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Highlights

Intrusion Detection Systems

Models Risks Control & Effect

Effect on Product Quality

Graphical Authentication Scheme

Discovering Thoughts, Inventing Future

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Review of Viruses and Antivirus Patterns

By Muchelule Yusuf Wanjala & Neyole Misiko Jacob

Jomo Kenyatta University

Abstract- Computer viruses are executable code programs that have a unique ability to replicate themselves in computer system and spread rapidly from one computer to another affecting file, documents and programs to alter their normal running. Viruses are represented as patterns of computer instructional codes that exist over time in computer systems. Antiviruses on the other hand are programs specially developed to counter challenges brought about by viruses as they protect the computer systems from virus attacks by heavily relaying on the controls enhanced in their databases. Antiviruses therefore scan the computer using some specific patterns of bytes indicative of known viruses. To stay current, they must be developers of these antiviruses update their databases whenever new viral strains arise. This paper reviews the various virus and antivirus patters and various detection schemes.

Keywords: viruses, antiviruses, patterns.

GJCST-C Classification: D.4.6 K.6.5

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Keywords: viruses, antiviruses, patterns.

I. Introduction

Computer viruses are executable code programs that have a unique ability to replicate themselves in the computer system and spread rapidly from one computer to another affecting file, documents and programs to alter their normal running [1]. Just like the spread of viruses in human population with an analogy that the individual persons being infected being a terminal, a node or an edge. Similarly, computers can be viewed as terminals in a network that can be infected with viruses from one computer node through to another via a network or any connection while sharing resource or infected data.

Alun L. Lloyd, Robert M. [2] deliberated computer virus spread analogy by comparing it to human disease spread where individuals (computers) are viewed as nodes of contact. Spafford [3] deduced that viruses are represented as patterns of computer instructional codes that exist over time in computer systems. The viruses like all functional computer codes, are manifestations of algorithms representing an underlying pattern [3]. He further postulated that the patterns of the viruses were to be viewed as a temporary set of electrical and magnetic field changes in the memory or storage of computer systems.

Antiviruses on the other hand are programs specially developed to counter challenges brought about by viruses, they protect the computer systems from virus attacks by heavily relaying on the controls enhanced in their databases. Kephart et.al [4] stated that antiviruses- generic virus-detection programs monitor computer system for virus-like behavior [4]. Kumar et.al [5] indicated that the antivirus program perform certain actions in protecting the computer systems, they open files, read information in them, open archives to scan them [5].

The antiviruses scan the computer using some specific patterns of bytes indicative of known viruses. To stay current, they must be developers of these antiviruses update their databases whenever new viral strains arise. Computer virus scanners use pattern matching algorithms to scan for many different signatures at the same time the best checking up to 10,000 signatures in 10,000 programs in less than 10 minutes [4].

II. Computer Virus Patterns

Computer virus analysis has some common patterns that lend efficiency to the analysis process. In order to stay far from the anti-virus scanners, computer viruses gradually through patters improve their codes to make them invisible. Simply put, computer virus patterns also referred to as virus signatures for those known by antiviruses are means through which viruses replicate themselves over and over as they infect computer systems. Virus signature is the representative byte-pattern part of virus family, which when a virus scanner recognizes it in a file, it notifies the user that the file is infected [6].

According to computer Hope [7], a virus signature is the fingerprint of a virus. It is a set of unique data, or bits of code, that allow it to be identified variety of viruses may have the same virus signature allowing anti-virus programs to detect multiple viruses when looking for a single virus signature. Because of this sharing of the same virus signature between multiple viruses, anti-virus programs can sometimes detect a virus that is not even known yet. Typically new viruses have a virus signature that is not used by other viruses, but new "strains" of known virus sometimes use the same virus signature as earlier strains.

Computer virus authors and antivirus vendors have constantly fought in an evasion of detection game through creation of new virus signatures. Computer malwares have become more and more sophisticated, using advanced code obfuscation techniques to resist antivirus detection. Polymorphic and metamorphic computer viruses are currently the hardest kinds of viruses to detect. Both types of viruses are able to mutate into an infinite number of functionally equivalent

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copies of themselves [8]. This sophistication comes with the creation of new virus patters that are not easily detectable by the antiviruses available in the market today.

Heuristic detection is a scanning mechanism that anti-virus software employs in detecting for virus signatures. The heuristic detection methods encompass more than 250,000 new virus signatures and are most effective for locating new virus signatures. When there are new signatures created each time a new virus comes out these then should be detect during the virus scans since it is necessary to create the new signatures as the new viruses cannot otherwise be detected[9].

Metamorphic type of viruses modify their code to produce an equivalent one during their propagation. These viruses attempt to evade detection through static analysis by implementing code obfuscation techniques. A technique implemented by swapping interchangeable instructions, inserting garbage instructions and introducing conditional jumps to produce the child virus. Here the signature of a virus is broken by changing the order of instructions without altering the control flow. A sophisticated type of this virus will generate code based on the host's operating system by translating the instructions to the corresponding machine code[10].The detection of these viruses using their signature is challenging since the signature is broken in each version of the virus. In order to detect such metamorphic viruses, the detection system should be designed to extract the essential instructions of the virus from virus instance. This extracted instruction set should be used to detect the viruses of that type [11].

III. Anti-Virus Detection Schemes

For antiviruses, a signature is an algorithm or hash that uniquely identifies a specific virus. Depending on the type of scanner being used, it may be a static hash which, in its simplest form, is a calculated numerical value of a snippet of code unique to the virus[12].Javier [13] stated that a virus signature should be understood how a reliable way to detect a host infected by concrete malware. It encapsulates the essence of a virus. Signature detection is complex and challenging but we will keep the focus on the need of gathering a simple signature together with related context information [14].

With the many antiviruses in the market today, various mechanisms have been employed by them to detect and manage viruses for instance with static analysis, a virus is detected by examining the files or records for the occurrences of virus patterns without actually running any code. Static Methods include the following methods [15].

The ant-virus software's usually scans files or your computer's memory for certain patterns that may indicate the presence of malicious software's such as viruses. They therefore look for presence of patterns based on the signatures or definitions of known malware.

The virus pattern available on a client computer depends on the scan method the client is using. According to a publication by IBM on the Trend Micro Pattern Files and Scan Engine (2015).The Virus Pattern contains information that helps Core Protection Module identify the latest virus/malware and mixed threat attacks.

For most antiviruses in the market today, the most common form of detection of viruses is a heuristic-based detection that use algorithms to compare the signature or patterns of known viruses against a potential threat. The heuristic-based detection allows the antiviruses to detect viruses that have not yet been discovered or previous viruses that have been modified or disguised and released as a new virus. This detection method is the best-known method for detecting new viruses but at times it also generate false positive matches meaning an antivirus scanner may report a file as being infected that is not infected. Further still, computer hope publication indicates that every antivirus scanner has a virus definition file, database, or dictionary that contains thousands of known virus signatures. These signatures allow an antivirus program to identify past viruses that have been analyzed by security professionals. For this another virus detection method includes the signature-based detection approach. This is an excellent way to prevent past known viruses and is best method of detection without creating a false warning. However, signature-based detection cannot detect new viruses until the definition file is updated with new virus information [7].

Other types of antiviruses employ behavior based detection mechanism to detect viruses. This is a unique string of bits, or the binary pattern, of a virus. The virus signature is like a fingerprint in that it can be used to detect and identify specific viruses. Anti-virus software uses the virus signature to scan for the presence of malicious code. Behavior-based intrusion detection techniques assume that an intrusion can be detected by observing a deviation from normal or expected behavior of the system or the users[16].

IV. Conclusions

Does increased security provide 100% assurance to technology consumers? With the Internet as a major essential communication between billions of people and also a tool for commerce, social interaction, there are increasingly new threats in viruses as new unrecognized signatures are evolving for the antiviruses to detect during the scan. Anti-virus software uses a virus signature to find a virus in a computer file system, allowing to detect, quarantine and remove the virus. In the anti-virus software, the virus signature is referred to as a definition file or DAT file.

Anti-virus software performs frequent virus signature, or definition, updates. These updates are necessary for the software to detect and remove new viruses. New viruses are being created and released almost daily, which forces anti-virus software to need frequent updates.The ability to detect heuristically or generically is significant, given that most scanners now include in excess of 250k signatures and the number of new viruses being discovered continues to increase dramatically year after year[12]. Further Landesman indicates that to maintain the highest level of protection, configure your antivirus software to check for updates as often as it will allow. Keeping the signatures up to date doesn't guarantee a new virus will never slip through, but it does make it far less likely.

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Illustration of IOT with Big Data Analytics

By Palaghat Yaswanth Sai & Pabolu Harika

Narayana Engineering College

Abstract- Internet of Things(IOT) is the way of connecting devices using sensors and monitored by internet. But the data produced by the IOT is growing rapidly because of the large scale development of various applications. As the data is turned and crossed over terabytes and leading to petabytes, there should be a solution to manage the overwhelming increase in data. Big data is the solution for the data problem and it is considered as the future's data dream. As by using big data, we are able to store unlimited amount of data in a secured manner, the demand for Big Data is increasing more. As IOT and Big Data are two trends in the present era, combining those will really create a technical revolution for the future generations. In this paper, we are going to present various scenarios of using big data with IOT.

Keywords: IOT, big data, hadoop, technical revolution, security, distributed file system, sensors, data bases, clusters.

GJCST-C Classification: B.4.1, C.1.3

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Palaghat Yaswanth Sai [α] & Pabolu Harika [σ]

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Keywords: IOT, big data, hadoop, technical revolution, security, distributed file system, sensors, data bases, clusters.

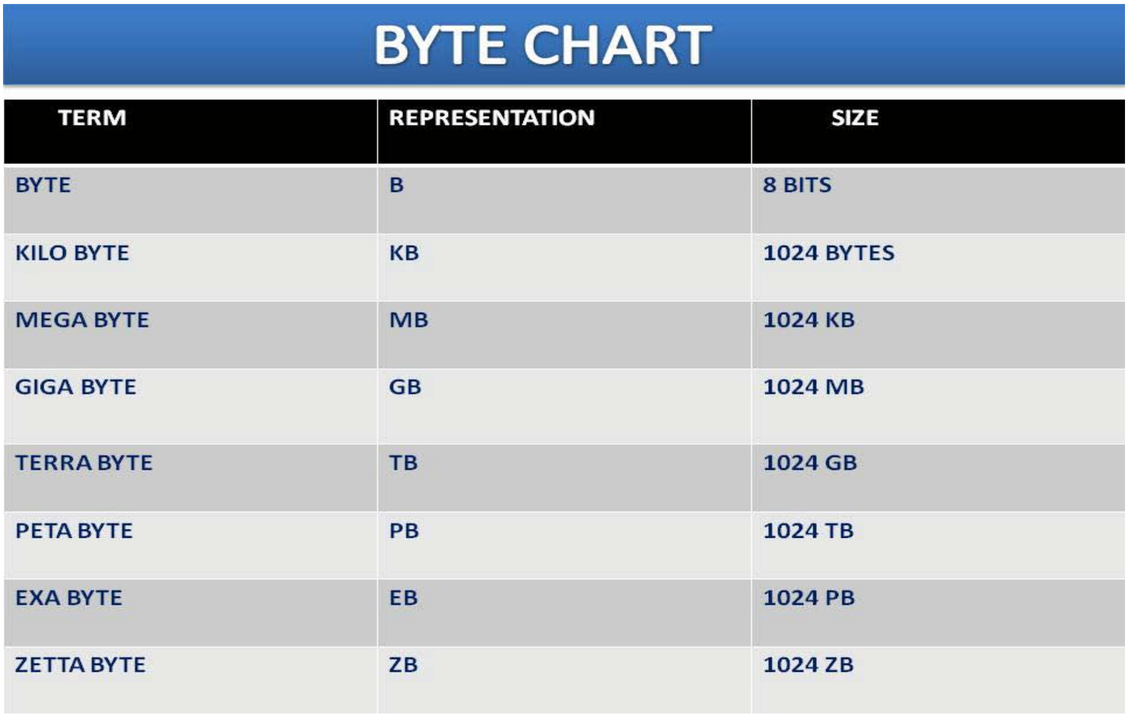
I. Introduction to Big Data

The word big data refers to the large volume of data. Now a days, internet is producing millions of pb of data every single day, but how can the data be managed?

Consider a social networking site Facebook, which has nearly 3.2 billion users is producing 0.8 Quintillion bytes of data every day. As the total data produced in a day by the internet is 2.5 Quintillion bytes. Where can this much of data be stored?

The solution is big data. By the concept of distributed file system big data handles millions of pb of data every minute.

Generally data is measured in bytes, starting with a byte, now there is a need of zetta bytes of data which may leads to the evolution of many new byte forms. As of now we have the following forms of data.



BYTE CHART

TERM	REPRESENTATION	SIZE
BYTE	B	8 BITS
KILO BYTE	KB	1024 BYTES
MEGA BYTE	MB	1024 KB
GIGA BYTE	GB	1024 MB
TERRA BYTE	TB	1024 GB
PETA BYTE	PB	1024 TB
EXA BYTE	EB	1024 PB
ZETTA BYTE	ZB	1024 ZB

Figure 1

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II. Internet of Things

Internet Of Things is springing as the third outbreak in advancing of internet. In present era Internet Of Things is the added essence in development of technology in smart way.IOT is generally documented with sensors and dictators (actuators) to operate things without any physical contact. Imagine a world where everything is interconnected through IOT, where things can automatically get operated and dropped without any human intervention. Think of devices like door lock, tube lights, vehicles like car etc where we can automatically drive those using sensors and remote controls by just including an emerging wave called “INTERNET”. In recent future IOT is expected to have an immense impact on business, education, consumer products, infrastructure, culture, startups etc. In conclusion, Internet Of Things is yet to be implemented if a common man would think. Utmost all the advances needed for it, have already been made, and moreover some corporates and producers have already began implementing it mini-scale version. The vital reason why it is not truly implemented is the effect it will have on security, cultures, ethics and social fields. Moreover even an average person or a corporation may not like to share their ideas as a fear of privacy concern. As a result of these reasons IOT is not being implemented and lagged back for longer than it truly need to be.

III. Literature Survey

Author [1] promotes the concept of smart and connected communities SCC, which is originating from the concept of smart cities.SSC says the relation between present, past and future living of a community using IOT in Bigdata.

Author [2] said that Millions of things are connected through IOT, and these contain enormous of data. The Data processing and transmission is a hard task. This paper mainly aims at role of Big Data in IOT and discuss about protocols and structures.

In [3] Author says about methods to overcome problems related to current technology like accessing the data, installation, usability, scalability. It also says about new query rewriting techniques and temporal and streaming data processing in one platform.

In [7] Author says that cloud services has a solitary nature, and searching such services is a challenging task. Author cloud service Crawler engine collected a massive data about such services based on many links. Based on this data, it provides a better understanding of the current status of cloud servicing provisioning, and it helps the cloud research community.

IV. Block Diagram Showing Functioning of IOT with Big Data

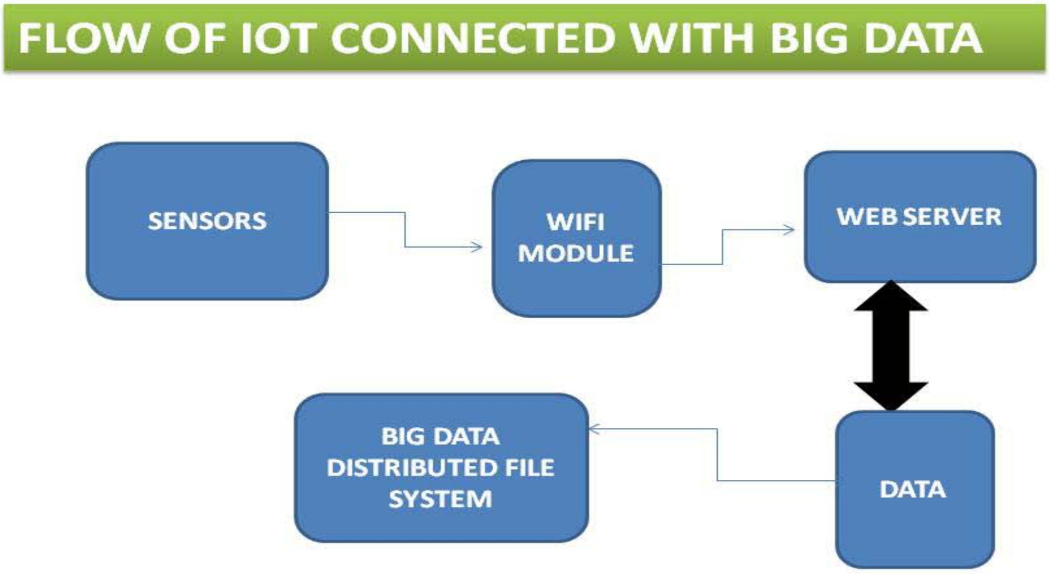
FLOW OF IOT CONNECTED WITH BIG DATA
SENSORS
WIFI MODULE
WEB SERVER
DATA
BIG DATA DISTRIBUTED FILE SYSTEM

Figure 2

The sensors will transmit the data to the web server through the Wi-Fimodule. The data in the web server in general should be handled by the databases in the local server, if once the data size limit crosses beyond the threshold limit, it is difficult to maintain databases. Hence big data is used to store the data.

