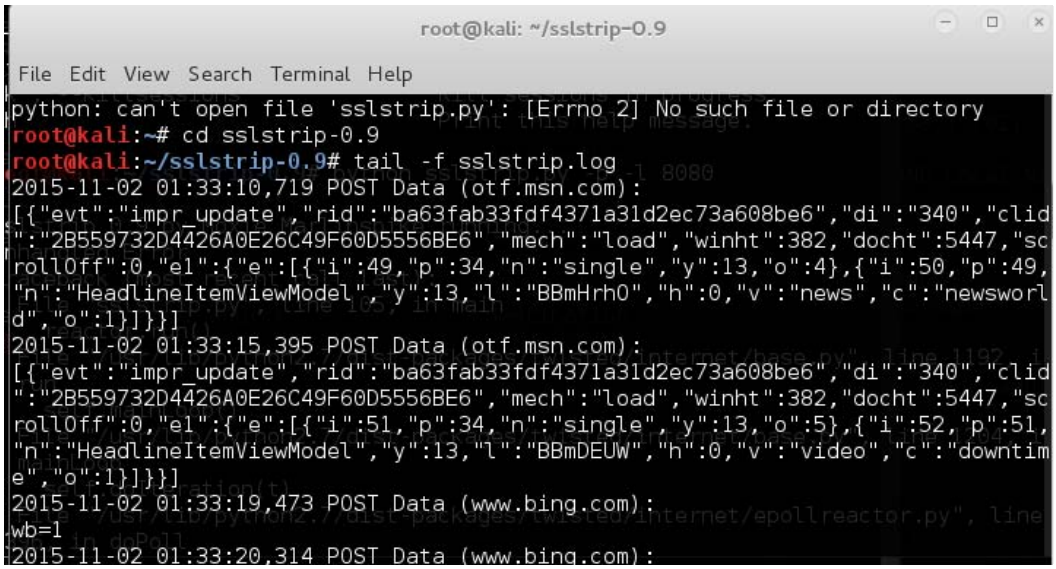

Fig. 9 : Monitoring Logfile of captured data

Now we need to make the victim's machine http traffic to pass by proxy server we do that my ARP poisoning attack.

We do that by Ettercap in kali Linux. We open it and scan the host. From the host list we put our router192.168.1.1to target 1 and the victim's machine 192.168.1.107to target 2 and start ARP poisoning as shown below:

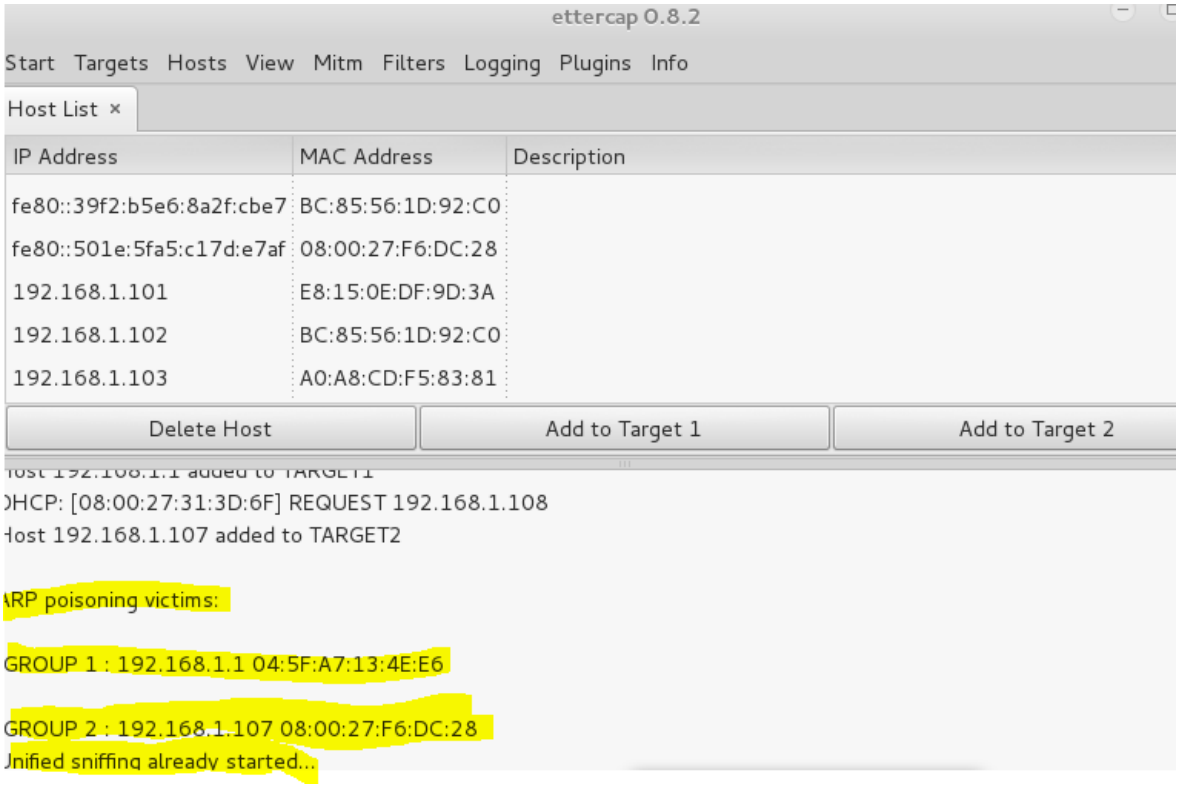

Fig. 10 : ARP Poisoning Victim's Machine

Now let's go to the attacker machine and open citybank online banking login page and we put ID as 123456 and password as =rivery227as shown below:

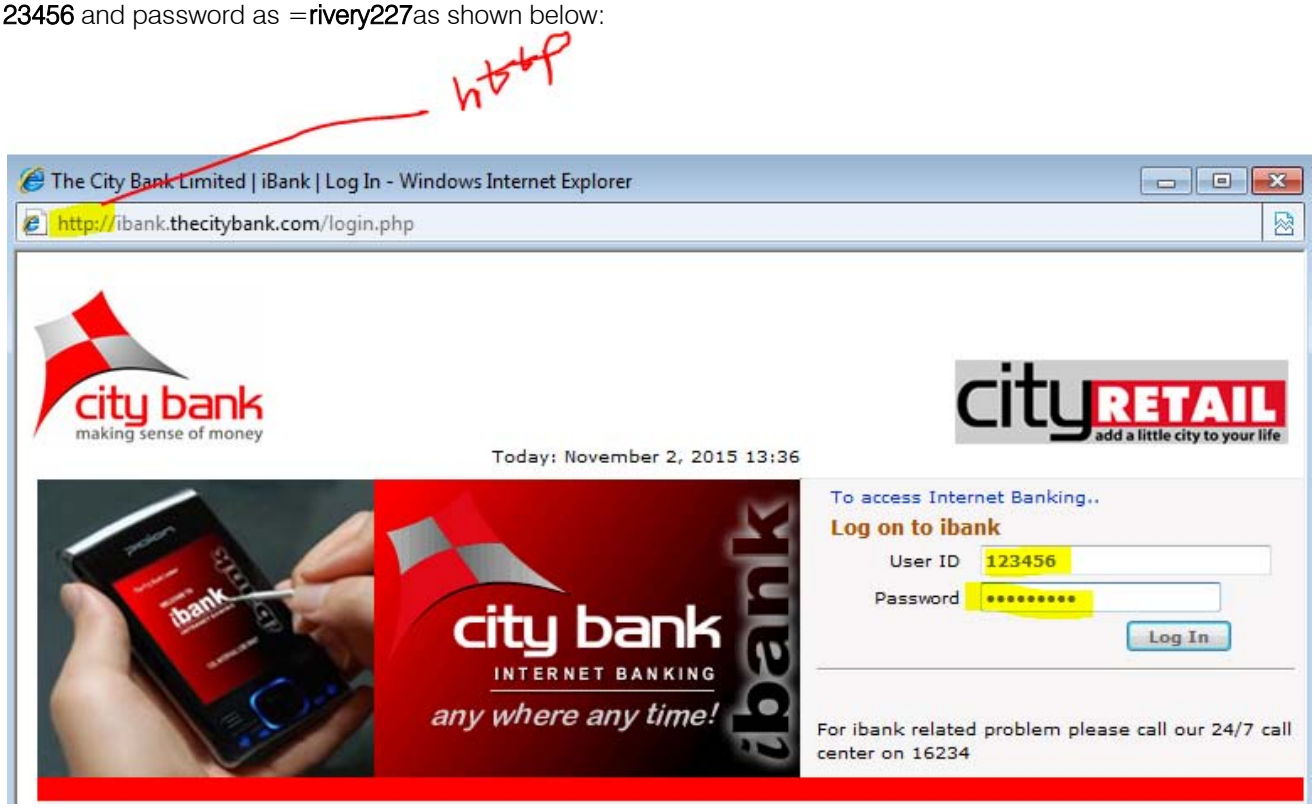

Fig. 11: Victim's Online Banking Login page

If we see the attacker machines ssltriplog file we will see it captured the ID and the password similar to what was mentioned earlier. It successfully stole the HTTP session of the victim's machine and strip of the HTTP to http as shown above in the figure above to steal login ID and the password.

The victim did not see the login page of his online banking been strip down from HTTPS to HTTP as shown above.

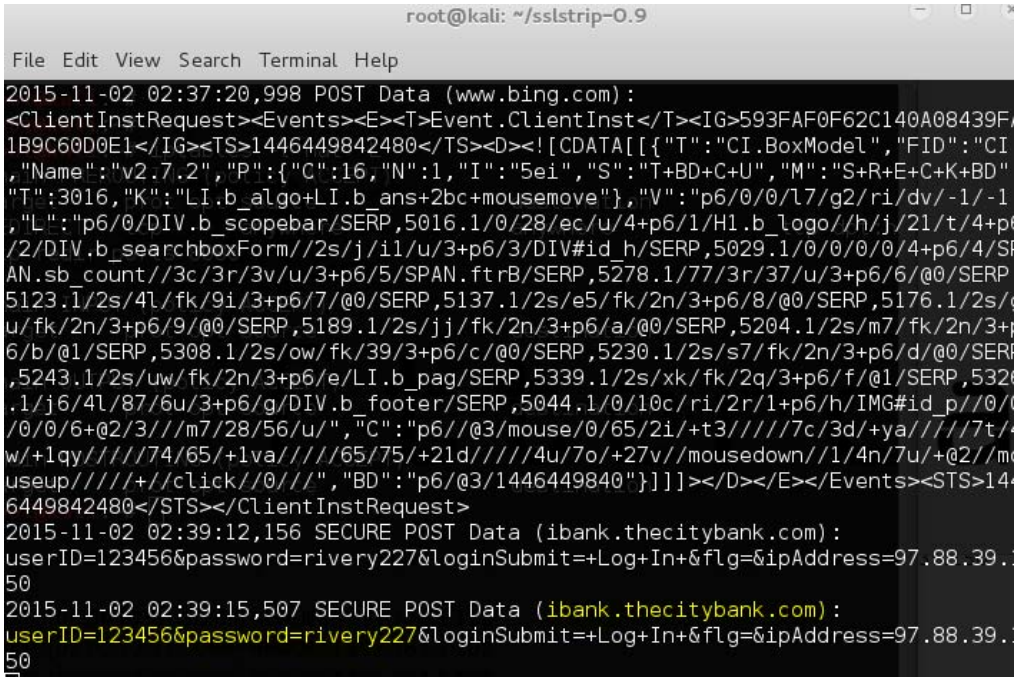

Fig.12 : Login ID and Password Stealing by HTTP Session Hijacking

Now the attacker is inside the session as long as the victim's will be and do any further attack as he/she might find it useful.