V. Major Components Used in IOT

a) GSM MODEM

A GSM modem is a specialized type wireless modem that works with a wireless network. It accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be an external deviceor a PC Card / PCMCIA Card. An external GSM modem is connected to a computer through a serial cable or a USB cable, When a GSM modem is connected to a computer, this allows the computer to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS message. GSM Modem sends and receives data through radio waves.

b) ESP8266 Wi-Fi Module

It is the leading IOT devices in the world in which it is very cheap and effective to use. The hardware connections required to connect to the ESP8266 module are fairly straight-forward but there are a couple of important items to note related to power:

- The ESP8266 requires 3.3V power–do not power it with 5 volts!
- The ESP8266 needs to communicate via serial at 3.3V and does not have 5V tolerant inputs. so you need level conversion to communicate with a 5V microcontroller like most Arduinos use.

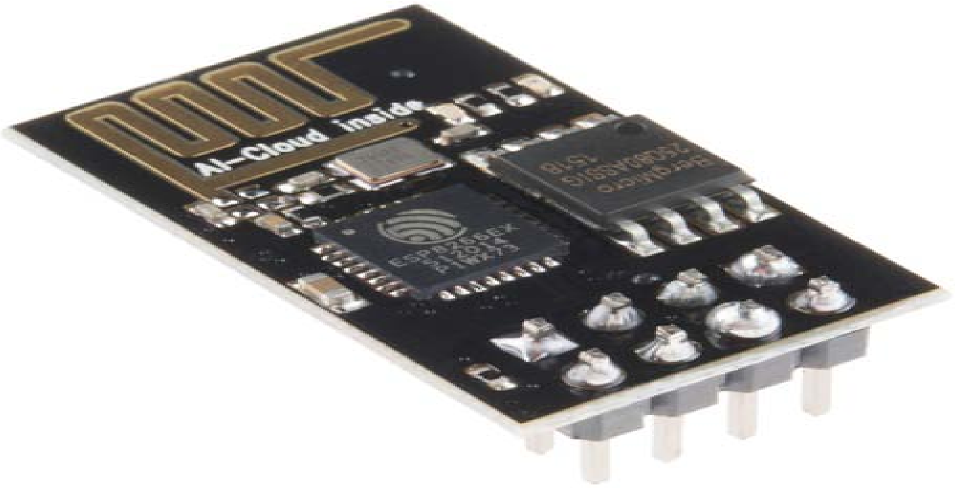

Figure 3

c) Arduino Microcontroller

Arduino microcontroller is a special type of microcontroller designed especially for IOT. It controls and monitors the entire sensor propagation. The code should be written in the Arduino software which is open source to control the sensors.

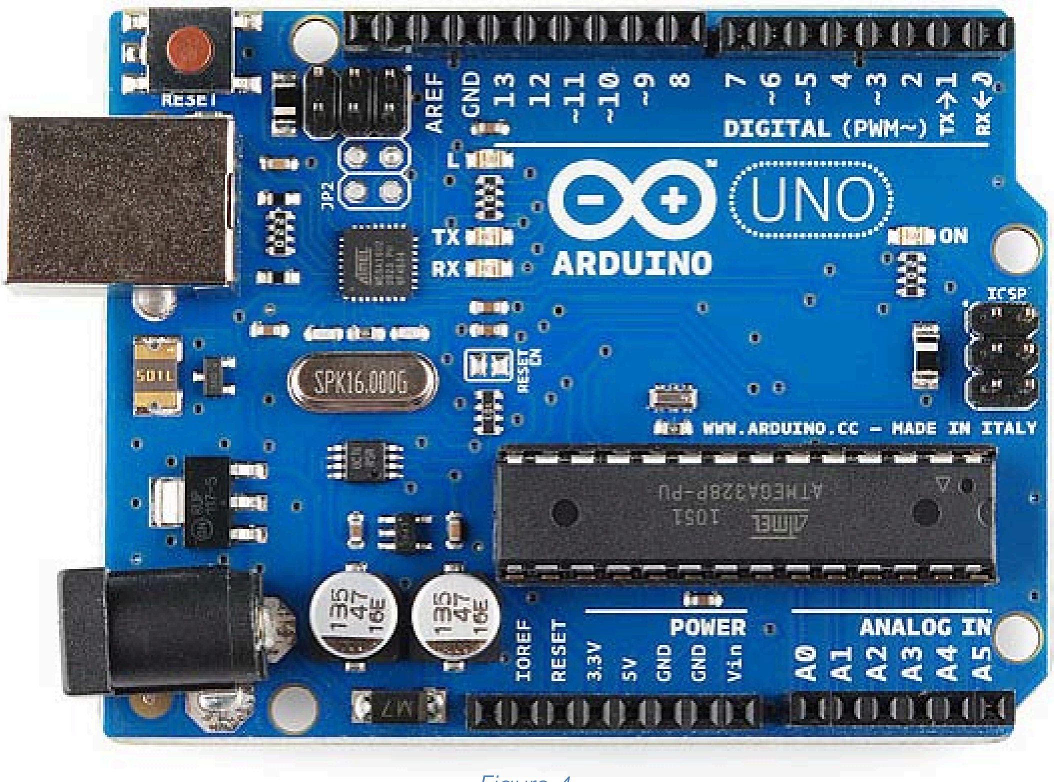

Figure 4

VI. IOT Applications with Big Data

a) *Trash monitoring system*

In this system, the trash levels in every dustbin placed at every street in the city is detected through ultrasonic sensors and data is transmitted through Wi-Fi module to the web server. The continuous monitoring at the web server will reduces the garbage level as the truck driver will be instructed at regular intervals to clean the trash.

The data send to the web server will be huge as the entire city data will be collected at the server end, so big data is used to maintain the regular data storage at time.

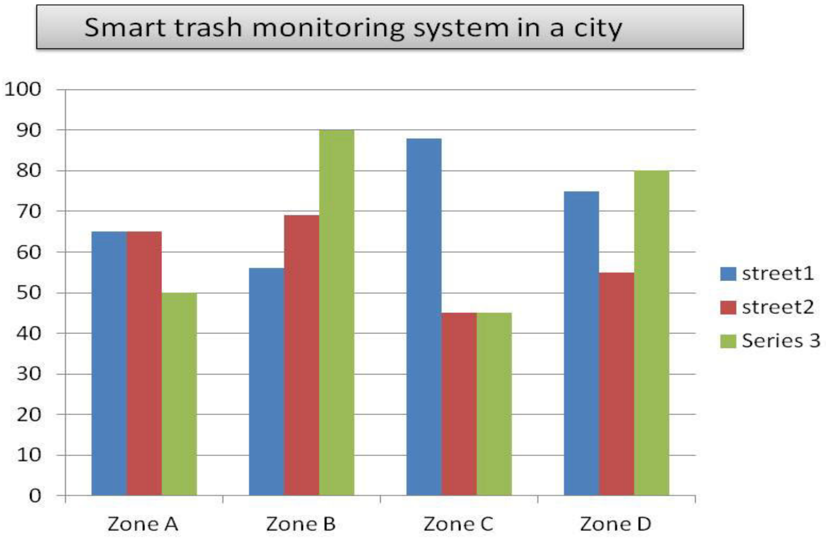

Figure 5

By using the data analytics of this project, we can able to analyze in which zone and street the problem of garbage is more and so that we can reduce the problem immediately.

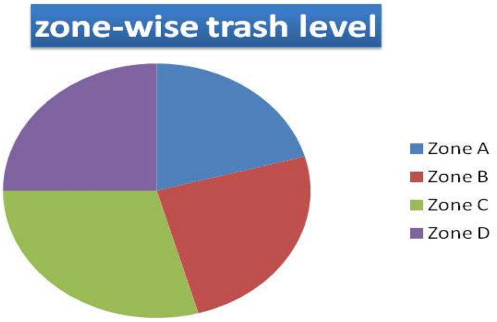

Figure 6

b) Smart water level indicator

In this project, we will find the water level of the particular pond by using the sensors, this can be very much helpful to monitor the needs of the people and water problem in irrigation and industries.

This is very veryful in irrigation and it can be used to control the monitor the water level by sitting in the home.

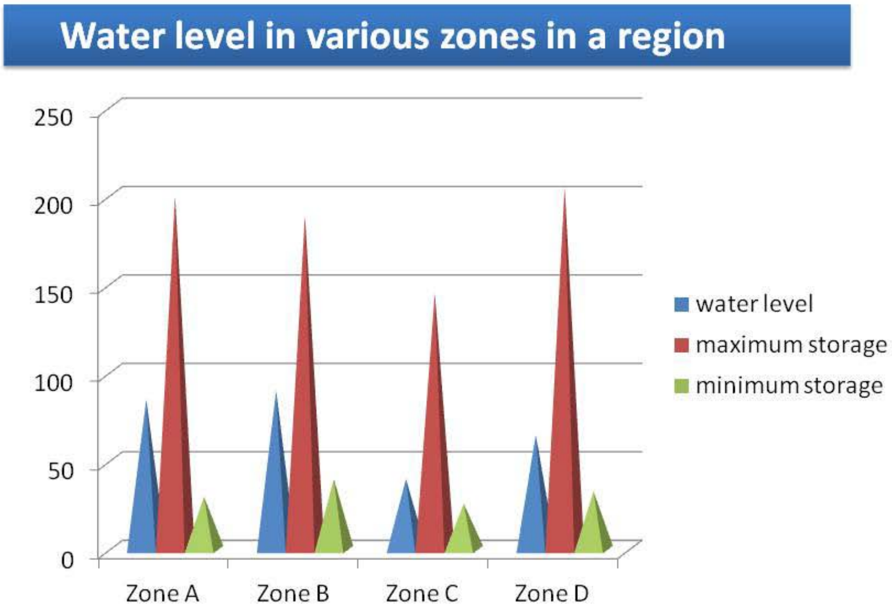

Figure 7

VII. Conclusion

IOT and Big Data are the two hotcakes which everyone is talking about, the relation between these two will gets tightly bonded as the days are passing ,the reason is because of the rapid increase in usage of internet. There is no chance that this will decrease because as the days are passing, the internet users are increasing but not decreasing. The statistics are clearly mentioned that the internet users will be approximately 6 billion by 2025.Then it would be left to our imagination that how much data will be produced in the internet every minute. So there is a need of IOT and big data should be combined to be reliable and be strong from the data obstacles in the future.

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A Review of Intrusion Detection Systems

By Neyole Misiko Jacob & Muchelule Yusuf Wanjala

Jomo Kenyatta University

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Keywords: IDSs. performance measure and performance measures.

GJCST-C Classification: K.6.3, C.2.1

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I. Introduction

Intrusion Detection is the process of detecting actions that try to compromise the overall integrity and confidentiality of a resource. The goal therefore of intrusion detection is to identify accessors that attempt to intrude and compromise systems security controls. Current IDS examine the entire data features to detect any intrusion and misuse patterns, although some of the features may be redundant and may contribute less to the detection process [1]. Current anomaly based intrusion detection systems and many other technical approaches have been developed and deployed to track novel attacks on systems. 98% detection rates at a high and 1% at a low alarm rate can therefore be achieved by using these techniques [2]. This paper review the various intrusion detection systems by evaluating their performance measures.

II. Classification of IDS

According to V. Jyothsna[3] there are three main types of intrusion detection systems: -signature-based (SBS), anomaly-based (ABS) intrusion detection systems and Network Intrusion Detection System (NIDS). SBS systems such as Snort [3]make use of pattern recognition techniques by maintaining the database of signatures of previously known attacks to compare them with newly analyzed data. An alarm is raised when similarities are established. On the other hand ABS systems such as PAYL [4] build a statistical model to describe the normal network traffic, where any abnormal behavior that deviates from the model are identified. On the contrary anomaly-based systems have the advantage that they can detect zero-day attacks [2].

a) *Signature based Detection*

With the explosion of internet commerce, e-business services on the web, e-banking and other high profile applications, organizations providing this services need to prepare themselves to the best possible protection against unauthorized penetration [5]. Signature detection involves searching network traffic for a series of malicious bytes or packet sequences. The main advantage of this technique is that signatures are very easy to develop and understand if we know what network behavior we are trying to identify. The events generated by signature based IDS can communicate the cause of the alert. As pattern matching can be done more efficiently on modern systems so the amount of power needed to perform this matching is minimal for a rule set. This technique can be easily deceived because they are only based on regular expressions and string matching. These mechanisms only look for strings within packets transmitting over wire. More over signatures work well against only the fixed behavioral pattern, they fail to deal with attacks created by human or a worm with self-modifying behavioral characteristics.

Signature based detection system (also called misuse based), this type of detection is very effective against known attacks, and it depends on the receiving of regular updates of patterns [6]. But signature based detection does not work well when the user uses advanced technologies like NOP generators, payload encoders and encrypted data channels. The efficiency of the signature based systems is greatly decreased, as it has to create a new signature for every variation. As the signatures keep on increasing, the system engine performance decreases. Due to this, many intrusion detection engines are deployed on systems with multi processors and multi Gigabit network cards. IDS developers develop the new signatures before the attacker does, so as to prevent the novel attacks on the system. The difference of speed of creation of the new signatures between the developers and attackers determine the efficiency of the system [2].

b) *Anomaly based Detection*

An anomaly-based intrusion detection system is an intrusion detection system for detecting both network and computer intrusions and misuse by monitoring system activity and classifying it as either normal or anomalous. The classification is based on heuristics or rules, rather than patterns or signatures, and attempts to detect any type of misuse that falls out of normal system operation. This is as opposed to signature-based systems, which can only detect attacks for which a signature has previously been created [7]. The anomaly based detection is based on defining the network behavior. The network behavior is in accordance with the predefined behavior, then it is accepted or else it triggers

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the event in the anomaly detection. The accepted network behavior is prepared or learned by the specifications of the network administrators.

The important phase in defining the network behavior is the IDS engine capability to cut through the various protocols at all levels. The Engine must be able to process the protocols and understand its goal. Though this protocol analysis is computationally expensive, the benefits it generates like increasing the rule set helps in less false positive alarms. The major drawback of anomaly detection is defining its rule set. The efficiency of the system depends on how well it is implemented and tested on all protocols. Rule defining process is also affected by various protocols used by various vendors. Apart from these, custom protocols also make rule defining a difficult job. For detection to occur correctly, the detailed knowledge about the accepted network behavior need to be developed by the administrators. But once the rules are defined and protocol is built then anomaly detection systems works well.

c) *Network Intrusion Detection System*

NIDS are deployed on strategic point in network infrastructure. The NIDS can capture and analyze data to detect known attacks by comparing patterns or signatures of the database or detection of illegal activities by scanning traffic for anomalous activity. NIDS are also referred as "packet-sniffers", because it captures the packets passing through the of communication mediums [6]. The network IDS usually has two logical components: the sensor and the management station. The sensor sits on a network segment, monitoring it for suspicious traffic. The management station receives alarms from the sensor(s) and displays them to an operator.

The sensors are usually dedicated systems that exist only to monitor the network. They have a network interface in promiscuous mode, which means they receive all network traffic not just that destined for their IP address and they capture passing network traffic for analysis. If they detect something that looks unusual, they pass it back to the analysis station. The analysis station can display the alarms or do additional analysis. A fundamental problem for network intrusion detection systems (NIDSs) that passively monitor a network link is the ability of a skilled attacker to evade detection by exploiting ambiguitiesin the traffic stream as seen by the NIDS [8].

III. IDS Performance Evaluation

The majority of published documents claiming to evaluate IDSs are conducted as comparisons, rather than evaluations. Evaluation should be considered to be a determination of the level to which a particular IDS meets specified performance targets [9].The basic task in intrusion detection system is to classify network activities as normal or abnormal while minimizing misclassification [10]. Many problems exist in IDS and need to be addressed, such as the low detection capability against the unknown network attack, high false alarm rate, and insufficient analysis capability. Generally, intrusion detection is targeted as classification problem, to distinguish between the normal activities and the malicious activities [11].

According to the NSS publication "Intrusion Detection Systems Group Test(2001), the evaluation of each IDS consists of two components. The first component is a qualitative analysis of the various features and functions of each product. The comments and analysis of the various features are well considered and unbiased [12]. The group further established that the quantitative component of consisted of four tests of the NIDSs on a controlled laboratory network. These test focused upon specific performance indicators, attack recognition, performance under load, ability to detect evasion techniques and a stateful operation test.

The performance measures used by these evaluation were: a ratio of attack detection to false positive, ability to detect new and stealthy attacks, a comparison of host vs. network based systems to detect different types of attacks, the ability of anomaly detection techniques to detect new attacks, improvements between 1998 and 1999, and the ability of systems to accurately identify attacks. The research also attempted to establish the reason each IDS failed to detect an attack, or generated a false positive. Both the 1998 and 1999 evaluations identified a number of weaknesses with existing IDSs.

A number of these issues have since been resolved, while others are still valid. The testing process used sample of generated network traffic, audit logs, system logs and file system information. This information was then distributed to various evaluators who would provide the appropriate data to the Intrusion Detection Systems. This ensured each system was provided with identical data, whilst allowing proper configuration of each system.

Ranum (2001) extract established that constructing good benchmarks and tests for IDS was difficult and in order to accurately measure IDS complexity one needed to expand considerable efforts in designing tests by ensuring that the tests weren't inherently biased or inaccurate. This was a challenge to the IDS especially as they depend on operation environment. He further concluded that if tests were to be made they were to base on qualitative and comparative measures. In his summary he presented some experiences in benchmarking IDS with a focus on poorly designed tests and their effects. And a technology continue to advance the IDS management systems would become increasingly inefficient [13].

Alessandri [14] proposed the use of a systematic description scheme for regulating the descriptions used to describe IDS functions. This approach should allow for an evaluation of IDSs based upon their descriptions, without necessitating experimentation. The disadvantage of this approach is the requirement of accurate descriptions. Currently such an approach does not exist so implementing it is not possible. This approach does hold a certain promise for the future.

IV. Performance Measurement Criteria

a) Ability to Identify Attacks

The main performance requirement of a NIDS is to detect intrusions. However the definition of an intrusion is currently unclear. In particular, many vendors and researchers appear to consider any attempt to place malicious traffic on the network as an intrusion. In reality a more useful system will log malicious traffic and only inform the operator if the traffic possess a serious threat to the security of the target host. Snort is tending towards this direction with the use an alert classification ranging from 1 to 10. With 1 representing a point of interest only and 10 representing a major threat to security.

b) Known vulnerabilities and attacks

All NIDSs should be capable of detecting known vulnerabilities. However research indicates that many commercial IDS fail to detect recently discovered attacks [15] [12]. On the other hand if a vulnerability or attack is known all systems should be patched, or workarounds applied thus the need for a NIDS to detect these events will be removed. Unfortunately the reality is that many systems are not patched or upgraded as vulnerabilities are discovered. This is clearly indicated by the number of system compromises that occur every day, and the fact that most of the problems on the SANS top twenty list are predominantly old well known problems, with fixes available.

c) Stability Reliability and Security

Any IDS should be able to continue consistently operate in all circumstances. The application and operating system should be capable of running for years without segmentation faults or memory leakage. An important function of a NIDS is to consistently report identical events in the same manner. One disadvantage of a product using signature recognition is the ability of different users to configure different alerts to provide different messages. Thus traffic on one network may trigger a different alert to the same traffic on another system of the same type.

A number of efforts are currently underway to solve this problem. Both securityfocus and CVE provide databases of known vulnerabilities, and exploits targeting them. The system should also be able to withstand attempts to compromise it. If a attacker can identify a NIDS on a network it will could prove to be a valuable asset. It is also possible the attacker will attempt to disable the system using DoS or DDoS techniques. The system should be able to withstand all of these types of attack.

d) Ease or complexity of configuration

Unfortunately the usability of a system is usually inversely proportional to the flexibility and customizability of that system. The desire for flexibility can configurable of the system will be determined by the users of the system, the network in which it will be operating and the level of functionality required from the system. If the system is to be maintained by a network administrator who is also responsible for standard network management he or she is unlikely to have the time available to optimize and configure the system so usability will be a primary consideration. On the other hand if an intrusion analyst if employed specifically to manage intrusion detection a more complex system with greater functionality may be desired.

e) Possible configuration options

The NIDS should be capable of being optimized for the systems on the network. As mentioned earlier there is no point in performing http analysis if a web server is not operating on the network under inspection. The level of traffic on the network will also determine the intensity of analysis performed. A simple system suitable for a single network segment with low traffic will be able to combine the sensor and analysis functions within the single unit. A network with high levels of traffic may need to separate the sensor and analysis functions across different hosts.

f) Scalability

Most organizations grow and expand over time. As they expand so do their supporting infrastructure, include computer networks. Any IDS should be capable of expanding with the network. As new network segments are added new NIDS may also be needed. Will it be possible to consolidate the reports from multiple NIDS into a single user interface? Another important question will be the storage of this information. If a small network is monitored data storage may be possible in flat files. However as the amount of data collected grows it may be necessary to transfer this data storage into a database.

g) Interoperability

Research has proven that the most effective intrusion detection requires correlating information from a range of sources. This includes NIDS, HIDS, system logs, firewall logs and any other information sources available. At the time of writing the Intrusion Detection Working Group (IDWG) had submitted a number of documents defining standards for communication between IDSs. It is expected that these will be released as RFCs in the near future. Once these standards are implemented any IDS using the standard protocols will be able to communicate with and other IDS. This will enable an organization to implement a range of IDS from different vendors and still maintain interoperability.

h) Vendor Support

The level of vendor support required in a implementation will be determined by the skill levels of the staff implementing the system. However as staff turnover rates are common in the IT industry it is worthwhile considering the level of support that is available from the vendor.

i) Signature Updates

Any signature based IDS is dependent upon it signatures to detect intrusions. The abilities of these systems to detect new, or even modified intrusions has been shown to be poor (Allen 2000). In order for these systems to be effective updated signatures must be available as new vulnerabilities and exploits are discovered. Many signature based systems now allow the operator to create their own signatures. This can allow the system to monitor for new alerts as they are discovered without relying on the vendor to supply updates. However monitoring vulnerabilities and writing signatures as they occur is a demanding task.

V. Conclusion

Selecting and implementing a NIDS is a challenging task. There are a number of factors to be considered, and these factors will change from situation to situation. In order to ensure a successful implementation an organization should determine its requirements and then locate a system that meets them.

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Shoulder Surfing Resistant Graphical Authentication Scheme for Web based Applications

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Abstract- Since the design and development of the first graphical authentication pioneered by Blonder in 1996, numerous research has been conducted on this area to be used in different scenarios especially on the Internet. One of the major motivators is the picture superiority which as studies have shown, states that images/pictures provide higher memorability as opposed to Text based authentication. However, graphical authentication is still faced with some challenges. In this paper, a shoulder surfing resistant graphical authentication scheme is proposed to tackle a major issue related to the graphical authentication schemes developed. The proposed scheme provides a high level of resistance to shoulder surfing attacks, mitigating the need to upload pictures and aids in finding chosen objects in the scheme.

Keywords: *authentication, text-based authentication, graphical based authentication, security, shoulder surfing.*

GJCST-C Classification: *D.2.6, H.5.2*

Shoulder Surfing Resistant Graphical Authentication Scheme for Web based Applications

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Abstract- Since the design and development of the first graphical authentication pioneered by Blonder in 1996, numerous research has been conducted on this area to be used in different scenarios especially on the Internet. One of the major motivators is the picture superiority which as studies have shown, states that images/pictures provide higher memorability as opposed to Text based authentication. However, graphical authentication is still faced with some challenges. In this paper, a shoulder surfing resistant graphical authentication scheme is proposed to tackle a major issue related to the graphical authentication schemes developed. The proposed scheme provides a high level of resistance to shoulder surfing attacks, mitigating the need to upload pictures and aids in finding chosen objects in the scheme. However, the schemes has some vulnerabilities which implies that there may not be a perfect graphical authentication scheme; each scheme has its merits and demerits making it a suitable candidate for different environment and/or event depending on its architecture.

Keywords: authentication, text-based authentication, graphical based authentication, security, shoulder surfing.

I. Introduction

Graphical based authentication is a type of knowledge based authentication which uses images/picture to assist users in generating a more robust password (Suo, Zhu & Owen, 2005). Due to its picture superiority which according to Paivio in 1991, pictures are dually encoded and this is an advantage over words. While words are merely encoded verbally, pictures produce both a verbal code and an image code because participants are more likely to hold a label for pictures than to imagine words. Having two types of codes tagged to the pictures allow a greater chance of retrieval during a memory task (Paivio 1991). In addition, classic cognitive science experiment conducted have shown that humans have a strong memory ability for images. The experiment showed a recognition performance exceeding 90%, indicating retention of over 2,000 items, even when up to 3 days elapsed between learning and testing (Standing, Conezio, & Haber, 1970).

The challenge of users generating weak guessable passwords in text based authentication has been one of the major reasons numerous research has been conducted on Graphical based authentication (Prakash, Infant & Shobana, 2010). The concept of Graphical based authentication is creating a level of abstraction whereby users do not actually know the set of password characters generated but a pattern used in generating the passwords. However, over the years, Graphical based authentication schemes have been faced with numerous challenges including vulnerability to shoulder surfing attacks, the size of pictures used and browsing through an array of images/objects without assistance(Biddle, Chiasson & Oorschot, 2011; Wiedenbeck, Waters, Birget, Brodskiy & Memon, 2005). The proposed Graphical authentication schemes reviewed in this paper tackles majorly on the above-mentioned issues.

The rest of the paper is structured as follows: a brief overview of Graphical based authentication and it techniques; examples of the schemes that utilize the techniques of Graphical based authentication, listing their features, pros and cons; the proposed scheme and its architecture; summary and conclusion.

II. Graphical based Authentication

Graphical based password authentication is a type of knowledge based authentication that uses images or pictures in verifying the identity of a user. It is categorized generally into the following: recognition-based, recall-based and cued recall techniques (Suo et al, 2005). Based on the various techniques, the steps for both registration and authentication varies.

a) *Recognition-Based technique*

This involves the recognition and selection of a set (usually a fraction of the main set) of pre-selected objects (usually images) from a portfolio of objects. One scheme that utilize this technique is as follows:

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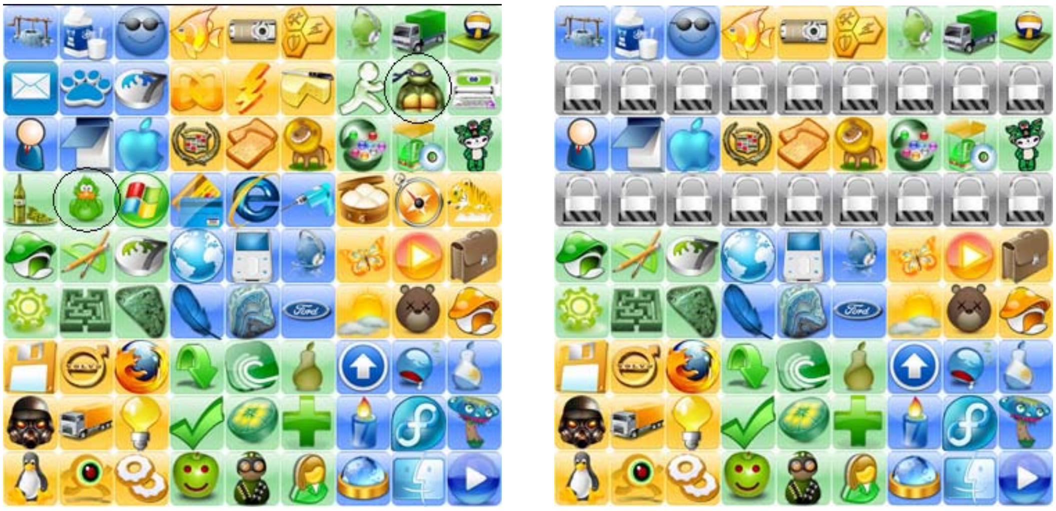
i. *Colorlogin*



Source: Gao, Liu, Wang and Dai(2009)

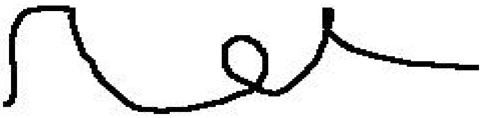
Figure 1.0: Colorlogin

ColorLogin by Gao et al utilizes recognition based technique involving choosing multiple icons as password icons or pass-icons (Shown in Figure 1.0). The background of every icon belongs to one of the finite set of colors given. Registration involves choosing a color which then displays all the set of icons whose background color is the same as the chosen color. Users are required to choose 3 icons from the set of icons displayed. During authentication, icons of different background colors including 2 of the user's icons will be randomly displayed on a grid. Users only need to select the row where the pass icon is located (no need to click on the icon itself but any other icon on the same row with it) and after which all the icons on that row will be substituted with a lock icon. A user is authenticated after getting the pass icon in one attempt else the icons will be shuffled for the user to try again. Using of colors and selecting of row improves the security against shoulder surfers. In this authentication, some icons are frequently chosen as pass icons creating so-called hotspots and also searching through an array of icons can become tiring for the user.

b) *Recall-based or Pure recall technique*

This requires the user to reproduce something that was created during registration; example includes:

i. *Passdoodle*



Source: Varenhorst, Kleek and Rudolph(2004)

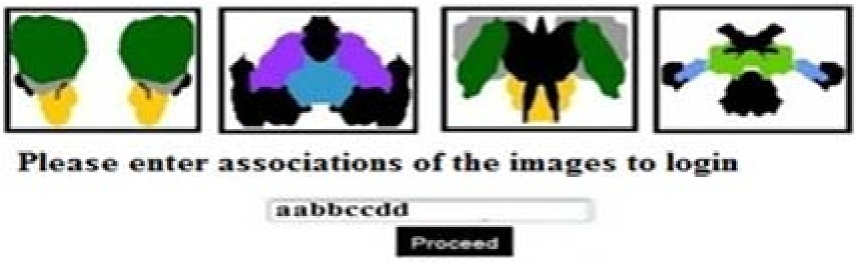
Figure 1.1: Passdoodle

Varenhorst et aldeveloped Pass-doodles in 2004 using recall based technique. It is a hand-written design usually drawn with stylus unto touch sensitive screen. A doodle in this case is an ordered set of points which is drawn (Figure 1.1 is an example of a doodle) and saved during registration. In addition to the doodle drawn, the speed used in drawing the doodle is also calculated and saved. This graphical authentication scheme provides an easy way for users to remember the pass-doodle drawn but it was observed that sometimes the users forget the order in which they were drawn and also it tends to be vulnerable to shoulder surfing.

c) *Cued recall technique*

Cued recall assist the user by providing a cue (a clue or hint) to enable the user recall from memory and reproduce the information that was created during registration. The following ae some examples:

i. *Passbolt*



Please enter associations of the images to login

aabbccdd

Figure 1.2: Passblot login screen

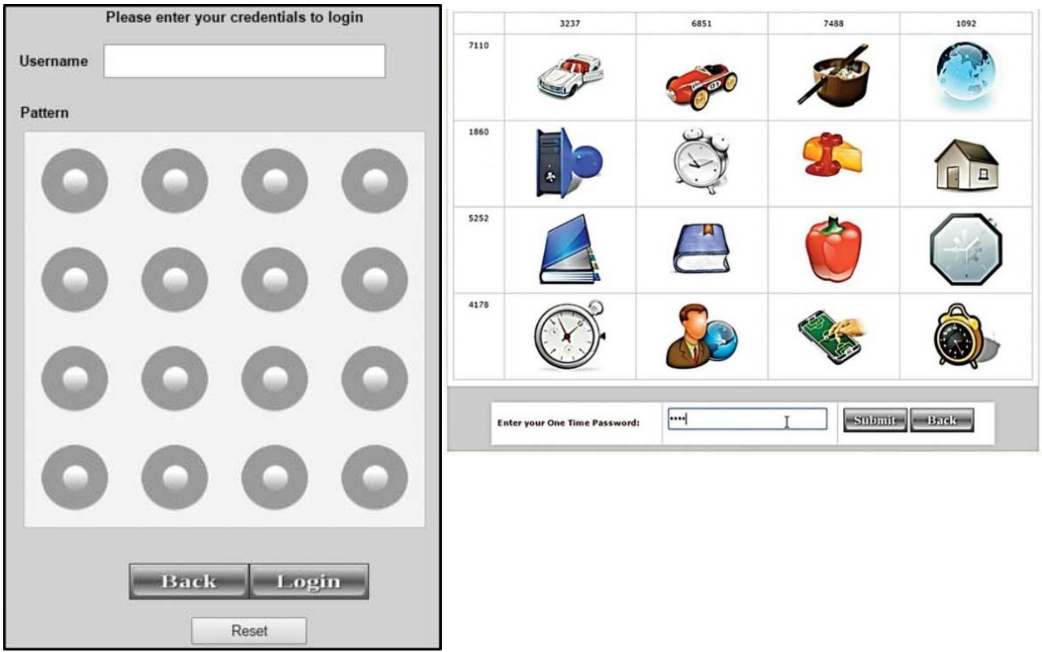
Source: Gupta, Sahni, Sabbu, Varma and Gangashetty(2012)