IV. Survey Analysis

A survey was done about the awareness of the Session hijacking. Between researchers, common users and the administrator. As expected the common users have very less knowledge about the session hijacking followed by the Administrator. Surprisingly the administrator though they knew about the session hijacking had very little knowledge on how to prevent it. For successful mitigation of session hijacking one needs to have awareness as well as secure operation policies implemented in the organizations. The graph below shows the session hijacking awareness between common user, administrator and the researchers.

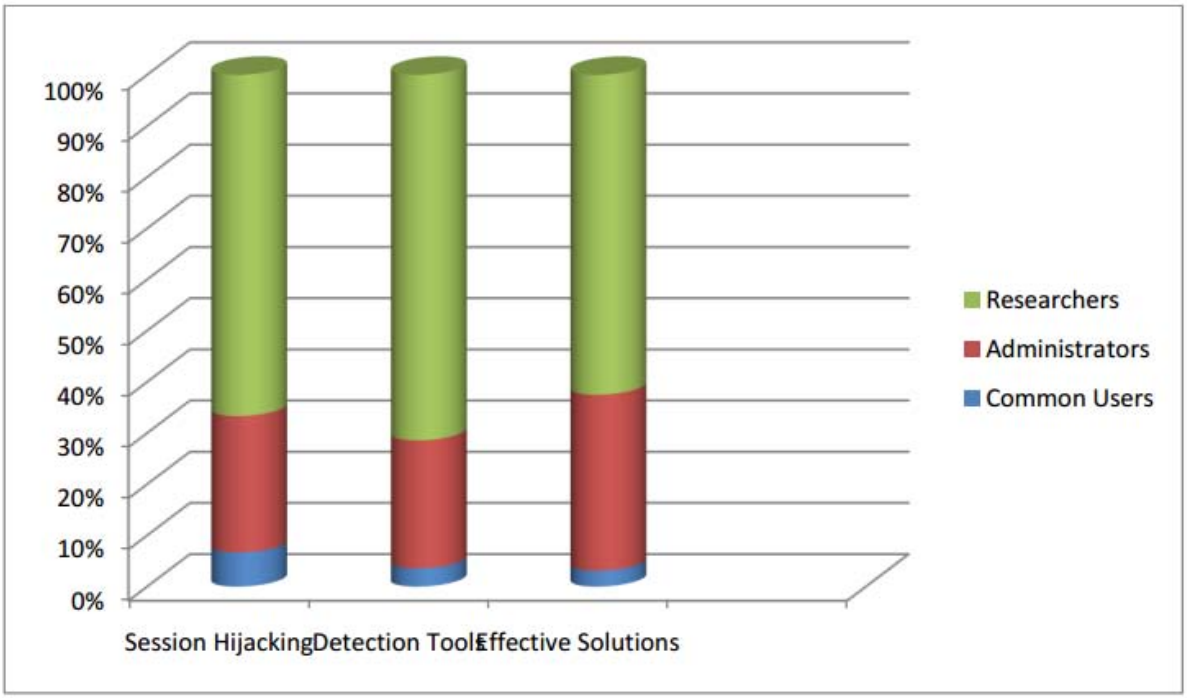

Fig. 13 : Session Hijacking Awareness [Louis, J. (2011)]

V. Counter Measure to Session Hijacking

There are number of ways session hijacking can be prevented. The countermeasure against session hijacking discussed below provided are based on recommended session hijacking techniques [CEHv8. Ethical Hacking and Counter Measures].We will be dividing the session hijacking in two layer of OSI layer as:

- Network layer
- Application layer

VI. Network Layer

a) Use of SSL at all time

Use SSL connection whenever it's possible. SSL (Secure Socket layer) Provide end to end encryption which make it really hard for attacker to look into any data passing over this encrypted SSL channels uses public key and symmetric key which are of 128/256 bits. Since it provides the integrity as well as the confidentiality sniffing and loss of information is protected while using SSL connection.

b) Use SSH for Remote Connection:

Often the remote connection to network devices or web server is required for the administrator for remote administration. SSH can protect the network as it guards against the IP spoofing as well as the data is encrypted. An attacker if has access to the target network can force the connected SSH user out of the connection but he/she cannot replay the packet as the data will be encrypted [Webopedia].

c) HTTPS Connection Only

It is very important to use HTTPS connection while login to your webserver, or any E-commerce site like Online banking, shopping sites as it encrypts the data with SSL as mentioned earlier to encrypt the authentication data back and forth. Attacker even if is successful to capture data will not be able to make any sense out of the data.

d) Implementing IPSec Protocol in Network Layer

IPSec protocol ensures the secure exchange of the IP packet and it provides two protection service. In transport mode it encrypts the data of the packet while in tunnel mode it encrypts the data as well as the header of the packet making the attacker hard to guess where the packet is going and coming from.

e) IDS/IPS Implementation

Implementing IDS/IPS along with firewall with proper rules can detect IP spoofing, packet sniffing which is the key to the session hijacking at the network layer. For example the rule can be set up as ignoring source routed packets or even blocking the source-routing completely. ARP poisoning as shown above in the simulated attack can be prevented by implementing static ARP table or by monitoring ARP table with tool like ''arpwatch''. Other techniques like ICMP redirection disabling can make it even harder for attacker to perform the MITM (Men in the Middle Attack).

f) Application Layer

Application layer deals with attacks on Web as our attack involved in URL session ID hijacking we will see below the countermeasure that can prevent such attacks.

g) Strong Session ID

Session ID is key to authenticate, create, re-establish connection with server. Session ID key must be strong nor predictable and it needs to be truly random. The session ID management system both in the client side and the server side needs to implement strong session management system. Following are some of the steps that can be taken to generate strong Session IDs

- *Making the Session ID Random* – As mentioned earlier the more random the session ID is more it's harder for attacker to guess or brute force the session ID. For making robust random session ID one can put the session number generation to a statistical analysis test.
- *Making The Cookie or the session ID longer* – The longer the session ID is harder it will be to brute force against. It will be very difficult to brute forcing against session ID of 50 characters in given time.
- *Use Server generated Session IDs* – Often the client side use its own session ID's which is less vulnerable to session hijacking.
- *Encrypt The Session IDs* – one can further encrypt the session Id to protect it from tempering. The session Id that is passed inside the encrypted channel SSL may look different from the one that is passed inside the unencrypted channel. One can write script to encryptеach session or can encrypt the whole channel by SSL. One such script for encrypting session are as follow:

Session Encryption Code: [D. (2015). Do you need to encrypt session data?]

```
session_start();


if (isset($_SESSION['fingerprint']))
if ($_SESSION['fingerprint'] != md5($_SERVER['HTTP_USER_AGENT'].'SECRETSALT'))
exit; // prompt for password
else
$_SESSION['fingerprint'] = md5($_SERVER['HTTP_USER_AGENT'].'SECRETSALT');
```

- *Forced Log Out* - There should be a mechanism to log out user and prompt for re-authentication for new connection that way the attacker cannot use the same session ID to take control of the session. So every new connection there should be new authentication and log out of the current authenticated user.
- *Generate ID after the authentication* - Often before the authentication is performed the session ID is generated and shared that way the session ID is exposed to the attacker and they can carry out session fixation attack. So for security reason the session ID should be generated after the authentication is done.
- *Token Regeneration*- Once in a while if the session token is regenerated it becomes hard for the hacker to remain in valid session as after certain time the session token becomes useless. Webserver can be implemented in a way to regenerate session tokens giving the attacker less time to be on a session [Martin Eizner, and Roy McNamara "A Guide to Building Secure Web Applications].
- *Time-Out*- Time out should be implemented after certain period of inactive time period so that the attacker cannot exploit any idle session.
- *Proper Input Validation Checking* – Proper form input validation checking needs to be implemented from the server side. Often the Cross site scripting, HTML injection vulnerability allows the attacker to take over the web application and thus exploiting the session.
- *Detecting Session ID Brute Forcing attacks* - OWASP suggest using booby traps session tokens to detect any brute forcing on session ID token. [Search Software Quality. (2015)]. It's a token which is attached to the actual session token to detect any brute force on tokens.
- *Captcha Prevention Technique:* -CAPTCHA means Completely Automated Public Turing test to tell Computers and Humans Apart" [AriyanZarei, (2014)]. It will help to enforce only one session per one single user and also will protect from any automated brute forcing attacking as CAPTCHA requires to put input based on some visual representation of images which requires human input keeping bot at bay.
- *Awareness and Training:* It's the awareness which often are the most neglected aspect and until the users are properly trained or at least be aware of how to safeguarding against session hijacking attacks it's very difficult attack to guard against. User should be aware of why using encrypted connection always, when to use proxy, VPN connection or to have strong password set up for their online account etc. All these will add up to the better safe environment against session hijacking.

VII. Observations & Recommen Dations

In this paper the simulated attack on CITY bank session hijacking was analyzed from literature and practical point of view and also the countermeasure to

such attack was explored in the end. The actual attack though did not yield in catastrophic effects but the researcher was startled to see how attacker was able to easily get into the victim's session just by modifying Cookie or session ID changes. Such attack can further exploits vulnerable system inside the bank's infrastructure which can enable the further severe exploitation to be successful. The hacker can get the users data and email ID. Nonetheless it's been projected that the user data loss will prosper further scamming and fishing attacks. The general recommendation to prevent such further attack encrypted and longer session ID with time out and effective IDS/IPS with Brute forcing detection mechanism to deter any attacker in carrying out such attacks in future.