Developed by Gupta et al in 2012, Passblot is a graphical One-Time Password (OTP) that uses cued recall technique. The authentication performs an inkblot test, a psychological evaluation to get the users unique description of an image (Carlson & Heth, 2010). Figure 1.2 describes Passblot authentication. On registration, a given set of inkblots images are displayed; the first and last letter of the description of each inkblot is saved (i.e. if a user's description for a particular inkblot is "butterfly" then "by" is saved or if the description is "standing man" then "sn" is saved). All the displayed inkblots images have to be described and saved for that particular user. Upon authentication, a fraction of randomly chosen inkblot images from the user's set will be displayed for the user to describe. By randomly selecting a fraction of the users set of pictures upon login gives a dynamic password creating a probabilistic situation for dictionary attack and brute force. Nevertheless, in other for the module to be properly secured a large amount of inkblot pictures is required which is a load for the server and can be tiring for the user on registration and authentication.

d) *Hybrid technique*

Over the years, in attempt to provide a more secured graphical authentication system, combinations of these techniques have been implemented. Examples of such systems includes:

i. *Graphical One Time Password*



Please enter your credentials to login

Username

Pattern

Enter your One Time Password: ••••

Source: Alsaiari, Papadaki, Dowland and Furnell (2016)

Figure 1.3: Graphical One Time Password

In 2016, Alsaiari et al developed Graphical One Time Password (GOTP) and as the name implies implements One-Time Password (OTP) mechanism for additional security. From Figure 1.3, this is a combination of three authentication mechanisms which includes a 4x4 grid lock pattern (recall-based), identification of pass image (recognition-based) and finally inputting an OTP corresponding to the chosen/identified images. The right OTP will be associated with the correct images and it is also a challenge from the server. On registration, a lock pattern is drawn and a set of four (4) images out of thirty (30) are chosen. During authentication, the user first begins by drawing the lock pattern, next to selecting the right images (two of the previously selected four) from the portfolio of images and finally inputting a random number (i.e. one-time password if the right one is chosen) associated with the selected images. This will be sent as a response to the server. This authentication improves the ability to recall the pattern and identify images more efficiently. Nevertheless, a reasonable amount of pictures need to be stored on the server for improved security which can be a bottle neck for the server.

III. Limitations of Reviewed Works

From the works reviewed, many of the graphical authentication models developed are susceptible to shoulder attack which has been found to be one of the major challenges. The few which are not susceptible require a search through an array of objects which can be demanding for the user and/or require a reasonable number of pictures (with lots of details) to be made secured which can be demanding in storing such unique images for different users creating a burden for the server. Therefore, there is a need for a shoulder surfing resistant graphical authentication for web applications which should require little number of images and little time to generate the graphical password.

IV. Proposed Scheme

This scheme utilizes set of colored rows and columns which may assist users in identifying their chosen cell. The interface design elaborates on the cued recall graphical technique being utilized. This scheme will involve the following;

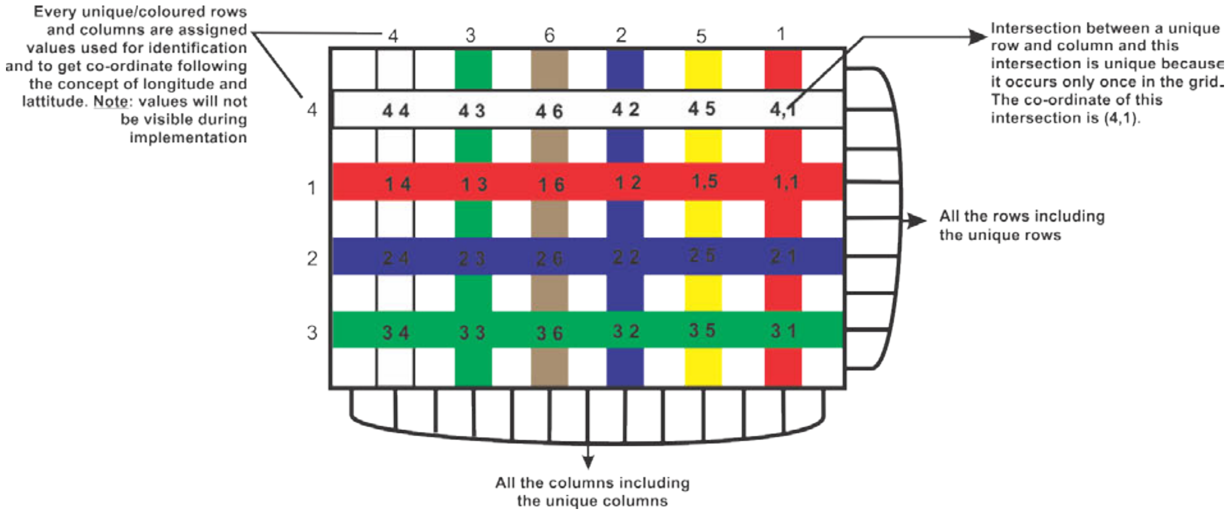
i. *Rows and Columns:* As shown in Figure 1.4, the grid is made of 13 columns and 9 rows. From these rows and columns are 6 columns and 4 rows that are assigned unique colours and values (these are all the even rows and columns; the odd rows and column are not assigned any colour or value). The values are permanently assigned to the rows and columns. The concept of these unique rows, columns and their intersection is gotten from the earth's longitude and latitude whose intersection is unique and are used to provide co-ordinates. (The Editors of Encyclopedia Britannica, 2012). Every intersection of the coloured rows and column is unique and its purpose is to assist in locating a particular cell in the grid. Figure 3.1, shows the intersection between the white row (4) and red column (1); the format of this co-ordinate is written as (4,1). During registration and authentication, these coloured rows and columns are randomly arranged on the grid but still retain the values given to them.

Table 1.0: Colored columns and their associative value

Color	Value
Red	1
Blue	2
Green	3
White	4
Yellow	5
Brown	6

Table 1.1: Colored rows and their associative value

Color	Value
Red	1
Blue	2
Green	3
White	4



Every unique/coloured rows and columns are assigned values used for identification and to get co-ordinate following the concept of longitude and lattitude. Note: values will not be visible during implementation

Intersection between a unique row and column and this intersection is unique because it occurs only once in the grid. The co-ordinate of this intersection is (4,1).

All the rows including the unique rows

All the columns including the unique columns

Figure 1.4: Unique rows, columns and their intersections

The position/location of every cell in the grid is relative to their neighbouring intersection as shown in Figure 1.5 (i.e. the cardinal points of the intersection). Each cell contains two values (integers between 0 and 9). The first value (or left value) and the second value (or right value). These values are different from the values assigned to each line.

ii. *Cells:* There are a total number of 117 cells in the grid. Each cell in the grid has a width and height of 50pixels each giving the grid a total area of 650 by 450 pixels. The position/co-ordinates of each cell is relative to the individual intersections closest to them. As shown in Figure 1.5, A cell can be in the North, North West, North East, East, South East, South West, South, West or at the centre of an intersection. All these positions are assigned values and are used in identifying the position/co-ordinates of a cell based on the unique intersection chosen.

Table 1.2: Cardinal Points and their associative values

Position	Value
Centre	0
North	1
North East	2
East	3
South	4
South West	5
West	6
North West	7

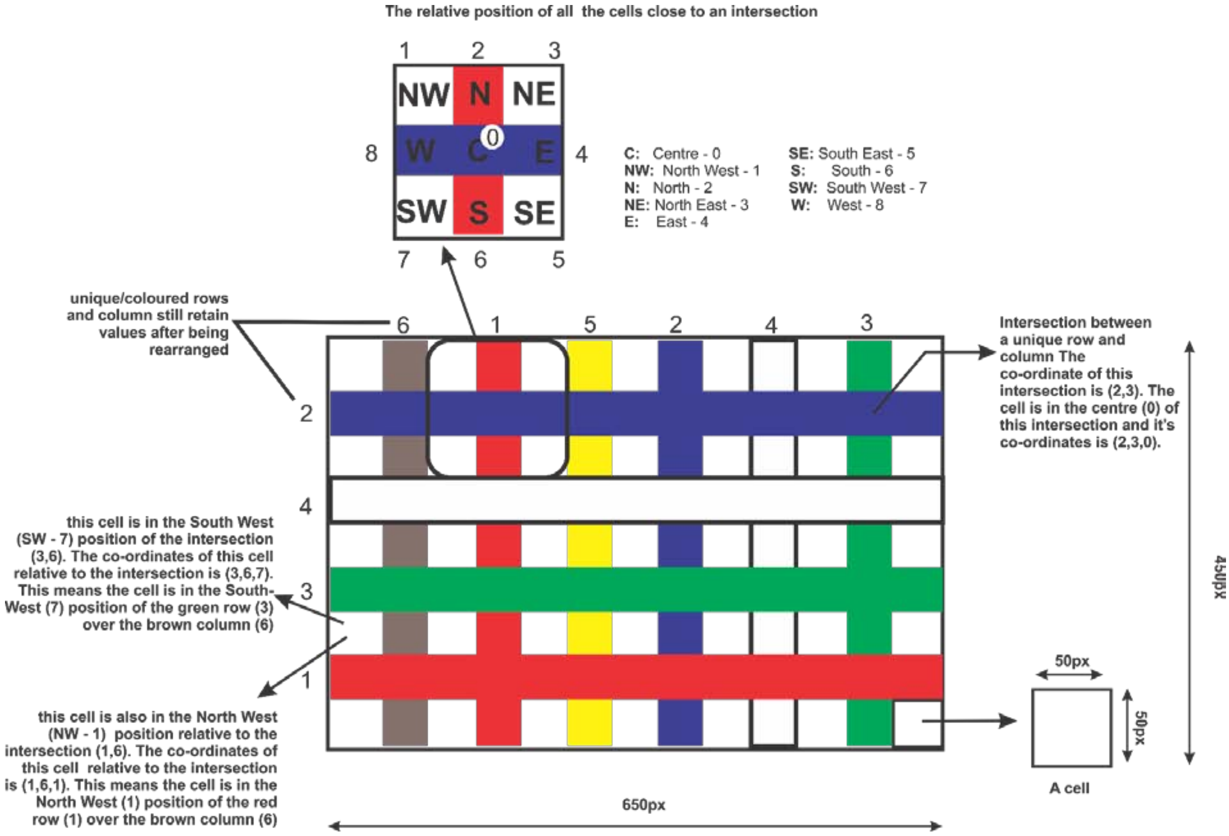
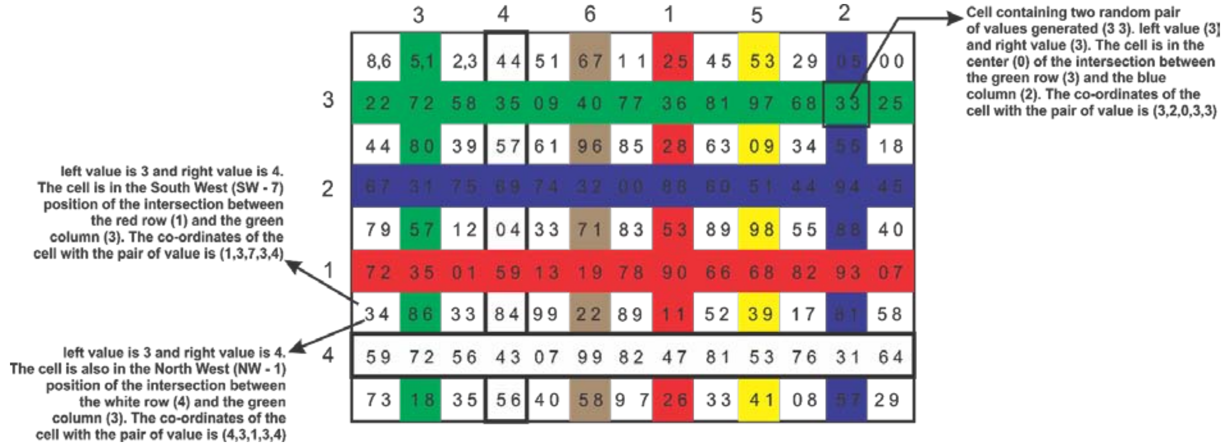

The relative position of all the cells close to an intersection
1
2
3
NW
N
NE
8
W
C
0
E
4
SW
S
SE
7
6
5
C: Centre - 0
NW: North West - 1
N: North - 2
NE: North East - 3
E: East - 4
SE: South East - 5
S: South - 6
SW: South West - 7
W: West - 8
unique/coloured rows and column still retain values after being rearranged
6
1
5
2
4
3
2
4
3
1
Intersection between a unique row and column The co-ordinate of this intersection is (2,3). The cell is in the centre (0) of this intersection and it's co-ordinates is (2,3,0).
this cell is in the South West (SW - 7) position of the intersection (3,6). The co-ordinates of this cell relative to the intersection is (3,6,7). This means the cell is in the South-West (7) position of the green row (3) over the brown column (6)
this cell is also in the North West (NW - 1) position relative to the intersection (1,6). The co-ordinates of this cell relative to the intersection is (1,6,1). This means the cell is in the North West (1) position of the red row (1) over the brown column (6)
450px
50px
50px
A cell
650px

Figure 1.5: Cells and their co-ordinates

Co-ordinates of several cells are shown in Figure 1.5. One of which is the cell at the South West (SW - 7) position of the intersection between the green row (3) and brown column (6) and this co-ordinate is written as (3,6,7).


Cell containing two random pair of values generated (3 3). left value (3] and right value (3). The cell is in the center (0) of the intersection between the green row (3) and the blue column (2). The co-ordinates of the cell with the pair of value is (3,2,0,3,3)
left value is 3 and right value is 4. The cell is in the South West (SW - 7) position of the intersection between the red row (1) and the green column (3). The co-ordinates of the cell with the pair of value is (1,3,7,3,4)
left value is 3 and right value is 4. The cell is also in the North West (NW - 1) position of the intersection between the white row (4) and the green column (3). The co-ordinates of the cell with the pair of value is (4,3,1,3,4)

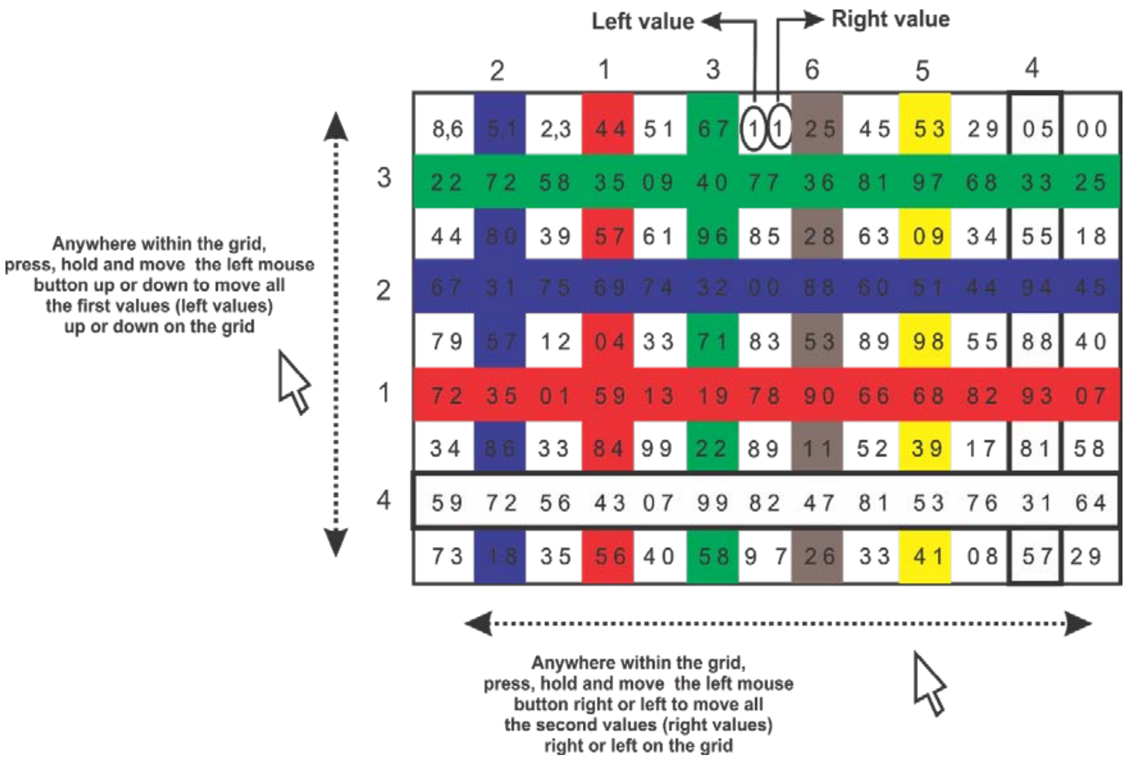
		3		4		6		1		5		2	
	8,6	5,1	2,3	44	51	67	11	25	45	53	29	05	00
3	22	72	58	35	09	40	77	36	81	97	68	33	25
	44	80	39	57	61	96	85	28	63	09	34	55	18
2	67	31	75	69	74	32	00	88	60	51	44	94	45
	79	57	12	04	33	71	83	53	89	98	55	88	40
1	72	35	01	59	13	19	78	90	66	68	82	93	07
	34	86	33	84	99	22	89	11	52	39	17	81	58
4	59	72	56	43	07	99	82	47	81	53	76	31	64
	73	18	35	56	40	58	9 7	26	33	41	08	57	29

Figure 1.6: The grid populated with pair of values in each cell

Figure 1.6 shows the complete interface used for the scheme. Each cell contains a pair of value; a right and a left. These pair of values are randomly generated between 0 and 9 using JavaScript and it is done during registration and authentication. As shown in Figure 1.6, one of the co-ordinates of a cell and the values it contains includes: the value of the green row (3), value of the blue column (2), the position of the cell relative to the intersection of the chosen row and column (which in this example is the centre - 0), the left value in the cell (3) and the right value in the cell (3) and this is written as (3,2,0,3,3). This forms the complete graphical password and will be stored in the database during registration and be generated during authentication.

ii. *Inserting values into the cells:* In this scheme, the use of the keyboard to inserts the desired pair of values (i.e. left and right values) is not allowed. In other to insert values, the user makes use of only the mouse. As shown in Figure 1.7, values are moved about from one cell to another either from left to right (or vice visa) or up to down (or vice visa).