VIII. Conclusion

In this short survey paper we tried to have look at the session hijacking attack and its implementation with demo Attack. The attack carried out by the attacker though was not known in terms of details that much but the security expert stated it was due to session hijacking attack. Session hijacking has been on the rise on recent past mainly due to the users/developers/administrators lack of awareness and poor session management of some of the web application and servers on the internet. By putting the effective countermeasure mentioned in the countermeasure section of this paper one cannot fully prevent such attacks but can at least make attacker to come harder and use some other tricks rather than the usual attack performed in this paper. Also it's recommended to test the defensive mechanism that are in place and also monitor to deter, prevent and counter attack on such attacks if ever take place.

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Low Cost Wireless Nurse Call System with Webserver & Pager

By Mahbub Arab Majumder
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Abstract- Nurse Call System is an essential tool for the present time hospitals. In this research work a wireless nurse call system with webserver is designed, developed and implemented. This system helps admitted patients in hospitals. Patient can call a nurse or patient care assistant (PCA) for help. This system is also capable to generate emergency alarm. When a patient calls a nurse the system updates the status on webserver that a patient from specific room number is calling. Each device has a unique identification number in the system. On web nurse can see the room number and time when the patient has called. In order to turn off the call nurse presses the attendance button. All the nodes transmit data to a base node and base node updates the data to webserver. LAN connected other PC can view the call using any browser or any nurse can view the call using her cell phone through Wi-Fi. Each cell phone acts as a pager. Nurse can be notified of a call on the run.

Keywords: nurse call system, wireless network, hospital call system, webserver, pager, wi-fi, tree network, nrf24l01.

GJCST-E Classification : C.2.1 C.2.4

Strictly as per the compliance and regulations of:

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I. Introduction

Day by day all medical equipment are getting sophisticated, complex and expensive, rising the medical service charges. The basic nurse call system has become a luxury product for most of the economical hospitals. But it is a must have tool for patients, who are unable to move from their bed. Some scissor patient is not able to call someone loudly. Considering the balance between need and cost in this paper an economical nurse call system is developed. Nurse call system is not a new research topic. There has been lots of research going on developing low cost nurse call system. Like Design development and implementation of wireless nurse call station [1]. In this paper a simple one to one wireless communication has been defined. But in hospital scenario multiple patients call to an individual nurse station. For these type of communication tree network is best. In this research tree network is implemented. In some of the recent research Design and Implementation of Remote Medical Nursing Monitoring System based on Computer Network [2] is an internet dependent system.

But real-time critical system like this one cannot depend on internet connectivity. If internet is not available, the system still should provide the service of nurse calling. In the proposed system internet is not required. Although if user wants to monitor data from outside world an internet connection can be plugged in. In some of other researches like Nurse calls via personal wireless devices; some challenges and possible design solutions [3] discussed about wireless communication advantages but wireless devices needs to be portable also. In most of the conventional system calling device is fixed at a point where patient have to reach in order to call the nurse. In this implemented design each calling key fob is portable battery powered. So that if electricity goes out still the system can run itself on battery.

II. Block Diagram of the System

Block diagram of the system is shown in fig.1. There are several types of nodes in the system.

Base node is the call station. All data transfers to base node and from base node all data get uploaded to webserver. Base node can connect up to 6 child node simultaneously. But this does not limit its capability to control thousands of node at the same time. Here base node is connected with 5 wards. In each ward there can be several beds. Each bed is sending data to its corresponding ward node and each ward node is relaying the data to the base node. Base node has an RTC module to calculate the exact time of data receive. Whenever base node receives any data it updates webserver with the time stamp. Base node monitor, control, receive and transmits data to its child nodes. As the base node is unique in every network it most of the time hold zero as its address.

Child nodes are direct connected with base node. Number of child node is limited for a base node. Only five child node can be connected to a base node. If the network is larger than present one, then each base node can be treated as a child node to cover six times present number of patient. For this network each child node is treated as individual ward. And in a ward there can be several patient. Cabins are considered as individual bed. Each child node can be connected with a direct patients bed or to an expand node. A child node can be connected up to six expand node.

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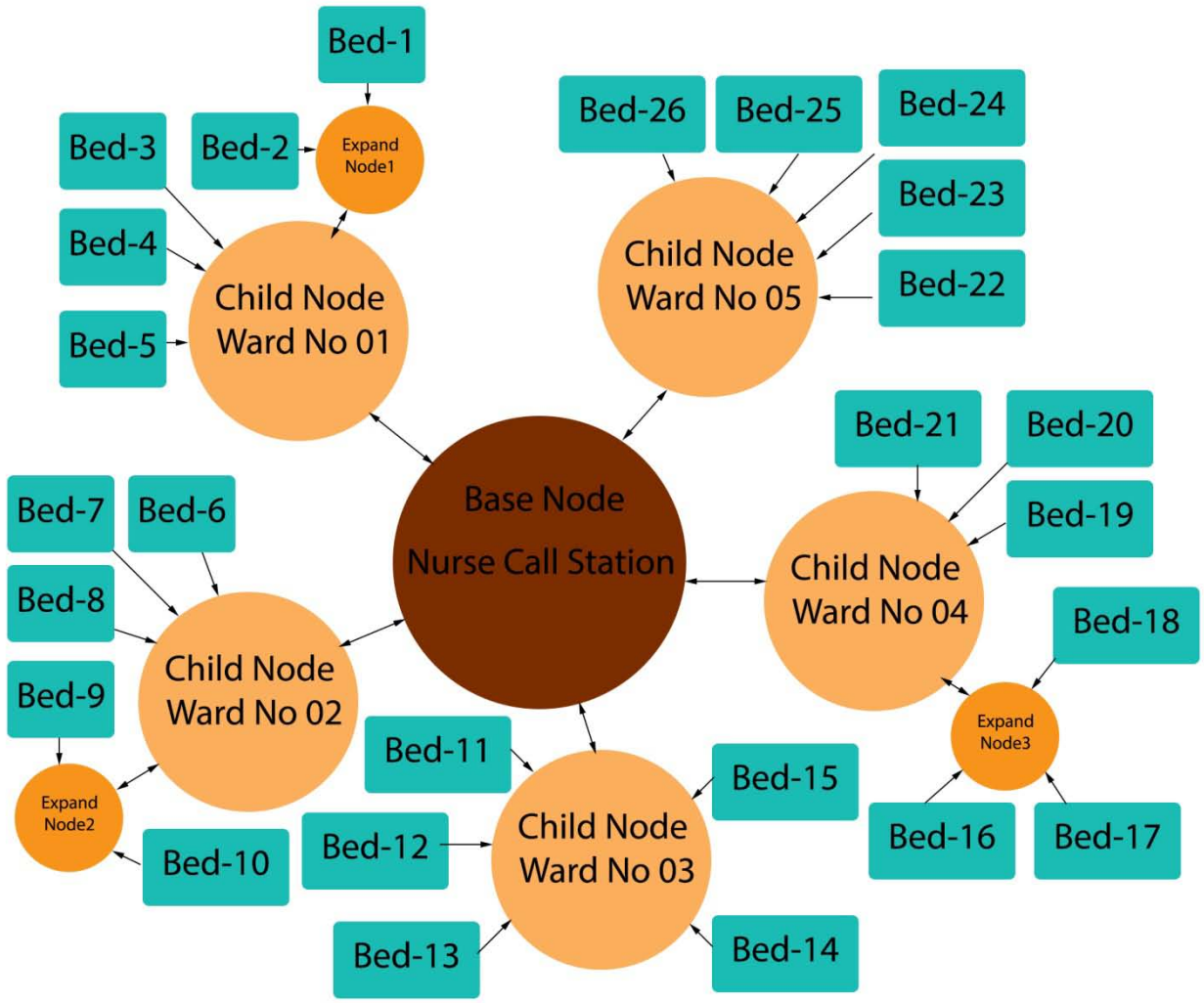

Fig. 1: Tree Network of the complete system

Expand node is a sub node of each child node. Expand nodes are used to expand the number of bed node. For example, if any ward has thirty-six patients then one child will get connected to six expand node. And each expand node will have six bed node. So the number of expand needed to be used in a ward depends on the number of patient in that ward. Expand node mainly expand the network. The network is a tree network. In a tree network each expand node works as a branch in the network. And from that branch other branch can come out or any leaves can come out. Branch nodes relay the data from end node to its above branch. Above branch can be another expand node or child node. Expand node does not modify any data. Expand node is always in receiving mode. Whenever any end node transmits any data to expand node. It receives the data and transmits the data to its upper node only.

Bed nodes are end node. This node is used by each patient. In a ward there will be only two end node. One for call a patient from bed and another node is in toilet. For ward number of end node and number of bed node are equal. But as the toilet is common so one node will be at toilet. End node only transmits data. For simplicity there is only one type of call to the nurse. But a call from toilet & a call from bed is different. Whenever a patient presses a button from toilet it indicates an emergency alert. And when the alert is generated from room it indicates a normal call for assistance or medication etc. Each end node is battery powered. It helps a patient to move around in the room with the call button. End node stays in sleep mode most of the time in order to save power. Whenever a patient presses the button the end node wakes up from sleep mode and transmits the signal to its parent node.