This is done by pressing, holding and moving the left mouse button anywhere within the grid. Moving the mouse left or right will affect all the right values in the cell causing them to move from one cell to another either to the left or right position. On the other hand, moving the mouse up or down will affect all the left values in the cell causing them to move from one cell to another either upwards or downwards. For cells located at the edge of the grid, new randomly generated values will be moved into the cell.



		2		1		3		6		5		4	
	8,6	51	2,3	44	51	67	11	25	45	53	29	05	00
3	22	72	58	35	09	40	77	36	81	97	68	33	25
	44	80	39	57	61	96	85	28	63	09	34	55	18
2	67	31	75	69	74	32	00	88	60	51	44	94	45
	79	57	12	04	33	71	83	53	89	98	55	88	40
1	72	35	01	59	13	19	78	90	66	68	82	93	07
	34	86	33	84	99	22	89	11	52	39	17	81	58
4	59	72	56	43	07	99	82	47	81	53	76	31	64
	73	18	35	56	40	58	97	26	33	41	08	57	29

Anywhere within the grid, press, hold and move the left mouse button up or down to move all the first values (left values) up or down on the grid

Anywhere within the grid, press, hold and move the left mouse button right or left to move all the second values (right values) right or left on the grid

Figure 1.7: Moving values in the cell within the grid

a) *Creating/Setting up a graphical password*

This section explains the steps for creating/setting up a graphical password. These steps are explained as follows:

i. Select one coloured row.
ii. Select one coloured column.
iii. Select a cell whose location is relative to the intersection of the chosen row and column (i.e. a cell North, South, South-East, South-West, North-East, North West, West or East of the intersection).
iv. Press and drag the left mouse button up or down within the grid to move a desired value into the first side (left side) of the chosen cell.
v. Press and drag the left mouse button left or right within the grid to move a desired value into the second side (right side) of the chosen cell.

Here the password created will be (in this order), the value of the chosen row, the value of the chosen column, the position (in value) of the cell relative to the intersection, the chosen value for the first side (left side) and second side (right side) of the chosen cell. The format is written as (R,C,P,Le,Ri) Where:

R = the value of the row chosen, 1<=R<=4.
C = the value of the column chosen, 1<=C<=6.
P = the position of the cell to the intersection of the chosen R and C, 0<=P<=8.
Le = the left value of the chosen cell, 0<=Le<=9 and
Ri = the right value of the chosen cell, 0<=Ri<=9.

The co-ordinates includes (R,C,P) which identifies the users chosen cell, while (Le,Ri) are the pair of values found in those co-ordinates (chosen cell). The graphical password includes the combination of the co-ordinates and the pair values which will be stored in the database. The co-ordinates will also be stored in the database to enable the authentication scheme know the users chosen cell in other to retrieve the inputted pair of value. The co-ordinates will be used for authentication.

b) *Generating a Graphical Password*

This section explains the steps for generating a graphical password after creating/setting up a password. In this phase, the co-ordinates stored for the registered user is utilized in other to know the user's chosen cell and acquire the pair of values in that cell.

Every time during this phase, the order/arrangement of the unique rows and columns are randomly placed, only the user knows his/her chosen row, column, position (co-ordinates) and the pair of values to be inserted in to the chosen cell. This phase includes the following:

i. By pressing and dragging the left mouse button up or down within the grid, assign the pre-chosen value for the first side (left side) into the chosen cell.
ii. By pressing and dragging the left mouse button left or right within the grid, assign the pre-chosen value for the second side (right side) into the chosen.
iii. Proceeding to the next phase the authentication scheme only validates the values located at the chosen cell as the scheme already knows the chosen cell.

c) *System Development Tools*

Selection of appropriate system development tools is required to provide a robust, reliable and effective graphical authentication system. These tools include.

1. *HTML (Hyper Text Mark-up Language)*: This is a mark-up language that is used to create and design the structure of the scheme. To achieve the grid system made of 117 cells, a table tag is created containing 9 table row tags which in turn contains 13 table definition tags each. Each table definition (a cell) contain a unique identity.
2. *CSS (Cascading Style Sheets):* This is used for presentation and in this scheme, provides each selected row and column its unique colour and styling.
3. *JavaScript:* It plays a major role in this research as it is responsible for interacting with the user. This performs the client side scripting and used for the development of the graphical interface for creating/setting up and generating password. In this project, it will be performed both at the frontend framework and backend framework.
4. *WAMP Package:* The acronym WAMP stands for Windows Apache MySQL PHP and it is a software suite designed specifically for Windows operating system. This suite creates a sandbox for the development of web based application which provides four key elements: An operating system, database, web server and a scripting software.

Apache is the web server used to execute the different codes presented. MySQL is the type of database used during this project. PHP (PHP Hypertext Pre-processor) performs at the backend, this is used to connect to the database and serve as the server scripting language.

5. *PhpMyAdmin:* This is a friendly interface used to manage the activities of the database.

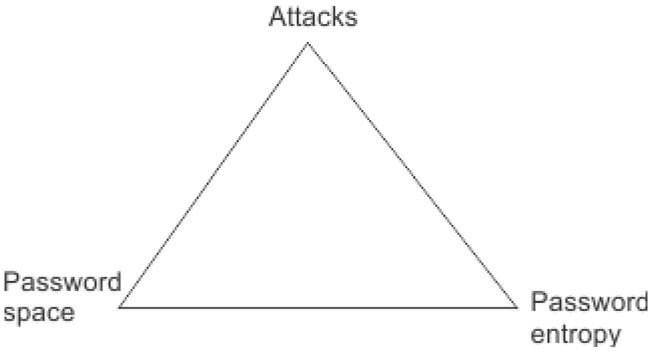
V. Features of the Proposed Scheme

The architecture of the scheme provides different features to tackle the issues associated with reviewed existing graphical schemes. These features include.

1. *Shoulder surfing resistance:* Firstly, during the process of inputting the chosen values into the chosen cells, every other value is affected and move simultaneously according to the movement of the mouse. Secondly, during every authentication, the coloured rows and column are randomly placed making the scheme dynamic. These feature screate a level of resistance to shoulder surfing attacks.
2. *Optimization of storage capacity:* The use of HTML (Hyper Text Mark-up Language), CSS (Cascading Style Sheet) and JavaScript creates a dynamic table where the coloured rows and columns are rearranged during authentication. This dynamic grid system is used as the image for authentication thereby mitigating the need for picture uploads and/or storage.
3. Assistance in finding objects: The coloured rows and columns provides assistance for users to locate the chosen cell for inputting the chosen pair of objects. Rather than searching through each cell, user focus on their chosen coloured row and column. This streamlines the search.

VI. Evaluation of the Scheme

Using magic triangle evaluation, an evaluation scheme designed by Lashkari, Manaf, Masrom, and Daud in 2011 which shows 3 attributes of security in Graphical authentication.



Source: Lashkari et al (2011)

Figure 1.8: Magic triangle for Graphical Authentication security evaluation

The password space and entropy was calculated using

$$\text{SPACE} = M^N$$

Where:

M = is the number of characters and

N = is the length of the password (Lashkari et al, 2011).

For password space and

Entropy = $N\log_2(|L||O||C|)$

Where

N = the length or number of runs,

L = locus alphabet as the set of all loci

O = is an object alphabet and

C = color of the alphabet (Zhu, Qibin, Yong, & Giusto, 2005).

The password space and entropy were shown to be $2.61*10^4$ and 14.39 respectively. These results are very low making it susceptible to brute force attacks, therefore, an additional security feature should be added to this scheme against such attacks.

VII. Limitation

Several researches have been conducted on Graphical based authentication schemes, however, this area is still in its infancy. In this scheme, the security issues tackled were majorly on shoulder surfing; other areas such as usability were not properly addressed.

VIII. Conclusion

From the different scheme reviewed, there has not been a perfect Graphical authentication scheme for all scenario. Every graphical authentication has its pros and cons suitable for specific scenario. Before utilizing any graphical scheme, a proper analysis should be conducted to determine the best scheme that will be appropriate.

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Simplification of Internet Ossification through Software Defined Network Approach

By Gaurav Kulkarni
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Abstract- Software-Defined Networking (SDN) has received a great deal of attention from both academia and industry in recent years. Studies on SDN have brought a number of interesting technical discussions on network architecture design, along with scientific contributions. Researchers, network operators, and vendors are trying to establish new standards and provide guidelines for proper implementation and deployment of such novel approach. It is clear that many of these research efforts have been made in the southbound of the SDN architecture, while the northbound interface still needs improvements. By focusing in the SDN northbound, this paper surveys the body of knowledge and discusses the challenges for developing SDN software. We investigate the existing solutions and identify trends and challenges on programming for SDN environments.

Keywords: software defined networking, SDN programming languages, software engineering.

GJCST-C Classification: C.2.5, C.2.6

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I. Introduction

The Internet architecture has become complex and hard to manage. Due to its large development and level of maturity, implementing strategies with a high degree of innovation is risky because the success of the Internet depends on the accurate operation of all of its subnets. The Internet became static and difficult to change its structure, a phenomenon known as *Internet Ossification* [1]. The need for making networks more dynamic, robust, and able to be experimented with new ideas and protocols in realistic scenarios brought a new paradigm called Software-Defined Networking (SDN). SDN enables a new network architecture that makes possible for computer networks to be programmable [2]. In its essence, SDN decouples the control plane from the forwarding plane. It enables researchers and software developers to create and deploy network applications, by abstracting the underlying infrastructure and even complex protocols present in traditional and legacy networks. Programmable networks have been the subject of active research in the past (e.g., Open Signaling [7], Active Networking [8], and Ethane [9]). However, they failed to be fully adopted by the industry due to many reasons, such as focusing on the data plane programmability as well as enabling programmability for specific network devices vendors. Although some of the SDN concepts are not new, it integrates the concepts of programmability in the network architecture in order to offer better network management strategies. In this scenario, Open Flow [2] has been considered the *de facto* and widely accepted solution to implement SDN. It is worth emphasizing that Open Flow and SDN terms cannot be used interchangeably.

Open Flow is a protocol that defines an open standard interface for SDN, and uses a programmable controller to communicate with the forwarding plane, manage the network, and possibly receive instructions from a network application. Such an interface has a low-level implementation, which offers basic features to developers. The complexity involved in developing advanced SDN software applications needs to be addressed by other means (e.g., via new programming languages), in order to increase its level of abstraction. In this scenario, full development and deployment of such applications in staging and production environments remains a challenge for network operators [10].

Although some previous studies [11] [12] [13] [14] have surveyed the state-of-the-art on SDN programmability, we take a different perspective on the topic by describing the techniques, methodologies, and challenges to develop and deploy SDN software applications. We provide a unique view from the perspective of the Software Engineering discipline in which we present the evolution, current maturity, and point out prospective research directions and challenges to develop applications for SDN.

II. Software Defined Networking

The separation of the control plane from the forwarding plane is one of the pillars of the SDN paradigm. Its decoupled architecture enables network programmability. Historically, the research community made several attempts to provide network programmability, where Active Networking (AN) and Open Signaling (Opening) are considered the seminal approaches [7].

a) SDN Architecture

When the control logic is decoupled from the forwarding devices, all the network intelligence (e.g., decisions about routing, permissions) is moved to the controller. The SDN controller becomes the network component responsible for network management, as

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Figure 1 depicts. Management then occurs through a flow table present in the network switches, which receive and register network rules defined by the controller (cf. section II. C). In other words, the SDN controller adds flow table entries in the switches for proper packet or flow handling. The controller has all the necessary network information (e.g., where the hosts are connected, topology, and the like) that it uses to deal with possible conflicts involving policies or to avoid misbehaviour of network elements. As Figure 1 depicts, the controller has two main interfaces, namely i) the northbound interface, for higher-level elements to support the development of network applications and services, or to program the SDN controller through a well-defined API and ii) the southbound interface, for the communication between controllers and network switches.

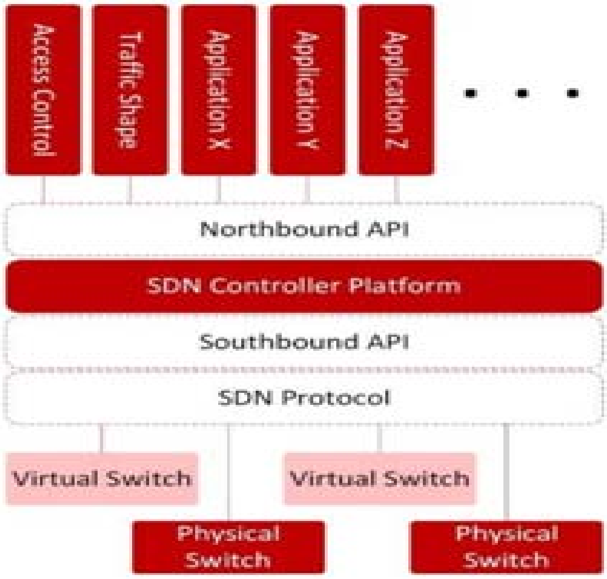

Figure 1: Northbound and Southbound Interfaces in an SDN Architecture

b) Controllers in the SDN Architecture

The SDN controllers are strategic control elements that communicate with the underlying switches (via SI) and with applications on the top (via NI). An SDN controller sends messages to switches disseminating specific or general packet handling rules, which are generally defined by a developer or administrator through the controller's northbound API [13] [14].

c) The open flow protocol

The Open Flow protocol defines how the exchange of information between control-plane and data-plane must occur .When an Open Flow switch receives a packet, its header fields are verified and compared to related fields in the flow table entries. If an entry corresponds to this packet header, the switch will perform the set of instructions or actions related with the flow entry.

III. Programming Paradigms, Languages Specification, and Software Engineering in SDN

The paradigm for programming languages applications development is the *declarative*, used in most research papers in the literature [04] [10] [14]. *Declarative programming languages* have been characterized by its extremely formal nature, often based on logic, but without arithmetic [42]. This paradigm allows a developer to define *what* action needs to be done in the network, but not *how* this action will do it. Please note that this definition applies to all declarative programming languages. To make it possible, a language interpreter is used to translate the "what" into "how". An example involving this approach in an SDN scenario is shown below, using the Frenetic notation [10]:

```
Select(packets) *
      GroupBy([srcmac]) *
      SplitWhen([inport]) *
      Limit(1)
```

Figure 2: Frenetic declaration to filter packets

The example presented in Figure 3 demonstrates a high-level declaration to filter packets in a given flow, which does not require the programmer's knowledge to implement how the Select(packets) clause will receive and direct the packets to some program or service that is requesting it.