III. Circuit Analysis

Base node consists of several components. Among them

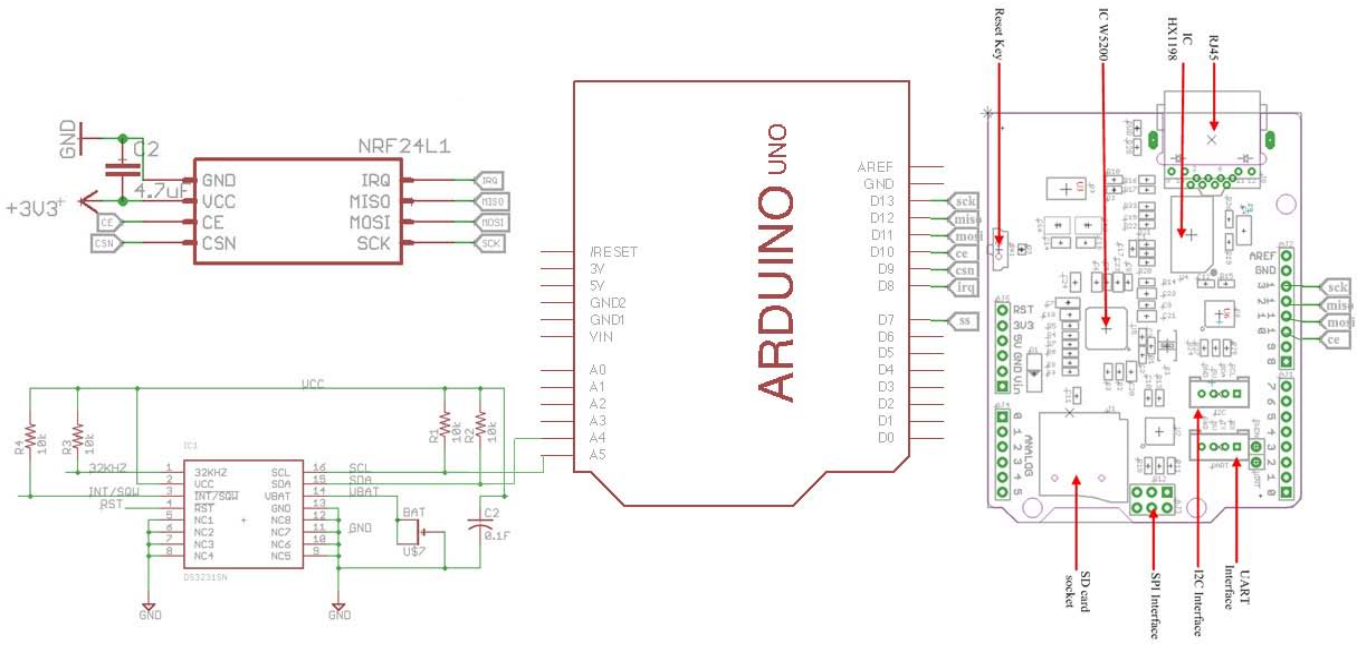

Fig. 2: Circuit Diagram of Base Node

The heart of the system is Arduino uno board. Arduino uno board consists of a Atmega 328 micro-controller. Atmega328 is a 8bit micro-controller runs at 16Mhz clock speed. Arduino uno has only one SPI, one I2C & several GPIO. The Serial Peripheral Interface (SPI) bus is a synchronous serial communication interface specification used for short distance communication, primarily in embedded systems [4]. SPI communication is essential because both NRF wireless transmitter & Ethernet module uses it. So the MISO, MOSI, SCK pins are common for both the module but the slave select is different. To select NRF slave select pin is CE which is connected to digital pin 10 of Arduino. And to select Ethernet module as slave by digital pin 7. Both the serial clock is same. NRF uses IRQ pin for interrupt but it is not used in this scenario as base module does not require any power save option. Another important note NRF devices require 3.3v to operate [5]. Arduino board has a 3.3v voltage regulator onboard which is capable to power NRF. Ethernet module is also powered through Arduino board. RTC module communicates with micro-controller through I2C communication protocol. I²C (Inter-Integrated Circuit), is a multi-master, multi-slave, single-ended, serial computer bus [6]. SCL pin of rtc module is connected with SCL or Analog 5 no pin of Arduino uno and SDA pin of RTC module is connected with SDA/ Analog 4 pin of uno. RTC module is powered by 5V through Arduino. But rtc module requires a cr232 battery to keep the original time even it is not powered by uno. This battery can keep time tracking even for one year.

Each Child node consists of Arduino uno and one nrf transceiver. Child node & expander node is identical except the fact that child nodes communicate with base node directly. Other nodes like expander node consists of micro-controller and NRF24L01 transceiver. NRF transceiver works on free 2.4Ghz bandwidth. With this transceiver Arduino uno receives data from child node and transmits it to end node.

End node requires to be small in size and portable. So the micro-controller for end node are Arduino nano. The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 [7]. Arduino nano can run on 3.3v and at end node there is only another device is connected which is NRF which also runs on 3.3v. So there is no 5v requires to run end node which is recommended for a long running portable node. To save power nano runs on sleep mode. Whenever user presses button to call nurse, nano wakes up from sleep and transmits the data to child node. And child node sends the data to base node. Nurse is notified through webserver with real time notification.

IV. Hardware Implementation

This project consists of four types of nodes but in hardware implementation the expansion module is not implemented. Here a small prototype is designed where other three nodes are implemented. First of all, base node.

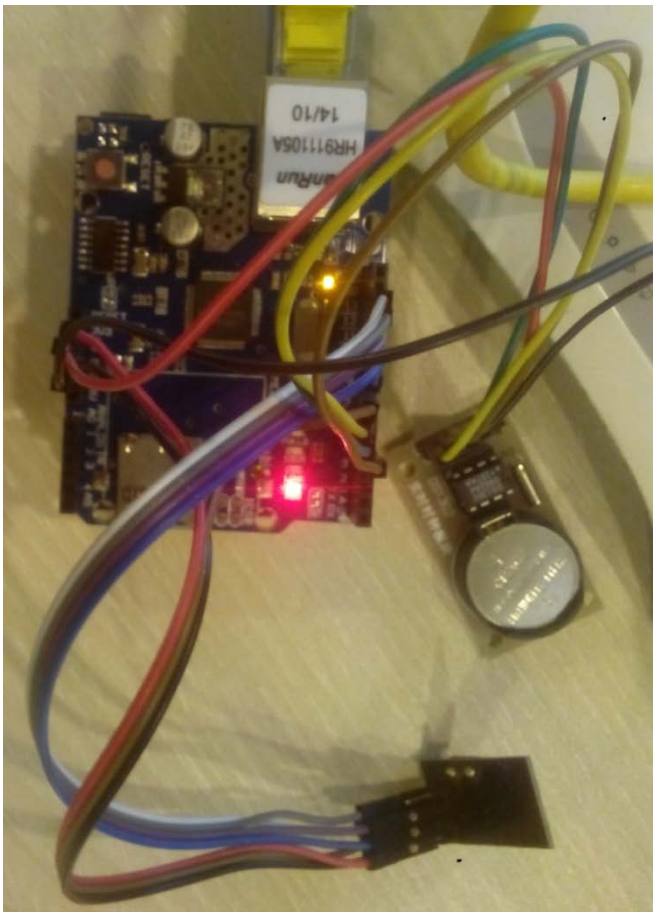

Fig. 3 : Implementation of Base Node

Base node is powered by a +5v adapter. This node will be stationary on nurse call station. Ethernet shield is stackable with Arduino. Arduino is under Ethernet shield. From extra header other unused pins of Arduino can be accessed. Ethernet shield is connected with router through RJ45 cable. And router is capable of generating wifi hot spot. So, any nurse near wifi can access the server through their cell phone.

End node or bed node is powered by a 3.3v battery. Arduino nano has dedicated pins for battery connection as this device is for low power solution. A push button is used to call nurse. As the size of end node is small it can be packaged in a hand held module.

Fig. 4 : Implementation of Child Node

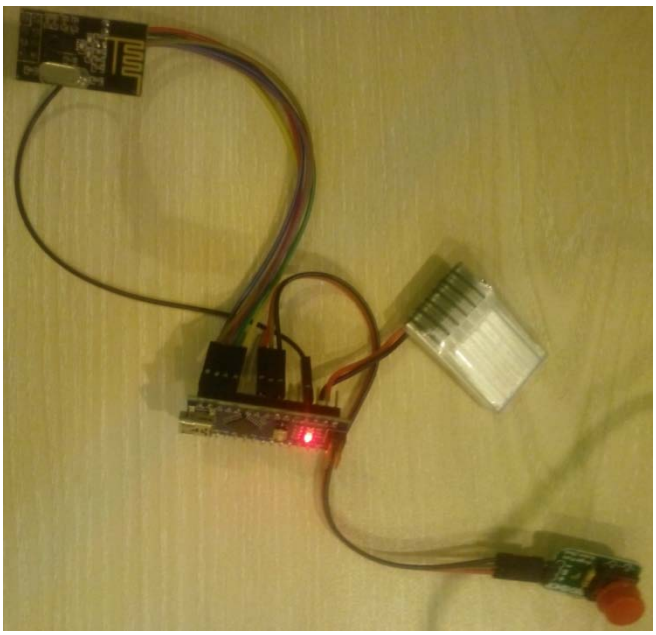

Fig. 5 : Implementation of bed Node

V. Output Analysis

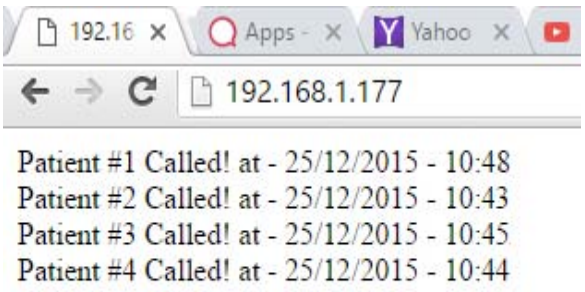

Fig. 5 : Implementation of bed Node

Outputs can be displayed in computer or any cell phone. Router generate a Wi-Fi using SSID of nurse call system. Ethernet shield generate the webserver on 192.168.1.177. It can be any IP which is assigned in micro-controller program. Here all the patients are displayed in list view. Patient number can be their bed number to identify each patient. Whenever a patient generate a call base node receives the signal and also collect the time stamp and upload to server.

VI. Conclusion

Nurse call system is an essential tool for every hospital. High cost nurse call system has far more facilities than this system. This system is designed considering the minimum requirement so that every hospital can afford a nurse call system. There are lots of improvement can be done in this system like nurse presence button. Adding blue code alert etc. This system is not suitable for any critical patient. For critical patient the system needs to be wired because it is possible to lose the wireless link. Although nrf auto reconnects if the wireless connection is lost. Additional circuitry can be added to implement an alert if any node is not found or lost. But all these features come with extra cost. This system fulfills the basic requirement for a general patient.

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Energy Efficient Cluster based Multipath Routing in Wireless Sensor Networks

By Shruti Karva & Naveen Choudhary
College of Technology and Engineering, India

Abstract- Wireless sensor network can be defined as a network of densely deployed sensor nodes. These sensor nodes have limited energy and have low processing and storage capabilities. Due to this, we require energy efficient routing protocols so that much of the energy of the nodes is not wasted in routing of data packets.

In this paper, we present and energy efficient routing scheme. This routing protocol is a combination of cluster-based routing and multipath routing. We arrange all the sensor nodes in the network in the form of small clusters. Each of these clusters has a cluster head. Nodes which lie within a cluster send its data to its respective cluster head. The transfer of data from nodes to cluster head is through direct communication. All the cluster heads transfer their data to the sink or base station. This transfer of data is through multipath routing.

Keywords: wireless sensor networks; cluster based routing; multipath routing; energy efficient.