Another widely used paradigm present in SDN programming languages is the *Functional Reactive Programming* (FRP). FRP is a well-suited solution for the development of event-driven applications, such as SDN applications, enabling programs to capture the *time flow* property pertinent to SDN systems [13].The reactive characteristic of FRP is direct related to the SDN environment, where switches and controllers continuously exchange information upon packet arrival and apply rules to the corresponding flow. When an SDN language follows the FRP paradigm, it automatically administers the time flow and the dependencies between data and computation.

The main idea behind FRP is to define everything in terms of *signals*. A signal is an element in which its values change in the course of time [14] (e.g., if a variable switch is equal to false, its value might changes to true due to emission of a signal). Figure 4 depicts a code example in the context of FRP.

```
def ip_monitor():
return(Select(counts)*Where(inport_fp(1))*
GroupBy([srcip]) * Every(INTERVAL))
```

Figure 3: FRP characteristic of Frenetic

IV. Analysis of use Cases and Applications for SDN Programming Languages

Prospective environments for SDN scenarios drive us to analyze a number of specific applications and use cases for SDN programmability. All the languages analyzed in this survey have use cases and evaluation scenarios in their respective publications. This section then presents an overview of the SDN programming languages and their possible applications to be developed. Initially we describe and categorize the applications in the use cases previously defined in this survey. Then, we map these applications and use cases to the SDN programming languages that may be used by developers to write them, as shown in Table 3. This mapping defines the lessons learned in this survey, providing directions on what language to use in developing SDN applications.

Admission Control: An admission control application enables the administrator to specify the authentication rules for hosts and users that try to access the network. Admission control applications can be implemented through an SDN programming language to define what default connectivity is allowed and which authentication mechanisms will be used.

Load Balancing: The load balancing use case might be seen as a congestion-aware routing for networks [76]. With a load balancing application, the controller prevents overload instructing the switches how to balance the incoming traffic among the network paths.

Quality of Service (QoS): For QoS applications, developers may use how resources should be allocated to different users and flow classes. This is done by setting some network properties, such as latency and available bandwidth. These applications to fit in the Applications-based Network use case. This is because end-user software can communicate with the SDN controller, which must be running a QoS application, to request some network resource.

NAT Administration: The Network Address Translation (NAT) Administration is generally used to enable multiple machines within a private IP range to share a single public IP address, mapping two pools of IP addresses. This translation requires an implementation which alters the IP and port number of each packet in the private network. This is the basic difference between NAT and others applications mentioned. In NAT administration, each packet in the flow must be modified, therefore requiring the network switches to support this functionality. In the SDN scenario, the NAT administration application may be executed on the controller, which installs rules into switches to perform the modification of headers of certain packets corresponding to IP addresses and port numbers that should have a specific quality [11].

Security Rules: A typical example of security rules is the implementation of an IP addresses black list module that prevents a malicious IP source addresses from sending traffic.

Fault Tolerance: An interesting use case involves network resilience scenarios. For instance, in the case of a link failure, the network should be able to choose a backup path dynamically.

Deep Packet Inspection: It is a network application which examines packet's payload looking for patterns, such as from well-known applications and services, viruses, attacks, and the like. In SDN, the controller executes some algorithm to perform DPI. SDN languages as Frenetic [10] and NetCore [13] have features to implement DPI applications.

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Cloud Orchestrator: The Cloud Orchestration use case needs a software orchestrator in order to manage the network and the virtual machines. All SDN languages partially enable the implementation of such a software, because they only provide methods to implement a network application, which in this case may create the network orchestrator. The orchestrator of virtual machine needs to be developed with third parties programming languages or obtained from vendors.

Policy Specification: The most basic feature of an SDN application and environment is the specification of policies. All the analyzed SDN programming languages enable the implementation of policies in several ways, as well as applications to define the network behavior through policies. However, they differ in the way of writing and implementing these policies in practice.

Network Monitor: Foster *et al.* [16] argue that querying network state is one of the fundamental elements in programming SDNs. A Network Monitor application in SDN can observe and request several types of information (e.g., packet counter state in a switch). All languages analyzed allow the implementation of applications that monitor network states.

Correctness: The verification and validation of network applications are desired features [14] [15]. SDN programming languages might offer constructs that help developers to avoid network misbehavior (i.e., verification), and to build correct applications (i.e., validation), according to the specified requirements.

V. Future Work

How to handle network failures? A recurrent discussion on SDN research involves handling of failures. Failures can occur in the availability of a controller or even in wrong policy rules defined by an SDN application. The authors of FatTire argue that programmers do not write programs using the primitive fast-failover OpenFlow mechanisms directly due to the increment of complexity in failure-handling control, which might make code more complex. In order to handle failures in SDN programming, the language needs to support an abstraction of the OpenFlow forwarding table called a *group table*. Group table consists of group entries. The ability for a flow entry to point a group enables OpenFlow to represent more methods of forwarding[16]. It enables multiple conditional rules in OpenFlow. One of the group table types is the *fast failover* (FF). The fast failover determine that if a flow entry belongs to this group type, the first *action bucket* (an ordered list of actions) will be performed.

FatTire [14] abstracts the construction of a fast failover group table, generating the entries in such group table automatically. This approach avoids the error-prone development made by programmers when interacting with fast failover group table directly [14].

From the *Software Engineering* perspective, the development of fault-tolerant applications must be based on languages that define dependable features or build rules created from formal methods. For instance, a language that provides modular development may enable an SDN application to run as redundant modules in replicated controllers, thus improving the recovering time of a network failure. However, synchronizing such modules is not a trivial task [13].

How to avoid conflicting rules? This is a challenge investigated by some research studies (e.g., PANE [80], Pyretic [16]). Avoiding conflicts means that a policy rule X does not invalidate a policy rule Y, and vice-versa, simultaneously, so that at least one policy rule should be correctly applied. In [16], Hinrichs *et al.* proposed two conflict resolution mechanisms, which we consider a valuable path to effective SDN programming, i.e. one has its features at the level of keywords, identifying the conflicting policies. The other mechanism is a schema that defines priority to each keyword (e.g. the keyword *deny* has precedence over the keyword *allow*). A similar approach can be also found in [15]. One possible approach to address conflicts in policies could be based on a DSML. In such an approach, invalid policies that result in conflicts could not be created due to the constraints contained in an underlying *metamodel*.

How can one realize automated tests? In order to identify inconsistencies or unexpected states in an SDN application, Canini *et al.* [12] and Vissichio *et al.* [12] propose approaches to realize tests in SDN applications. End-host applications and switches affect the program running on the controller. In [10] Canini *et al.* address this challenge by generating flows with several possible events occurring in parallel. It also enables the programmer to verify generic correctness properties (e.g., forwarding loops or black holes) and code validation (i.e., global system state determined by code fragments). On the other hand, in [82] Vissichio *et al.* use *Test-Driven Development* (TDD) to perform tests on SDN applications.

How to abstract the complexity in SDN development efficiently? The low level of abstraction used by OpenFlow and its releases makes it hard to program applications and to define a desired behavior into the network. The studies analyzed suggest that a decomposition of the controller, through one relationship with the OpenFlow protocol and adding a layer to specify policies, reduces the complexity to develop and deploy SDN applications, mainly due to the readiness to build applications without the need to worry about maintaining consistency of various rules present in an SDN environment. Therefore, such an abstraction is more than only adding more layers for SDN architecture or controllers; it also provides smart structures that reduce the complexity in SDN applications development, and not just encapsulating the methods from the underlying structures. Furthermore, this layering and efficient structures can be used by some DSML, further increasing the level of abstraction, enabling the concrete visualization of network behavior.

Be reactive or proactive? The proactive or reactive behavior and structure of a certain SDN language will depend closely on the controller and how packet handling occurs. It is worth emphasizing that one could follow a hybrid approach, where a combination of both strategies allows the flexibility from reactive paradigm to particular sets of traffic control, while proactively providing low latency routing for ordinary traffic. Creating a framework or SDN language to support these two main approaches seems to be the most correct way to achieve completeness. As far as we are concerned to create an SDN language, the possibility of defining a DSML enables developers to develop high-quality SDN applications. This isdue to the ability of DSML to raise the level of abstraction in software programming, because its visual representations are easier to understand than the syntax of textual programming languages.

How to improve the SDN programmability? Although this question allows a number of answers, we aim at presenting and discussing the four most important issues that need improvements: i) verifying and validating applications (e.g., consistent updates, rules, and the like), which could be achieved by using DSMLs or constraint checkers in compilers; ii) offering high-level tools for developers, since there is no widespread tool (e.g., Integrated Development Environment – IDE, CASE tool) for creating SDN applications; iii) providing programming languages independent from the underlying controllers or southbound protocols, which fortunately there are some efforts in this direction, such as P4; and iv) writing applications that meet network dependable requirements.

VI. Conclusion

Some current challenges show that the programming of SDN applications is still complex and not completely standardize. Although there are several abstractions at application level for SDN there are still some issues to be addressed such as interoperability, fault handling, conflict resolution or detection. SDN offers the opportunity of innovative and powerful networking scenarios, the development of correct application with efficiency and efficacy is still work in the progress. In particular advance study MDD/DSML is a possible research path in order to achive correctness, completeness and ease of use and productivity.

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Oil Exploration using Soft Computing

By Dr. Ashit Kumar Dutta
Shaqra University

Abstract- Soft computing (SC) techniques provide wide variety of applications in data processing, analysis and interpretation. SC play a key role in the geo sciences due to the immense size and uncertainty associated with the data. The nature of SC assesses oil industry in oil exploration and optimization of oil wells. There is a significant change in oil industry due to the complex techniques and modern equipment. Intelligent systems like Neuro computing and Artificial Intelligence are available for the exploration of oil and popular evolutionary algorithms have effective methods for the optimization of oil wells but processing of vague data create problems for the existing techniques. Uncertainty data plays a crucial role to take vital decisions. The research uses seismic data in the process of oil exploration and compared the proposed method with the existing methods and results are favorable to the proposed research.

Keywords: soft computing, oil well, oil field, decision tree, J48, data mining.

GJCST-C Classification: K.5, K.6.2

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Strictly as per the compliance and regulations of:

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I. Introduction

A process of drilling in the Earth brings petroleum oil hydrocarbons to the surface and the well is termed as oil well. Modern directional drilling tools allocate for powerfully deviated wells provide sufficient depth and with the proper equipment, actually become horizontal. This is of great value as the reservoir rocks which contain hydrocarbons are usually horizontal; a horizontal wellbore used in a production zone has more surface area than a vertical well, and increase the production rate. The use of deviated and horizontal drilling tools allow production team to reach reservoirs several distance away from the location for the production of hydrocarbons located below locations that are either difficult to rig depends on the environment.

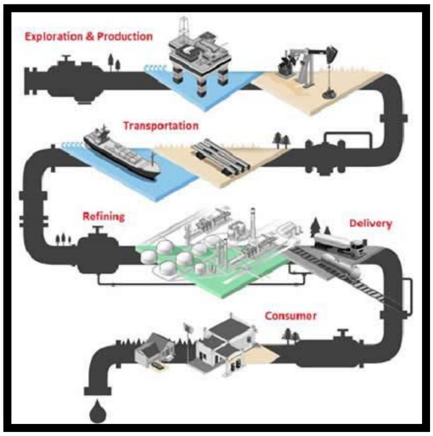

Figure 1: Life cycle of oil

The introduction of data mining (DM) in the field of computer science in late 80's lead many researches in data analysis and discovered lot of statistical and data crunching tools. The massive growth of data in all kind of business urges to use data management and data warehousing applications. The growth of data mining in the last three decades can be divided into three parts. In the first part, programmers developed machine learning algorithms to train machines to handle huge amount of data to generate pattern from it. In the second part, many business people realized the application of DM tools and started implementing in their business and took decision according to it. In the third part, web is a huge database with semi-structured data. DM tools were implemented to study the data in the web. Web mining is the concept derived from DM and successfully used for web management. The DM is a domain expertise tool and considered one of the pioneer applications of SC. Continuous research indicate that decision tree data mining algorithm produce best results.

The further part of the paper will explain the literature work based on oil exploration and results and discussion of the methods employed in the research work.

II. Review of Literature

In[1], a review of recent applications of soft computing in oil exploration. Artificial neural network (ANN), fuzzy logic, probability reasoning, and Bayesian belief network were methods highlighted in the study. ANN has the ability to deal with linear and non – linear problems and ideal for the oil – exploration. Fuzzy logic has the ability to manipulate symbolic information in an effective way than other methods. The concept of fuzzy logic employed for seismic data interpretation and oil reservoir litho logy identification. Data in oil exploration are dynamic and uncertain and probabilistic reasoning used to handle uncertainty in decision making. BBN is suitable for casual rules and represents probabilistic relationship. The review explained the activities involved n the oil exploration like data acquisition and pattern recognition and prediction.

In [2], a research on oil exploration using big data. Seismic data management and analysis were the task optimized for the methods used in the research. Semma process used to disclose patterns hidden in the large volume of data. Oil exploration using data analysis is the paramount task. Insight, predict and optimize are

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the processes of big data used to explore oil from the huge amount of data.

In [3], Big data analysis on safety mechanism and real analysis of the exploration of oil. The research employed business intelligence tools, data warehouses and other transactional applications and generated better results comparing to existing methods. Hadoop system used to derive results from websites logs and complex databases. Real time analytics and recommendations were done by the system using the big data and hadoop.

In [4], a paper on overall maintenance of oil industry. The paper described the activities involved in the maintenance of equipment by collecting data from pumps and wells then adjust the repair schedule and prevent the failures. Big data employed in the process of optimization of production volumes.

III. Results and Discussion

The implementation of data analytics and prediction tool is a complex task due to scalability and time complexity. The proposed method and other methods used in the research were implemented in Java using i7 processor. K-means, Naïve Bayes, K-NN and SVM are the methods compared with the proposed J48 methods. The algorithms were taken from Google algorithms and the dataset for the experiment were downloaded from international well data (www.ihs.com). We have used two locations Saudi Arabia and Canada well data to show the ability of proposed method. Machine learning and automated tools need training to generate results, therefore during the training phase, selected data from the dataset given to the methods to learn the environment. During the testing phase, the performance will be evaluated by calculating the time. The Table -1 and 2 shows the training phase data and figure 1 and 2 shows the relevant graph to the data generated during the training phase.

Table 1: Training Time (in seconds) for the location in Saudi Arabia

Methods	Seismic Data	Percentage of Hydrocarbon	Distance from Ground	Latitude & Longitude
J48	0.178	0.261	0.272	0.314
K-Means	0.214	0.291	0.283	0.364
Naïve Bayes	0.192	0.242	0.286	0.412
K-NN	0.191	0.260	0.281	0.292
SVM	0.184	0.312	0.317	0.319

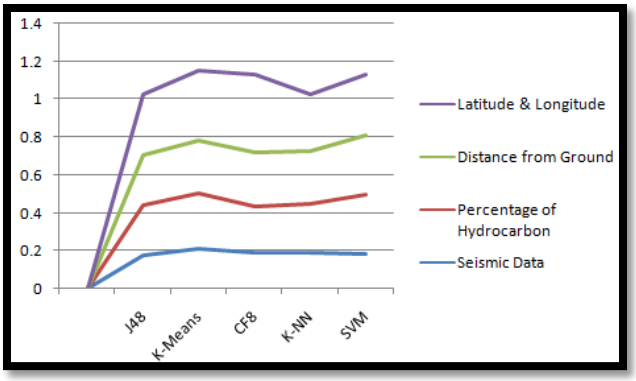

Figure 1: Training Time (in seconds) for the location in Saudi Arabia

Table 2: Training Time (in seconds) for the location in Canada

Methods	Seismic Data	Percentage of Hydrocarbon	Distance from Ground	Latitude & Longitude
J48	0.098	0.101	0.085	0.145
K-Means	0.125	0.154	0.114	0.189
Naïve Bayes	0.137	0.138	0.142	0.189
K-NN	0.115	0.119	0.121	0.162
SVM	0.099	0.128	0.126	0.149

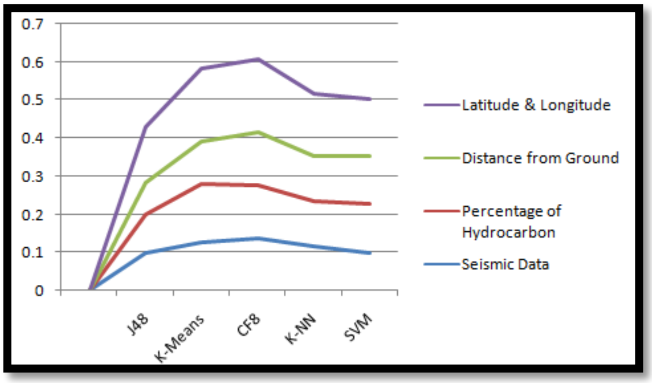

Figure 2: Training Time (in seconds) for the location in Canada

J48 is the implementation of ID3 (Iterative Dichotomiser 3) based on the classification algorithm. It has shown better training time than other methods. It has the ability to produce results in short duration with improved performance. Saudi Arabia is the largest oil producer and Canada is the fifth in the world. In the location of Saudi Arabia, the numbers of oil wells are more than the location of Canada. The training phase data shows that the employed methods had taken more time to learn the scenario and the attributes used for the training were seismic data, percentage of hydro carbon, distance from ground and latitude and longitude of the oil well. The trained attributes are vital to predict the location of oil well. Table 3 and 4 shows the testing time of the methods and the proposed method have better performance. Figure 3 and 4 shows the graph for the testing time of methods for the two locations.