GJCST-E Classification : C.2.1 C.2.3

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I. Introduction

The recent technological advances in wireless communication, electro-mechanical systems and digital electronics have led to the development of small, low power and low cost sensor nodes which communicate within short range of distances. Sensor nodes are active nodes which perform the sensing task to sense their environment. These nodes then communicate the sensed data among each other or directly to the sink or base station. A sensor network is described as a large network of such sensor nodes which are densely deployed either inside a phenomenon or very close to it[1]. Wireless sensor networks differ from other wireless networks in numerous ways. Sensor nodes within a sensor network are highly constrained in terms of energy, processing and storage capabilities. The data flow in sensor networks is from various sensor nodes to a single base station called sink. Since, there is large number of sensor nodes; the data collected might be redundant. Due to this, the traditional routing protocols cannot be used for wireless sensor networks[2].

The routing techniques in wireless sensor networks can be classified on the basis of network structure and protocol operation. On the basis of network structure, we have flat, hierarchical and location based routing. Routing on the basis of protocol operation can be classified as multipath, query based, QOS based, negotiation based and coherent based. In order to develop an energy efficient routing algorithm, we combine the advantages of multipath routing and hierarchical cluster based routing.

Wireless sensor network consists of large number of sensor nodes. Applications that require scalability and efficient data aggregation can make use of clustering. In clustering, the whole sensor network is divided into small clusters where each cluster is headed by a cluster head. The major role in sensor node clustering is to select a set of cluster heads among the nodes in the network, and group the rest of the nodes with these heads.

Multipath routing protocol makes use of multiple paths for routing the data rather than using a single path. This helps in load sharing and load balancing. By using multipath routing, we can increase the reliability of the network but at the same time the overhead of maintaining alternate paths is increased.

II. Related Work

Yahya and Ben-Othman [3] proposed a multipath routing protocol called REER (Robust and Energy Efficient Routing). This energy efficient multipath routing protocol makes use of residual energy, buffer space and signal to noise ratio to find out the next hop. In this way, the best preferred path and alternate path is calculated. In the first version(REER- I) Data is transmitted over a single path until the path cost falls below some threshold.

Younis and Fahmy[4] gave a model in which each sensor node can act either as a source or a server (cluster head).The major challenge is to find appropriate servers to satisfy the system goals. In this paper, the selection of cluster head from all the nodes is done probabilistically based on the residual energy of the nodes. The remaining nodes join the clusters such that the communication cost is minimized.

LEACH (Low Energy Adaptive Clustering Hierarchy) [2] [7] was the first sub-cluster-style routing protocols in WSN. LEACH is an energy efficient algorithm because it uses data compression techniques and sub-cluster dynamic routing technology. In this, the cluster heads are chosen randomly and therefore the network

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load is balanced and also rapid death of cluster heads is prevented.

Khedoand Subramanian [5] proposed the MiSense hierarchical cluster based routing algorithm (MiCRA) to extend the lifetime of sensor networks and to maintain a balanced energy consumption of nodes. MiCRA is an extension of the HEED algorithm with two levels of cluster heads. In this, cluster heads are selected randomly based on their residual energy and nodes join clusters such that communication cost is minimized.

Multihop-LEACH [8] is a cluster based routing algorithm in which self-elected cluster heads collect data from all the sensor nodes in their cluster, aggregate the collected data by data fusion methods and transmit the data through an optimal path between the cluster head (CH) and the base station (BS) through other intermediate CHs and use these CHs as a relay station to transmit data through them.

W. Lou [6] proposed an N-to-1 multipath routing protocol that finds different node-disjoint paths between a sink and a source node. Nodes are arranged in a spanning tree structure with the sink as the root. The protocol finds multipaths by traversing the tree. Multipaths are used to distribute the traffic in order to improve the reliability and security of the data transmission.

III. Proposed Method for Energy Efficient Routing in Wireless Sensor Networks

Our proposed routing algorithm is a combination of both cluster based routing and multipath routing. We combine the advantages of hierarchical cluster based routing and multipath routing in order to get a reliable, energy efficient routing algorithm. We modify LEACH (Low Energy Adaptive Clustering Hierarchy) routing protocol by introducing multiple hops for inter cluster communication. The routing protocol used for this inter cluster communication is based on REER (Robust and Energy Efficient Multipath Routing), an energy efficient multipath routing protocol.

In this paper, we first explain LEACH and REER routing protocols and then give our proposed method of energy efficient routing in wireless sensor networks.

a) LEACH (Low Energy Adaptive Clustering Hierarchy)

LEACH[7] is one of the first hierarchical routing protocols for wireless sensor networks. The major aim of this protocol is to increase the lifetime of the network. In this protocol, the whole network is divided into small clusters and each of these clusters has a cluster head. The non cluster- head nodes are known as the member nodes of that cluster. Only the cluster heads can communicate directly with the sink. The member nodes send their data to their respective cluster heads which then send it to the sink.

The cluster head is responsible of performing all the important functions like collecting the data from its member nodes, aggregating the data and sending the aggregated data to the sink. Due to these additional functions, the cluster head dissipates more energy as compared to rest of the nodes. If the same node is used as cluster head, it will drain all its energy and die quickly. Therefore, LEACH introduces randomized rotation of cluster heads to save the battery of individual node.

The whole of LEACH operation is broken down into a number of rounds. Each of these rounds has 2 phases: setup phase and steady state phase. The setup phase is meant for the organization of clusters and in the steady state phase, data transfer to the base station takes place.

The working of setup phase is briefly described as below.

Each node in the network generates a random number between 0 and 1. The value of generated random number is compared to a threshold value T(n). If the number is less than T(n), that node is selected as cluster head. The value of threshold T(n) is calculated as follows:

$$T(n) = \begin{cases} \dfrac{P}{1 - P * (r \bmod \frac{1}{P})} & if\ n \in G \\ 0 & otherwise \end{cases}$$

Where,

n is the node id in the current wireless sensor network, p is the predefined percentage of cluster heads, r is the current round number and G is the set of nodes which have not been selected as cluster heads since the last 1/P rounds.

By using this function, there is a randomized rotation of cluster heads and so the same node does not continually drain its energy.

After the cluster heads have been determined, all the cluster heads send a broadcast message in the network to announce themselves. Each normal node decides on which cluster to join on the basis of the received signal strength. It then sends a request message to the corresponding cluster head. After receiving the request messages from the nodes, the cluster head confirms them as members of that particular cluster, adds them in the routing table and allocates TDMA table of slots for the cluster members telling each member when it can transmit data.

After the selection of cluster heads and clustering of member nodes, the steady state phase starts. In this phase, transfer of data takes place. All the member nodes send their data to their respective cluster heads by single hop communication during the allocated slot according to the TDMA table. After receiving the data from each member node, the cluster head fuses it into a single signal and transmits it to the base station. After the completion of data transfer, the entire network comes into the next round.

b) REER(Robust and Energy Efficient Multipath Routing)

Bashir Yahya and Jalel Ben-Othman [3] have proposed a robust and energy efficient multipath routing protocol (REER).REER calculates multiple paths for communication between source and destination. These paths are calculated on the basis of residual energy, buffer space and interference (signal to noise ratio).After the discovery of multiple paths, the data is transferred through the best preferred path. When the cost of the best preferred path falls below some threshold, next alternative path is used.

A function called link cost function is used to calculate the next hop in the path discovery phase. The link cost function depends on the residual energy of the node, available buffer space and signal to noise ratio. Let $N_x$be the set of neighbors of the node x. We can get the next hop by the given formula

$$\text{Next hop} = \max_{y \in Nx}\{ \alpha E_{resd,y} + \beta B_{buffer,y} + \gamma I_{interference,xy}\}$$

Where, $E_{resd,\ y}$ is the current residual energy of node y, where $y \in N_x$, $B_{buffer,\ y}$ is the available buffer size of node y, and$I_{interference,\ xy}$is the SNR for the link between nodes x and y.

The total cost of the path is calculated from the individual link costs. The total cost C_{total} for the path P which consists of a set of K nodes can be given as the the sum of the individual link costs $l_{(xy)i,\ i \in K}$ along the path. This means:

$$C_{total\ ,P} = \sum_{i=1}^{K-1} l_{(xy)_i}$$

The whole operation of REER is explained as follow. The first phase is the initialization phase in which each sensor node broadcasts a HELLO message. The purpose of this HELLO message is to get information about the neighbors. During this phase, each sensor node maintains and updates its neighboring table. After this, every sensor node has all the information about its neighboring nodes. With this information, they calculate the link cost using the link cost function. Now, the sink begins to calculate its preferred next hop and sends a route request message to the most preferred next hop. The same procedure continues from hop to hop until the source node is reached. The sink sends an alternate path route request to its next most preferred path for finding the alternate path.

The multiple alternate paths are kept alive by flooding KEEPALIVE messages through those paths. The flooding of these messages is done by the source node periodically.

After the paths and multipaths have been discovered, transfer of data takes place. Upon receiving a query packet, the source nodes begin collecting all the relevant data and send it to the sink via the best preferred path. Each node consults its neighboring table and finds out the ID of the next hop, and then forwards the data to its next hop. This process continues until the data reaches the sink node. Transmission of data continues over the primary path until a certain threshold is reached, then the next best alternative path is being used, and so on.

c) Proposed method

After the brief overview of the LEACH and REER routing protocols, we give our proposed method of energy efficient routing. LEACH is a very efficient clustering protocol with randomized rotation of cluster heads. But since the communication from cluster head to sink is single hop, it is a very high energy transmission. Energy consumption of the inter-cluster is much more than the intra-cluster. Therefore, it is obviously important how to set the reasonable inter-cluster communication mechanism to decrease cluster heads' energy consumption [9].This can be rectified by introducing multiple hops for cluster head to sink communication since the smaller the distance to transmit the lower the consumption is [10]. This means, that each cluster head will send its data to the sink by sending it to the intermediate cluster heads. Now, since the cluster head to sink communication is multihop, we need some routing scheme. We introduce a routing similar to REER for this multihop communication between cluster head and sink.

The whole algorithm is divided into a number of phases. These phases are described as follows:

Cluster Formation phase: In this phase, clustering of the network takes place. Clustering is usually used to speed up route discovery by structuring the overall network nodes hierarchically [11]. The procedure for the selection of cluster heads and cluster formation is similar to that of LEACH. Each sensor node in the network generates a random number to decide whether it will become a cluster head or not. The random number generated by the node is compared to the threshold T(n) and if the value is less than T(n), it is selected as the cluster head. This threshold value is calculated on the basis of percentage of cluster heads to be elected and the number of times the node has been elected as a cluster head.

$$T(n) = \begin{cases} \dfrac{P}{1 - P * (r \bmod \frac{1}{P})} & if\ n \in G \\ 0 & otherwise \end{cases}$$

In this way, each node gets a chance to be the cluster head. After the selection process, each node that has been elected as cluster head broadcast an advertisement message. When the nodes receive the advertisement message, they decide on which cluster to join on the basis of received signal strength from the cluster head. These nodes inform the cluster head that they will join the cluster by sending a message to that cluster head.

Multipath inter cluster communication: In the LEACH protocol, the cluster heads send their data directly to the sink irrespective of the energy being utilized for this transmission. In order to minimize this energy usage, we introduce multiple hops between cluster head and sink. The cluster heads send their data to the sink via other cluster heads. Now, a HELLO message is broadcasted by the cluster heads to other cluster heads and the sink. In this way, all the cluster heads have all the necessary information about the other cluster heads in the network. Each head maintains a neighboring table. The base station or the sink will now calculate the preferred next hop using the link cost function as proposed by REER. It sends a RREQ message to the calculated next hop. The preferred next hop again computes its next hop and sends the RREQ message. This continues until the source node is reached. The base station then sends the alternate path RREQ. The primary and alternate paths are node disjoint. Due to this, in case of failure of a path, the alternate path will not be affected.

Route maintenance: Now, for keeping the multiple paths alive, a KEEPALIVE message is flooded through the alternate paths. Through this, all the paths are maintained

Data transferring phase: After the grouping of nodes and discovery of multiple paths, transfer of data takes place. We assume that each node has data to send. The member nodes send their data to their cluster head. This is a single hop communication. Since the nodes within the cluster are within small transmission range with the cluster head, therefore, energy used is low. Also, due to single hop communication, the data delivery ratio is high. Transmission of data from the cluster head to the base station takes place through the discovered multipaths. The data is transferred through the primary path. In case of node failure, i.e. when the data packet cannot be forwarded to the next hop in the current path, the current link is considered to be disconnected. So, an error message is sent to the source node. When the source node receives this error message, it removes the current path from its routing table and selects the next preferred path from its routing table. After this, the transmission process is resumed. The use of alternate paths makes the communication more reliable. Node failure does not affect the reliability of the network.

After a single round is completed, the cluster reconstruction takes place. New cluster heads are elected and again the whole process continues.

IV. Simulation and Results

We simulate and analyze LEACH [7], REER [3] and our proposed method on NS2 [12] simulator. We evaluate the results on the basis of lifetime of the network and average delivery ratio. Our simulation environment consists of a 100m x 100m network consisting of 200 randomly deployed nodes. All the nodes are assumed to have same initial energy. The simulation runs for 100secs.

Table 1: Simulation Parameters

Parameters	Value
No. of nodes	200
Network field	100m x 100m
MAC layer	IEEE802.11
Percentage of cluster heads	20
Initial Energy	10joules
Simulation time	1000 seconds
Base station position	(25,100)

a) Energy Efficiency

We evaluate the energy efficiency with the lifetime of the network. *Fig. 1* shows a graph between the number of dead nodes and the simulation time. The graph clearly shows that the lifetime of proposed algorithm is better than LEACH and REER. This is due to the energy aware clustering used in the proposed algorithm. We use multihop inter cluster communication, thereby avoiding high energy transmission. Also the multipath routing used, considers the residual energy of the nodes while selecting their next hop. Due to this, a single node does not continually drain its energy, thereby increasing the lifetime of the network.

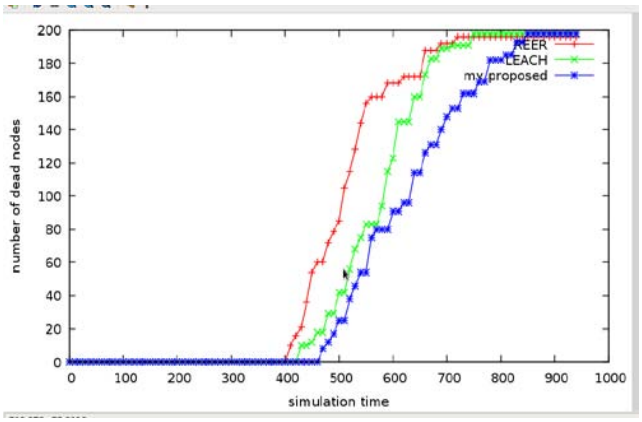

Figure 1: Number of dead nodes

b) Average delivery ratio

It is the ratio of number of packets successfully received to the number of packets sent. *Fig. 2* shows the graph between the average delivery ratio of nodes and time. The average delivery ratio of LEACH is best among all the three routings because LEACH is a single hop routing algorithm. The data does not need to travel via intermediate nodes. The average delivery ratio of REER is the lowest. Our proposed algorithm lies between LEACH and REER since it has fewer hops as compared to REER.

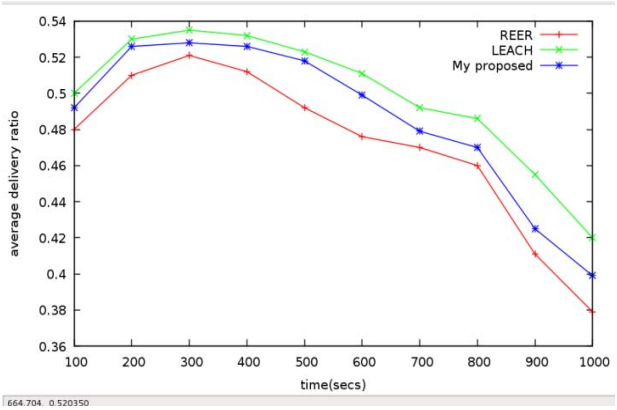

Figure 2 : Average delivery ratio

V. Conclusion and Future Work

We have successfully implemented our proposed routing algorithm. In our protocol, cluster formation is same as in LEACH. Nodes within a cluster transfer data to the cluster head through single hop. For the transfer of data from cluster heads to the base station, we introduce multihop communication. The path used for this multihop data transfer is decided by using the link cost function. The link cost function uses the residual energy, buffer space and signal to noise ratio to determine the next hop.

We find that the proposed routing is more energy efficient as compared to LEACH and REER. This is because the proposed routing uses the benefits of both multipath and cluster based routing. Our algorithm is more reliable and has a higher average delivery ratio than LEACH. This is due to the use of multipaths. In case of failure of a single path, alternate path is used.

As our future work, we will analyze the protocol more deeply by evaluating other performance metrics such as control overhead and average delay. We will also work on sensor networks with mobile nodes.

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Design and Implementation of Internet based Power Monitoring and Controlling System using PIC16F84A Microcontroller for Energy Regulation

By Vinyl Ho Oquino
Adama Scince and Technology University, Ethiopia

Abstract- One of the major causes of high electrical energy consumption is unawareness of usage of electricity. Most people forget of turning-off lights and electrical equipment when not used or even when they are not around. Study shows that 80 per cent of the employee in different offices would forget to turn off lights and other electrical equipment when they are out of the office. The internet based remote control systems are commonly available in most advanced countries. Thus, for developing country like Ethiopia this technology is very much helpful for regulating the energy consumption of every government and private establishment. The main objective of this project is to control and monitor any electrical appliances using internet anywhere. The main components of this project were low cost computer as server and a low cost microcontroller PIC16F84A.

Keywords: microcontroller, power monitor, power control, internet remote control, energy regulation.

GJCST-E Classification : C.2.0

Strictly as per the compliance and regulations of:

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Keywords: microcontroller, power monitor, power control, internet remote control, energy regulation.

I. Introduction

Energy usage depends on the time and power rating of the loads. Monitoring to the different facilities helps the administrator or owner manage the energy consumption of the building. Aside from energy management, the safety, maintenance, and reliability of the facilities are being maintained. [1] Many commercially made power monitoring products are available in the market today. [2] But some of these products are costly and not serviceable. This results to a high maintenance cost by using this product.

This study aimed to design and implement an internet based system that can monitor and control the electrical power using a low cost microcontroller. The system is accessible using the internet and the server computer. The output of study can benefit the commercial establishment buildings, universities and residential establishments that need to monitor and control the electricity of the facilities.

II. Hardware Design

The hardware component of the research project includes the microcontroller module, the low voltage to high voltage interface driver, the computer server, and the modem router for the internet connectivity. The block diagram and the connection to the internet were shown in figure 1.

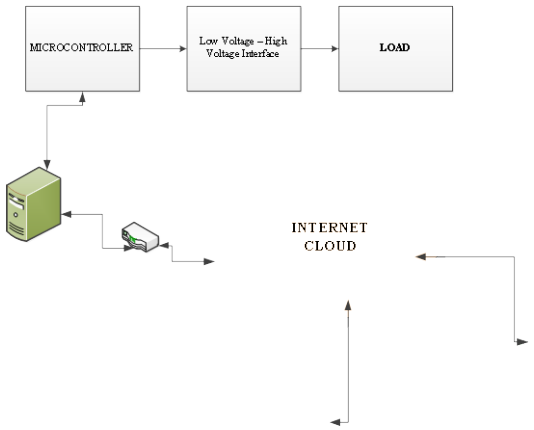

Figure 1: The Hardware Block Diagram

The outputs of the microcontroller were connected to the low voltage - high voltage interface. The low voltage – high voltage interface control the load based on the output of the microcontroller. The microcontroller was also connected to the server computer via a serial communication. The server computer was connected to the modem router in order to access via internet. The database application was installed in the server computer recording all the status of the loads. Any activities by the microcontroller were stored in the database through the server computer.

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a) Microcontroller Circuit Design

The PIC16F84A microcontroller was used to control the load through the low voltage – high voltage interface. The port B of microcontroller was used as output. Figure 2 shows the connection of the microcontroller and the serial port. The 4 MHz crystal oscillator was used in the controller circuit as the clock speed of the microcontroller. A 22 pF ceramic capacitor was also used as filter connected to the oscillator pin of the microcontroller.

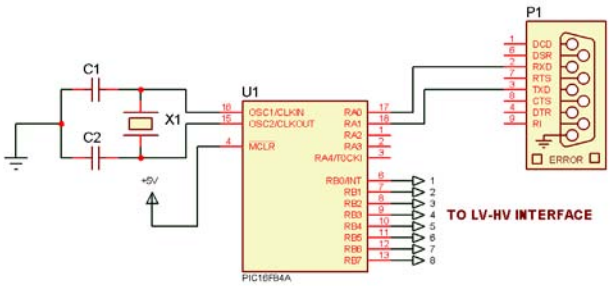

Figure 2 : The Microcontroller and the Serial Port Connection

The port A of microcontroller was used as serial port. This port was used to communicate with the computer server.

b) The Low voltage - High voltage Interface

The output of the microcontroller was only 5V DC. The loads operate at 240V AC. The low voltage – high voltage interface was used to connect the microcontroller to the loads. The interface connection was shown in figure 3.