Table 3: Testing Time (in seconds) for the location in Saudi Arabia

Methods	Seismic Data	Percentage of Hydrocarbon	Distance from Ground	Latitude & Longitude
J48	0.091	0.101	0.160	0.147
K-Means	0.112	0.132	0.192	0.241
Naïve Bayes	0.101	0.212	0.242	0.312
K-NN	0.098	0.174	0.174	0.180
SVM	0.094	0.118	0.181	0.174

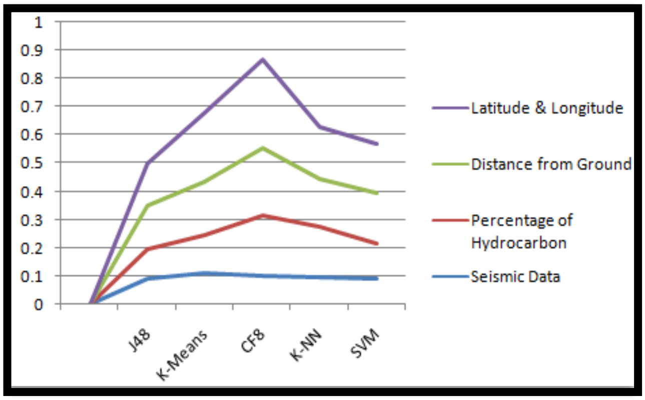

Figure 3: Testing Time (in seconds) for the location in Saudi Arabia

Table 4: Testing Time (in seconds) for the location in Canada

Methods	Seismic Data	Percentage of Hydrocarbon	Distance from Ground	Latitude & Longitude
J48	0.084	0.112	0.078	0.056
K-Means	0.121	0.125	0.134	0.101
Naïve Bayes	0.097	0.159	0.145	0.114
K-NN	0.187	0.145	0.089	0.077
SVM	0.107	0.127	0.095	0.081

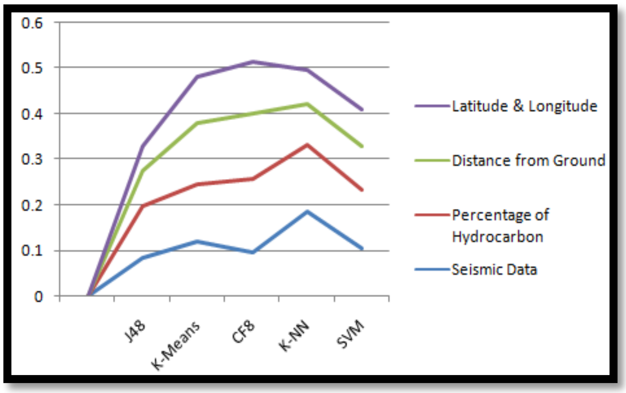

Figure 4: Testing Time (in seconds) for the location in Canada

K-NN and SVM has nearest value to the proposed method but the accuracy of the methods are the better criteria to know the efficiency of the methods. The table 5 shows the percentage of accuracy produced by methods employed in the research. The research work have shown overall 90% accuracy for all the methods and the proposed work has overall better efficiency than the other methods.

Table 5: Accuracy of results (in percentage)

Methods	Saudi Arabia	Canada
J48	95	97
K-Means	91	92
Naïve Bayes	90	90
K-NN	93	92
SVM	93	95

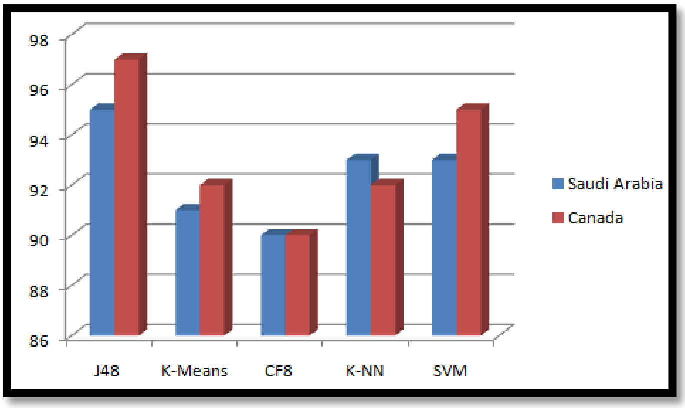

Figure 5: Accuracy of results (in percentage)

IV. Conclusion

SC is the combination of machine learning algorithms employed in the interest of development of application for real- world problem. The data mining algorithms were successfully implemented in all kind of business to provide decision in the complex situation. Oil exploration is the complex problem and data are vague and difficult to derive information and proposed method has achieved accuracy of an average of 92% for the dataset employed in the research. The ability of J48 to produce results achieved the better accuracy and shortest time than other methods employed in the research. The future work of the research is to expand the work for the other region in the world.

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Software Development Top Models, Risks Control and Effect on Product Quality

By Ajayi W ., Adekunle, Y.A., Awodele, O., Akinsanya, A.O., Eze, M.O. & Ebiesuwa Seun

Babcock University

Abstract- In recent time, considerable efforts have been made to improve the quality of software development process and subsequently the end product. One of such efforts is finding a way to avoid or prevent risks in the overall process; and where or when it is not possible to prevent, risk alleviation readily comes handy.

Several problem solving methods such as six thinking hat, risk table, and riskit analysis graph (RAG) applied along with generic models such as spiral, waterfall, prototyping and extreme programming have been used in the past to prevent risk and enhances both delivery time and product quality.

However, some gaps were identified in the earlier works done in this area and in the generic models designed for evaluating and controlling risks prompting the development of modern ones.

Hence, this work tries to investigate different types of risks and risk management models, leaning on the gaps in research; it attempts to create a framework for better risk prediction and alleviation with the aim of enhancing delivery time and product quality.

GJCST-C Classification: K.6.3

Software Development Top Models, Risks Control and Effect on Product Quality

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Hence, this work tries to investigate different types of risks and risk management models, leaning on the gaps in research; it attempts to create a framework for better risk prediction and alleviation with the aim of enhancing delivery time and product quality. To enhance good understanding and reading of the work, it has been structured into different sections. It concludes on some recommendations for future research in this paradigm.

I. Introduction

In our world today, virtually everything around us depends on software. Our businesses, banking sector, educational system, our phones, home gadgets, even our cars and houses have been made smart and are being controlled by software (Chappell, 2012). Based on this reality, it simply means without quality software most business, basic home appliances and security, even modern civilization could fall apart.

To attain quality in software development, a range of possible factors such as the process that births the software, the choice of models used, formation and motivation of the teams involved in the development, handling of risks and risk areas all must come to play.

As would be explained later, amongst these factors, the choice of process models vis-à-vis how risks is handled are some of the major determinant of quality and quick delivery of software and these two are inevitable entities in the developmental process (Poth and Sunyaev, 2013).

Office of Government Commerce- OGC (2013) defined risk as an uncertainty or set of events that if allowed to occur, will have adverse or negative effect on the software development process or the quality of the end product. Risk is not limited by the location or site of the software project, the time spent planning or the sophistication of the resources invested into the development process, it could happen anywhere and at anytime during the software development life cycle (SDLC).

Some examples of where improper management of risks has led to either delay in delivery, poor quality or total failure of projects include: Canada's payroll system which was proposed to make accounting management easier but failed probably due to coding error or some other unforeseen factors, and this happened after spending whooping $50M.

Again, National Aeronautics and Space Administration – NASA (1986) reported that for thirty two (32) months, space shuttle could not launch into space due to an unforeseen circumstances leading to the death of the crew of "challenger" on Jan 28, 1986.

The popular "Y2K problem" in the late 1990s was caused as a result of ignorance about the sufficiency of using just the last two digits to represent the year (Aggarwal and Singh, 2007).

These few aforementioned are just some examples of notable projects that have either failed or did not complete as scheduled due to poor risk control procedure and bad planning.

Here in this work, an attempt would be made to create a model for better risk prediction and alleviation with an aim to enhance delivery time and product quality. Since this work tries to address software risks and its prevention, it is deemed fit to introduce its major concepts.

a) *Major software risk Concepts*

Based on OGC (2013) and the work of Chappell (2012), the following are some of the major concepts associated with software risks and the systematic identification, evolution and prioritization of risk events and their likely consequences.

1. *Software Risk Identification:* the concept of risk identification falls into a futuristic category; it is a prediction of the unpleasant events that may occur along the developmental process.
2. *Software Risk Analysis:* understanding the nature of the risk, likelihood of occurrence, and the degree of impact. Impact level may be set from beginning from range 0 to 5, or from low to medium and high.

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3. *Software Risk Planning:* this is usually based on the information gathered from analysis, one can then come up with strategic actions and implement them in order to avoid risk
4. *Software Risk Monitoring:* ensuring that the risk does not occur and looking out for signals that indicate occurrence.

i. *Aim and Objectives*

The aim of this work is to examine the possibility of improving software quality through better control of risk.

The basic objectives are to:

1. Show that proper risk control will enhance fast delivery of software project objectives.
2. Show that quick identification of risk and risk areas of software development process will reduce the risk of the overall developmental project
3. Identify the basic parameter that must work together to attain quality product (software).
4. Analyze previous risk management models and existing works to establish gap or new trend in this paradigm.

b) *Problem Statement*

It is very imperative to state first that like every sector; software development process too is characterized by different types of challenges.

Earlier works studied in this paradigm show that in most cases, success rates of software projects have been found to be lower than expectation; and inability to easily identify and control risk have been identified as a major factor contributing to the failure rate.

Again, nowadays software is a major player in our daily life. Almost all our daily activities, our gadgets, cars, house security, depend on it, hence there are needs to design and develop software with utmost caution. It is believed that quality can only get better if risk is handled well because it has a direct effect on the quality of the software produced at the end of the whole process.

Thus, the main goal of this work is to review existing risk management techniques models along some traditional software models and related works in areas of software quality. After this, then come up with research gaps and ideas on how to develop a more meticulous model that will overcome the limitations in existing models and help enhance quick delivery and better quality.

c) *Methodology*

The methodology adopted in developing this work includes:

1. Literature search and analysis.
2. Model adaptation (from generic ones).

II. Literature Review

Of late, the study of risk in software development has attracted great interest. To an extent, one could look at it as just mere interest which started as an attempt to test the strength of technology or computer science in handling just about anything possible; but more likely, the study of risk tends more to the quest to attain "better quality" in software and software developmental process. Hence to confirm either of the assertions, in this section, we try to evaluate some previous works done in this paradigm vis-à-vis design, problem solving techniques and models. However before proceeding, it is very pertinent to look into the categorized and other intrinsic risks (as seen in literature).

a) *Categories of Risks*

As analysed in OGC(2012), software project risks and other Information Technology related projects risks can be categorized into the following major areas.

i. *Technical Risk:* These categories of risks identify potential design, implementation, interface, verification and maintenance problems. If not handled and managed very well, this category of risk may threaten the quality and timeliness of the software to be produced.

ii. The second category is the development risk. This risk according to OGC(2012), involves inadequate planning, wrongly developed product features, interfaces which are not user oriented and failure of real life testing.

iii. *Business Risk:* The third category is the business risk. Further classifications of this risk are:

- *Market risk:* okay but no one really wants it
- *Strategy risk:* okay but no longer fits into the clients strategy
- *Sales risk:* okay but sales force can-not sell
- *Management risk:* losing the support of senior management due to a change
- *Budget risk:* okay but lost budgetary or personnel commitment.

Furthermore, analysis and deductions made from the work of Ghayyur and Khan(2010) used along with Kaur, Kaur and Kaur (2014) on *"Study of Different Risk Management Model and Risk Knowledge acquisition with WEKA"* revealed some other intrinsic risks that may occur or hinder the success of software development and the processes associated with it.

These amongst others include:

> "Personnel Hiring and Shortfalls, Poorly trained project team members (personnel risk), Unrealistic Schedules and Budgets, Developing the Wrong Functions and Properties, Developing the Wrong User Interface,

Gold-Plating, User Platform Incompatibility, Continuing Stream of Requirements Changes, Shortfalls in Externally Furnished. Components, Shortfalls in Externally Performed Tasks, Real-Time Performance, Shortfalls, Straining Computer-Science Capabilities, Case Tools under Performance, Unrealistic nature of temporary project plan, Loss of project *data,* development risk, Facility and equipment Machine etc*"*

Aside what is identified as direct risk which may delay, hinder success or cause total failure of software projects, sometimes software project may also fail as a result of the following.

a. Customer Involvement – for example in prototyping.
b. Using wrong process model.
c. Non consideration of risk.
d. Repetition of Task – e.g in the Risks management of Spiral model.

Having done with the different categories of risks possible in the software project development, the following sections enumerate the different methods that have been used in one way or the other to solve problems or (and) in handling risks.

b) Overview of Some Existing Methods for Solving Problems and Handling Risks

Leveson (2013) shows that several methods have been developed in the past to predict, avoid or alleviate risks in the software development process. Some of these methods include:

(a) Use of risk table/log using RMMM (risk mitigation, management and monitoring). (b) Brainstorming. (c) Six thinking hat. (d) Risk analysis graph (RAG). (e) Risk matrix. (g) The Rich picture. (h) Use of financial models.

Other methods used for identifying risk include:

i. Check-listing: listing risks from past project.
ii. Interviews and Surveys: ask the right questions.
iii. SWOT Analysis: of products and methods.
iv. Direct Observations.

c) The Risk Table

A risk table or risk rating table is a tool for assessing the likelihood and consequences of risk (Worksafe, 2014). Although there are different opinions on what should constitute the headings of the risk table, It appears that the constituent of the headings is subjective (based on the environment being assessed). However, generally based on Williams (2004) on risk management and some other earlier works in this area, headings of a risk table template should at least comprise of risk category, rank, risk-item, probability of risk occurrence, last ranking and action taken. Other views and addition that exist in this area tend to prefer the use of risk matrix or in some cases use both table and matrix.

A major point to note here is that to get better result while trying to get inputs for the table, it is better to consider an equally fit problem solving method for the purpose. For instance, to generate the Risk table, brain storming seems a perfect tool in enhancing the input for the table. Else, capturing all that needs to be captured may be a little challenging. To exemplify this, some inputs were generated and presented as table 1 below.

Please note that the input figures and other parameters were generated during a class session with some undergraduate software engineering students through brainstorming and other available data.

Table 1: Showing risk inputs generated from the use of brainstorming technique and other available data (from the client requirement /requirement engineering) for an action platform

Risk item	Risk category	Components likely to be affected	Probability	Impact level (if allowed to happen)	RMMM (Risk monitoring, mgt &mitigation
Team member	Human resources	Schedule/cost/over head	10%	3	Team members must have clear knowledge of project
Poor estimate and planning	Project team and finance	Schedule, cost and performance	15%	2	Correct budget estimation
Project data	Equipment/tech	Schedule,cost,personnel	20%	4	Backup of files, duplicate duties,
Cyber threats	Technical	Cost/data	10%	4	Build-in/Ensure proper security
Theft/AZrm robbery	Project/technical	Physical systems and others/cost	2%	5	Hire guard, burglary, Install security gadgets

The cyclic management approach of William (2004).

Essentially, the work of Williams (2004) which was one of the earlier works done in the area of risk in the early 2000 used the educational sector as a case study. The approach sees risk management as cyclic events which involve monitoring, identification, analysis, prioritization, planning and mitigation, all of which stands on communication. The work presents an in-depth analysis of risk management, and also provided an insight to inputs for the risk table that are not readily available. For example, the work explains that if numerical values were attached for the probability of a risk happening, (say in percentage) and impact is given in (monetary terms), the risk exposure can then be calculated. According to their work, the risk exposure is given by:

$$\text{Risk Exposure (RE)} = P \times C$$

Where: P is the probability of occurrence for a risk and C is the impact of the loss to the product should the risk occur.