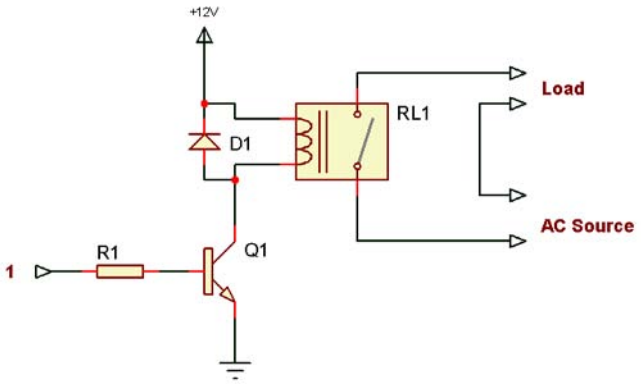

Figure 3 : The Low voltage – High Voltage Circuit

A 12V DC relay was used in the circuit. The transistor Q1 was used as driver to the relay. Diode D1 was used as protection of the transistor during the switching off of transistor. The value of transistor depends on the coil current of the relay. A 9013 general purpose NPN transistor was used in the circuit. The relay coil resistance was 120 ohms.

$$\text{Relay Coil Current} = \frac{\text{Coil Operating Voltage}}{\text{Coil Resista nce}}$$

Thus, the coil current operating at 12V DC was 100 mA. The coil current was the current flowing to the collector of the transistor. The resistor value in the base of transistor

$$R = \frac{4.3\ v}{\text{Base Current}}$$

$$\text{And base current} = \frac{\text{Collector Current}}{\text{Transistor Gain}}$$

Thus, the value of resistor was 4.3 ohms.

c) The Power Supply

The microcontroller operates at 5V DC supply. The relay operates at 12V DC. The power supply circuit for the study was shown in figure 4. The power supply uses a full wave rectifier circuit to convert the ac voltages to dc voltages. The 2200uF capacitor was used in the circuit as filter capacitor to minimize the ripple. A LM7805 regulator was used to provide a 5V output voltage for microcontroller.

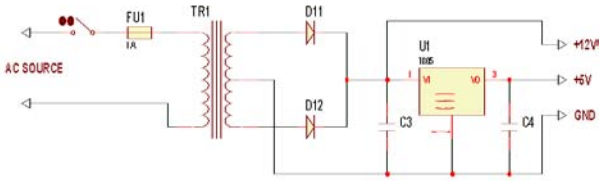

Figure 4 : The 12 and 5 Volts DC Power Supply Circuit

III. Software Developments

Different software was used in the research. Each of this software has its own functionality in communicating the hardware.

a) Embedded Software

The microcontroller needs embedded program instruction in order to give an output based on the requirement. Figure 5 shows the flow chart diagram of the embedded program. The program was written using mikro C compiler and compile directly to hex file.

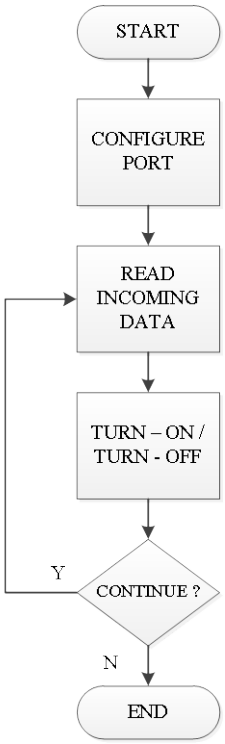

Figure 5 : Flow Chart Diagram of Embedded Program

The PIC16F84A microcontroller doesn't have built-in serial port module. The software UART library was used to configure PORTA to communicate serially. [3] After configuring the different port used in the system, the microcontroller starts reading the incoming data via serial port. The data sent to serial port was used either to turn-on or turn-off the load. Then after the execution of turning-on or off, the program decide either to continue or end the program. This program continues as long as the microcontroller receives power.

b) Controller Software

The controller software was written in visual basic. It was used to send and receive data to microcontroller. Figure 6 shows the controller program written in visual basic.

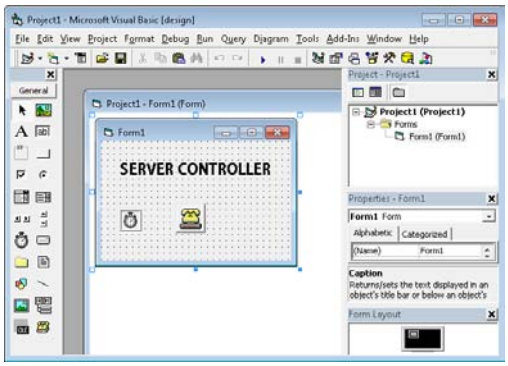

Figure 6 : The Controller Program in Visual Basic

The visual basic has communication tool that was used to communicate with the serial port. The timer tool was used in order to continue sending and receiving data with the microcontroller. The visual basic program also communicate the MySQL database for updating the data.

c) Web Application

A web page application was written using HTML and PHP scripting. The MySQL database was also used to store the status of the load. Figure 7 shows the web page application for monitoring the load power status. Using the webpage, the users can turn-on and turn-off the power.

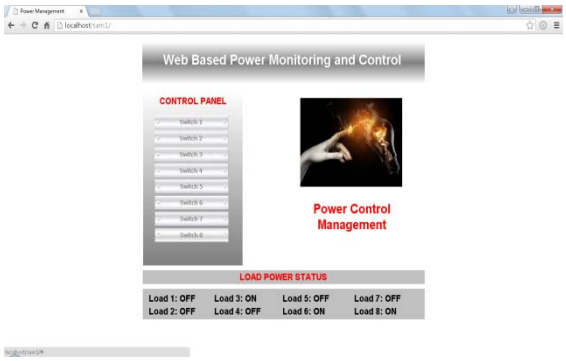

Figure 7 : The Web Application

The PHP scripting language was used to communicate the serial port and store the data into the database. The HTML was used for the display in the web page. Figure 8 shows the control panel of MySQL database. The database was created using the PHP admin cpanel interface.

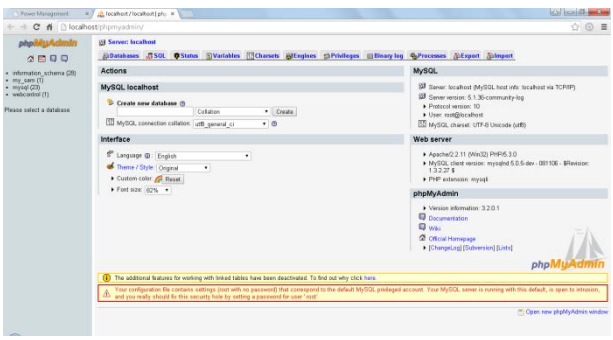

Figure 8 : The C panel of My SQL Database

IV. Network and Server Configurations

The server computer was connected to the router in order to be connected to the internet. The user access the internet to the computer via router connected in the system.

a) Server Computer Configuration

The server computer contains all necessary software application needed for the system. The server computer contains the WAMP web server and the

controller software written in visual basic. The WAMP server application software was installed to host the webpages for the system. The controller software that was written in visual basic was used to communicate the server computer and the microcontroller via USB port.

The microcontroller received data from computer through serial communication.

b) Router Configuration

All hardware connected to internet has its own ID or address. The router was used to select the data path based on the address of the data. In order to connect to the internet a public IP address was issued by the internet provider. [4] All connected to the router can access the internet. If the computer wants to broadcast its data to the internet, the router was configured its port forward. [5] The port forwarding option of the router needs to be enabled. Assign a port number corresponding to the IP address of the computer connected to the router. There were different procedures of configuring router depending on the manufacturer.

V. Implementation Results

The final output of the development of low cost power monitoring and controlling system is discussed in this section.

The microcontroller module development was shown in figure 9. The PIC16F84A microcontroller was used in the module. It was designed to communicate form the load to the computer. The embedded program that was loaded to the microcontroller uses soft UART library. This library was used so that it can be configured by using serial communication. The serial communication was used to communicate with the server computer.

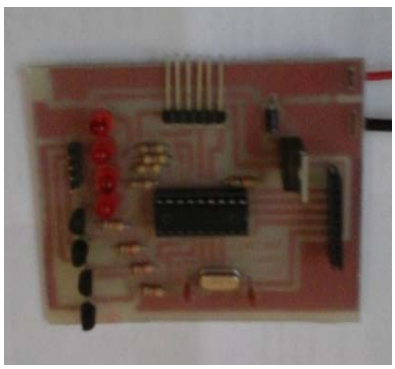

Figure 9 : The Microcontroller Module

Figure 10 shows the driver module that was used to interface the low voltage coming from the microcontroller to the high voltage load, typically a 230 volts AC. The relay was used as an interface to the load. The relay was operating at 12v DC with a 10 ampere contactor.

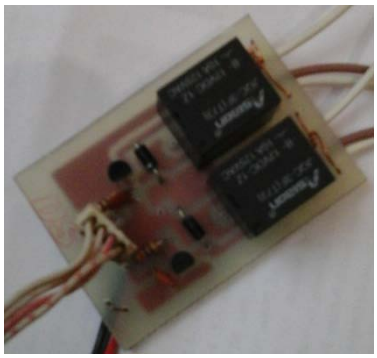

Figure 10 : The Interface Driver with Relay

The USB to RS232 converter was used in order to connect the microcontroller with the computer. Figure 11 shows the USB to RS232 converter cable. This cable was used since the computer uses USB port.

Figure 11 : The USB to RS232 converter Cable

The interface module with the relay was directly connected in the circuit breaker in the panel board as shown in figure 12. The relay contactor was used to control the power from each load connected to the circuit breaker. The circuit breaker was used to protect the system against short circuit and over loading form the load side.

Figure 12 : The Panel Board Breaker and the Interface

The connection of circuit breaker with the interface device, computer and from the main source was shown in figure 13. The main source was directly connected to the contactor of the relay. The relay driver was connected to the microcontroller module output.

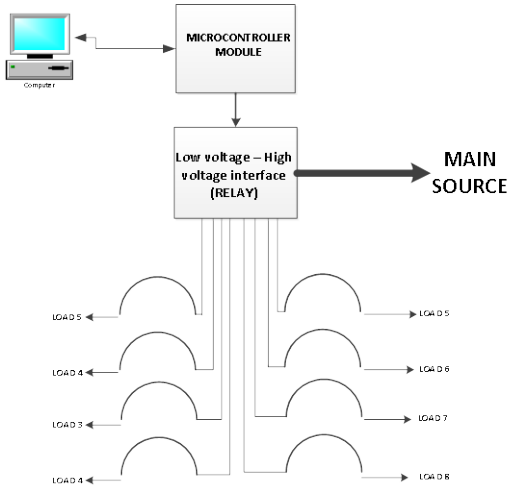

Figure 13 : The Circuit Breaker Connection to Controller

The Internet Based Power Monitoring and Controlling System Using PIC16F84A Microcontroller for Energy Regulation were tested in one of the computer laboratory of Adama Science and Technology University, Ethiopia and in ACLC College, Philippines. And it was a successfully adopted by the administrator. The said project was applicable in any buildings that required power monitoring and controlling for energy regulation. The system were tested 24/7 without

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Global Journals Incorporate (USA) is accredited by Open Association of Research Society (OARS), U.S.A and in turn, awards "FARSC" title to individuals. The 'FARSC' title is accorded to a selected professional after the approval of the Editor-in-Chief/Editorial Board Members/Dean.

- The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

FARSC accrediting is an honor. It authenticates your research activities. After recognition as FARSC, you can add 'FARSC' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, and Visiting Card etc.

The following benefits can be availed by you only for next three years from the date of certification:

FARSC designated members are entitled to avail a 40% discount while publishing their research papers (of a single author) with Global Journals Incorporation (USA), if the same is accepted by Editorial Board/Peer Reviewers. If you are a main author or co-author in case of multiple authors, you will be entitled to avail discount of 10%.

Once FARSC title is accorded, the Fellow is authorized to organize a symposium/seminar/conference on behalf of Global Journal Incorporation (USA).The Fellow can also participate in conference/seminar/symposium organized by another institution as representative of Global Journal. In both the cases, it is mandatory for him to discuss with us and obtain our consent.

You may join as member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. In addition, it is also desirable that you should organize seminar/symposium/conference at least once.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The FARSC can go through standards of OARS. You can also play vital role if you have any suggestions so that proper amendment can take place to improve the same for the benefit of entire research community.

As FARSC, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders, Auto-Responders, Email Delivery Route tracing, etc.

The FARSC will be eligible for a free application of standardization of their researches. Standardization of research will be subject to acceptability within stipulated norms as the next step after publishing in a journal. We shall depute a team of specialized research professionals who will render their services for elevating your researches to next higher level, which is worldwide open standardization.

The FARSC member can apply for grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A. Once you are designated as FARSC, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria. After certification of all your credentials by OARS, they will be published on your Fellow Profile link on website https://associationofresearch.org which will be helpful to upgrade the dignity.

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The FARSC member also entitled to get the benefits of free research podcasting of their research documents through video clips. We can also streamline your conference videos and display your slides/ online slides and online research video clips at reasonable charges, on request.

The FARSC is eligible to earn from sales proceeds of his/her researches/reference/review Books or literature, while publishing with Global Journals. The FARSC can decide whether he/she would like to publish his/her research in a closed manner. In this case, whenever readers purchase that individual research paper for reading, maximum 60% of its profit earned as royalty by Global Journals, will be credited to his/her bank account. The entire entitled amount will be credited to his/her bank account exceeding limit of minimum fixed balance. There is no minimum time limit for collection. The FARSC member can decide its price and we can help in making the right decision.

The FARSC member is eligible to join as a paid peer reviewer at Global Journals Incorporation (USA) and can get remuneration of 15% of author fees, taken from the author of a respective paper. After reviewing 5 or more papers you can request to transfer the amount to your bank account.

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The ' MARSC ' title is accorded to a selected professional after the approval of the Editor-in-Chief / Editorial Board Members/Dean.
The “MARSC” is a dignified ornament which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., MARSC or William Walldroff, M.S., MARSC.

MARSC accrediting is an honor. It authenticates your research activities. After becoming MARSC, you can add 'MARSC' title with your name as you use this recognition as additional suffix to your status. This will definitely enhance and add more value and repute to your name. You may use it on your professional Counseling Materials such as CV, Resume, Visiting Card and Name Plate etc.

The following benefitscan be availed by you only for next three years from the date of certification.

MARSC designated members are entitled to avail a 25% discount while publishing their research papers (of a single author) in Global Journals Inc., if the same is accepted by our Editorial Board and Peer Reviewers. If you are a main author or co-author of a group of authors, you will get discount of 10%.

As MARSC, you will be given a renowned, secure and free professional email address with 30 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders, Auto-Responders, Email Delivery Route tracing, etc.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The MARSC member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.

Once you are designated as MARSC, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

AUXILIARY MEMBERSHIPS

Institutional Fellow of Open Association of Research Society (USA)-OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

Open Association of Research Society (US)/ Global Journals Incorporation (USA), as described in Corporate Statements, are educational, research publishing and professional membership organizations. Achieving our individual Fellow or Associate status is based mainly on meeting stated educational research requirements.

Disbursement of 40% Royalty earned through Global Journals : Researcher = 50%, Peer Reviewer = 37.50%, Institution = 12.50% E.g. Out of 40%, the 20% benefit should be passed on to researcher, 15 % benefit towards remuneration should be given to a reviewer and remaining 5% is to be retained by the institution.

We shall provide print version of 12 issues of any three journals [as per your requirement] out of our 38 journals worth $ 2376 USD.

Other:

The individual Fellow and Associate designations accredited by Open Association of Research Society (US) credentials signify guarantees following achievements:

- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

- In addition to above, if one is single author, then entitled to 40% discount on publishing research paper and can get 10%discount if one is co-author or main author among group of authors.
- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
- The Fellow can become member of Editorial Board Member after completing 3yrs.
- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

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Process of submission of Research Paper

The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

(II) Choose corresponding Journal.

(III) Click 'Submit Manuscript'. Fill required information and Upload the paper.

(B) If you are using Internet Explorer, then Direct Submission through Homepage is also available.

(C) If these two are not convenient, and then email the paper directly to dean@globaljournals.org.

Offline Submission: Author can send the typed form of paper by Post. However, online submission should be preferred.

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MANUSCRIPT STYLE INSTRUCTION (Must be strictly followed)

Page Size: 8.27" X 11'"

- Left Margin: 0.65
- Right Margin: 0.65
- Top Margin: 0.75
- Bottom Margin: 0.75
- Font type of all text should be Swis 721 Lt BT.
- Paper Title should be of Font Size 24 with one Column section.
- Author Name in Font Size of 11 with one column as of Title.
- Abstract Font size of 9 Bold, "Abstract" word in Italic Bold.
- Main Text: Font size 10 with justified two columns section
- Two Column with Equal Column with of 3.38 and Gaping of .2
- First Character must be three lines Drop capped.
- Paragraph before Spacing of 1 pt and After of 0 pt.
- Line Spacing of 1 pt
- Large Images must be in One Column
- Numbering of First Main Headings (Heading 1) must be in Roman Letters, Capital Letter, and Font Size of 10.
- Numbering of Second Main Headings (Heading 2) must be in Alphabets, Italic, and Font Size of 10.

You can use your own standard format also.
Author Guidelines:

1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

1. GENERAL

Before submitting your research paper, one is advised to go through the details as mentioned in following heads. It will be beneficial, while peer reviewer justify your paper for publication.

Scope

The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

Journals Inc. (US) are being abstracted and indexed (in process) by most of the reputed organizations. Topics of only narrow interest will not be accepted unless they have wider potential or consequences.

2. ETHICAL GUIDELINES

Authors should follow the ethical guidelines as mentioned below for publication of research paper and research activities.

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Authorship: The authors and coauthors should have active contribution to conception design, analysis and interpretation of findings. They should critically review the contents and drafting of the paper. All should approve the final version of the paper before submission

The Global Journals Inc. (US) follows the definition of authorship set up by the Global Academy of Research and Development. According to the Global Academy of R&D authorship, criteria must be based on:

1) Substantial contributions to conception and acquisition of data, analysis and interpretation of the findings.

2) Drafting the paper and revising it critically regarding important academic content.

3) Final approval of the version of the paper to be published.

All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

Acknowledgements: Contributors to the research other than authors credited should be mentioned under acknowledgement. The specifications of the source of funding for the research if appropriate can be included. Suppliers of resources may be mentioned along with address.

Appeal of Decision: The Editorial Board's decision on publication of the paper is final and cannot be appealed elsewhere.

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3. SUBMISSION OF MANUSCRIPTS

Manuscripts should be uploaded via this online submission page. The online submission is most efficient method for submission of papers, as it enables rapid distribution of manuscripts and consequently speeds up the review procedure. It also enables authors to know the status of their own manuscripts by emailing us. Complete instructions for submitting a paper is available below.

Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications.

Research letters: The letters are small and concise comments on previously published matters.

5. STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(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, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

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

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

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

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

Structure

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

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

Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

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

Key Words

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

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

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

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

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

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

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

Acknowledgements: Please make these as concise as possible.

References

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

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

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

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

Tables, Figures and Figure Legends

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

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

Preparation of Electronic Figures for Publication

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

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

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

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

6. AFTER ACCEPTANCE

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

6.1 Proof Corrections

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

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

(Free of charge) from the following website:

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

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

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

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The Global Journals Inc. (US) are enclosed by our publishing's Early View service. Early View articles are complete full-text articles sent in advance of their publication. Early View articles are absolute and final. They have been completely reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after sending them. The nature of Early View articles means that they do not yet have volume, issue or page numbers, so Early View articles cannot be cited in the conventional way.

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6.4 Author Material Archive Policy

Please note that if not specifically requested, publisher will dispose off hardcopy & electronic information submitted, after the two months of publication. If you require the return of any information submitted, please inform the Editorial Board or dean as soon as possible.

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You must strictly follow above Author Guidelines before submitting your paper or else we will not at all be responsible for any corrections in future in any of the way.

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

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Informal Guidelines of Research Paper Writing

Key points to remember:

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

Final Points:

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

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

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

General style:

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

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

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

In every sections of your document

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

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

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

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

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

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

Title Page:

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

Abstract:

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

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

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

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

Approach:

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

Introduction:

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

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

Approach:

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

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

Procedures (Methods and Materials):

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

Materials:

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

Methods:

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

Approach:

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

What to keep away from

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

Results:

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

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

Content

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

What to stay away from

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

Approach

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

Figures and tables

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

Discussion:

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

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

Approach:

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

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

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

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

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

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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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