However, less was done to compare what would have been the result if a different model is chosen instead of agile method which was used in the scenario; this could also be improved on.

d) The Rich Picture

The rich picture is a requirement gathering and knowledge elicitation tool which uses cartoon-like and somehow inexperienced pictures, diagram and symbols to aid quick thinking and depict ideas about a situation (Berg and Pooley, 2013). Going by Better Evaluation-BE (2016) analysis, it is a mind map which helps to open discussion, and then later lead to shared understanding of a situation. Though to use this method, one needs to first identify the issue that needs to be addressed, and then develop an unstructured narrative of the scenario of the challenge.

In their work, Bell and Morse (2010) used rich picture to harness solutions to problems from team members mind expressed through their different drawing. According to them, in using this method, two major rules have to be followed.

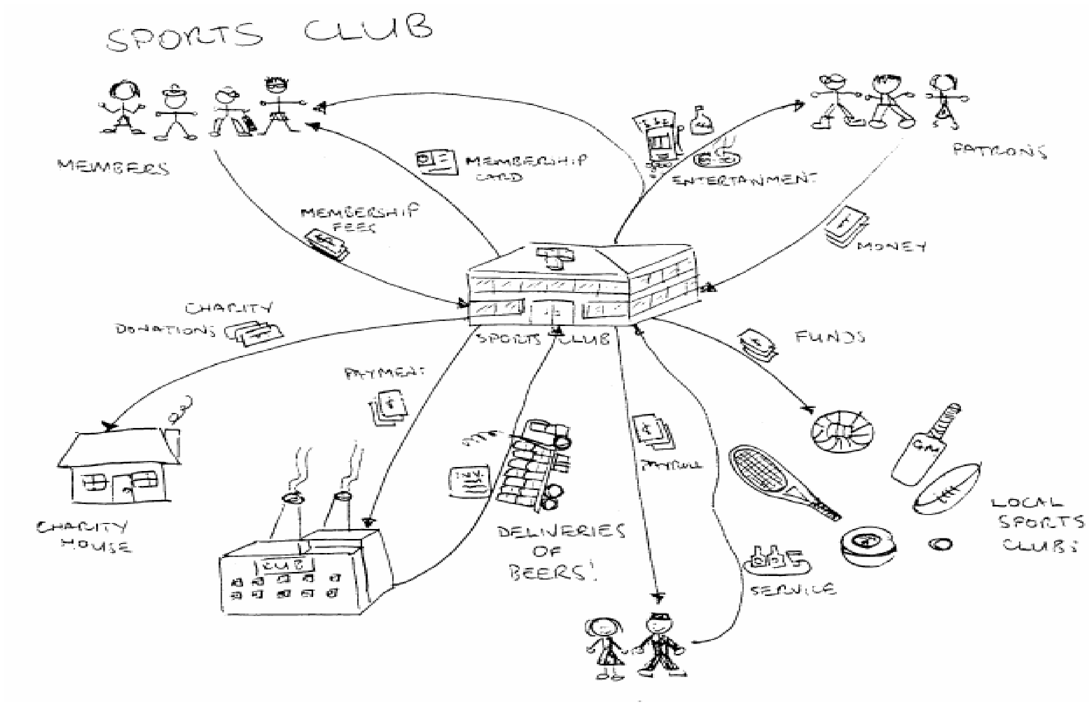
The drawings have to be visible to all team members at all times so it is clear to all what decisions have been made as to the components and linkages within the system being considered. Secondly, text should be limited or avoided totally because diagrams are much easier to appreciate visually.

Generally, the rich picture belongs to the category of soft system methodology (SSM) which is used for gathering information about complex or "hard knot" situation. As shown in fig 1a and fig 1b below, the end point should be a picture of the problem situation ; a very detailed and rich one which can be put together and analyzed within the time frame.

Though Bell and Morse (2010) work depicts rich picture in clear terms and richness in solving the set goal of their work, it however did not present much on the drawback or weaknesses of the model.

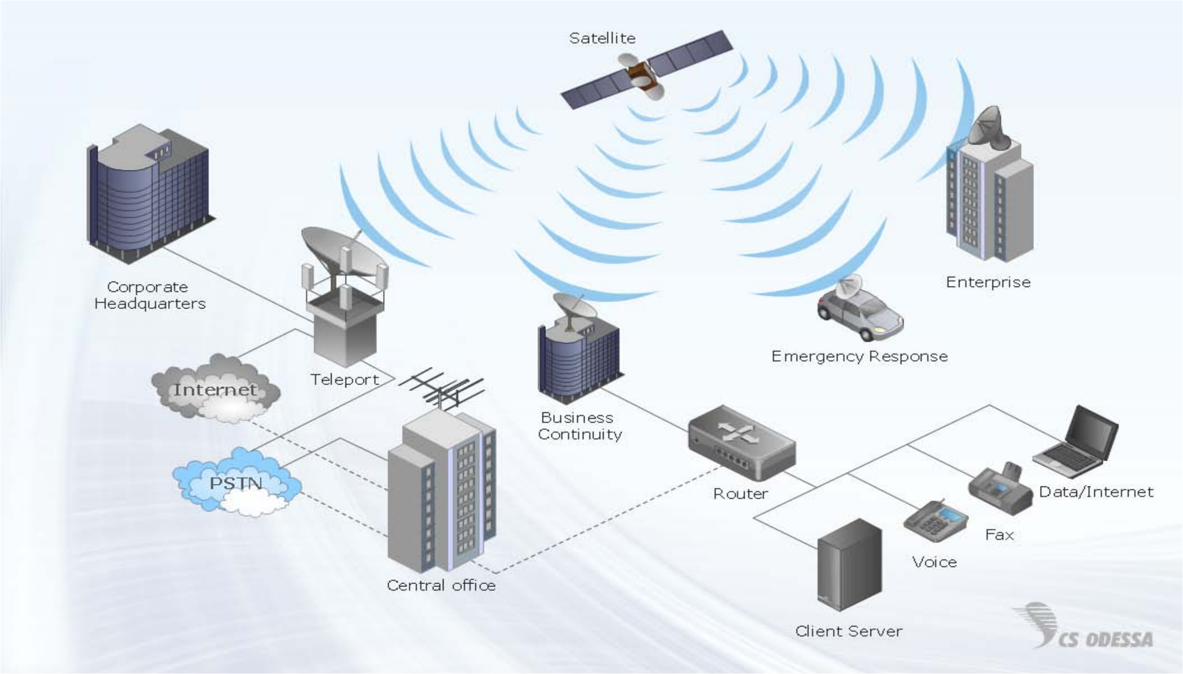
As seen in Pedell and Vetere (2005) and some other works of earlier researchers of the technique, in order to understand the pictures in its true form, the initial sketches might also need to be detailed which may lead to waste of project time. Although to some Information Technology project managers, this may seem like few minutes wasted, but when compared to the execution time of other techniques, this means a lot! And this constitutes a major gap compared to other methods for addressing risk.

Again, the rich picture does not take care of issues of laziness and team members who cannot create or interpret pictorial representations. In most cases, another form of algorithm may be needed for pictorial interpretation.



source: (Horan, 2000)

Fig. 1a: Showing rich picture drawn with free hand



Source: http://www.conceptdraw.com

Fig. 1b: Showing another example of rich picture

e) Brainstorming

Brainstorming is a fast and easy way to generate original ideas for problem solving and innovation (Unicef, 2015). Based on this author, it can be done alone or in a group. However, before the brainstorming exercise, some grand rules must be set for participant. Amongst others, some of these rules include, originality of ideas, no criticism, and the exercise must be done within a time frame.

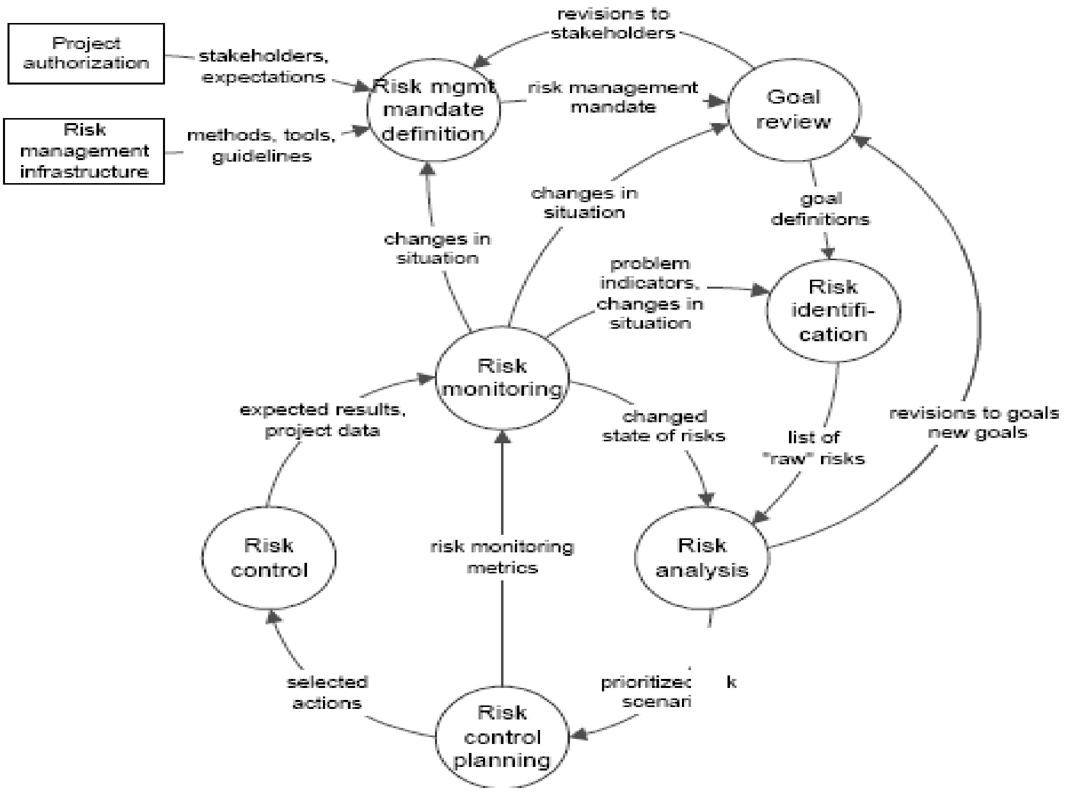
In Naser and AlMutairi(2015) brainstorming technique was implemented to find its effect in improving the problem solving skills for a set of male students in Kuwait. The result tends to be positive as envisaged from the beginning. However, the authors view and usage of this method is too narrow or simply biased along gender line.

Females' capacity to offer solutions and advice has enjoyed lots of advancements with good result in recent times (Forbe, 2014) and (Claremont, 2012). Hence, restricting females to the confines of household limit opportunities and it's a waste of potential for ideas. Again, the author did not analyse the risks embedded in using the approach.

Generally, brainstorming ought to be used for divergent thinking and must be used as such. It is an important strategy in provoking creativity and solving problems in virtually every field. The technique must be applied in a controlled team meeting, restricted to one point per person at a time and judging others is not allowed. Through the technique, lots of ideas about risk and difficult issues can be generated.

f) The Risk Analysis Graph (RAG)

The RAG is an acronym for Riskit Analysis Graph. It is one of the oldest Model or methods of analysing and managing risks. Several works have been done to analysed the RAG. The work of Freimut et.al.(2001) sees Riskit technique as a broad risk management process that is rooted on sound theoretical principles designed to have sufficiently low overhead and complication so that it can be deployed in a real-time limited software development project.



Source : (Freimut et.al 2001)

Fig. 2: Showing RAG.

Based on this author, the model allows the totality of risks captured in the developmental process and the project as a whole to be broken down into components such as factors, events, outcomes of an event, reactions, and effects on overall goals. By doing this, the impact of any risk can be explicitly considered by building up the scenario that encapsulates it.

Furthermore, it allows visual yet more formal documentation of risks and risk areas (enhances communication)

Major limitations noted from this model are in the following areas:

1. Risks prioritization during risk analysis is based on their probability and loss.

2. Documentation effort may be too high.

Literatures consulted for this study show that each of these risk control methods comes with basic strength as well as weakness.

For example the Capacity Maturity Model Integration- CMMI strength could be an advantage when used along with RAG since the CMMI is well grounded in documentation (Coffin and Lane, 2009).

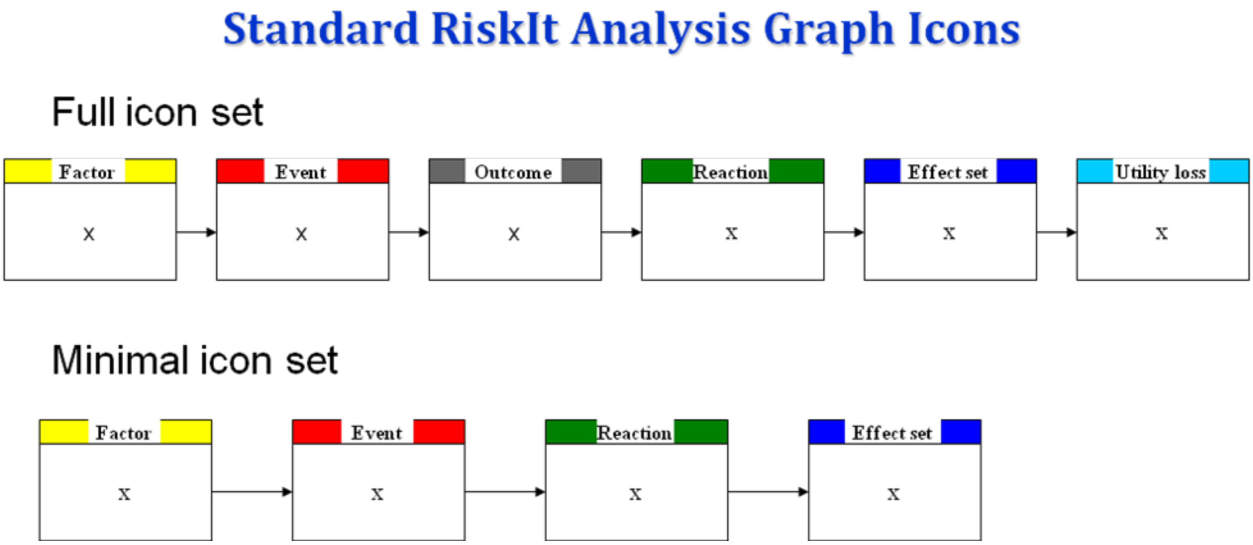


Fig. 3: Showing standard riskit analysis graph icons

g) Software Process Models and Risk

A software process is a planned set of activities which are considered necessary to develop a software system while a software process model is as an abstract representation of a process which presents a description of the process from some particular point of view (Sommerville, 2011). Software process model presents a description of a process from some particular perspective as:

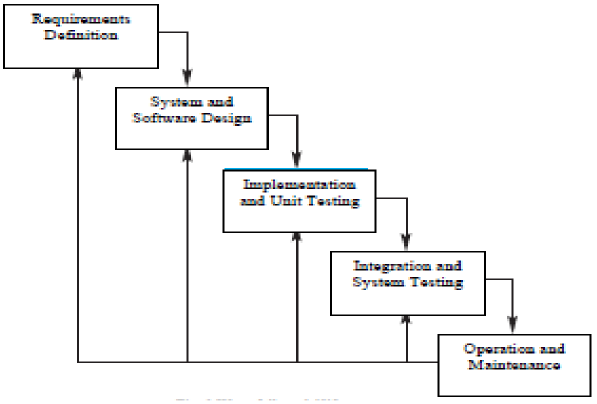
1. Specification.
2. Design.
3. Validation.
4. Evolution.

Several or different process models could be employed for the development of software (Ali Munassar and Govardhan, 2010). Based on this author and deductions from the works of SEI CMMI (2014) and Moniruzzaman and Hossain (2013) these process models which have been used in the past for software development involve the following major process.

1. The waterfall model
2. The spiral model
3. The V- Model
4. Prototyping
5. Extreme programming
6. Capacity Maturity Model Integration
7. Agile

Ali Munassar and Govardhan(2010) work was an extensive comparison work on the major but different models of software engineering. Basically, their work presents the five of the development models namely, waterfall, Iteration, V-shaped, spiral and Extreme programming. Based on the review of some existing work, their study was able to analyse the advantages and disadvantages of the different models, and make comparison amongst them to show the defects. However, this work was just a" literary comparison" no empirical or practical study was done to establish their claims.

We can say based on their work and other literatures, that the models do have their strengths, weaknesses and limitations. While the waterfall model (fig 4) may be used in small or medium projects low overhead and less attention to risk, the spiral model may not be suitable for small projects but has an inherent plan for risk. Hence, for the purpose of this work, our attention shall be on the spiral model. The choice of the spiral model was due to the original tenacity built into it for risk prevention.


Requirements Definition
System and Software Design
Implementation and Unit Testing
Integration and System Testing
Operation and Maintenance

Source: adapted from (Ali Munassar and Govardhan, 2010)

Fig. 4

h) The Spiral Model

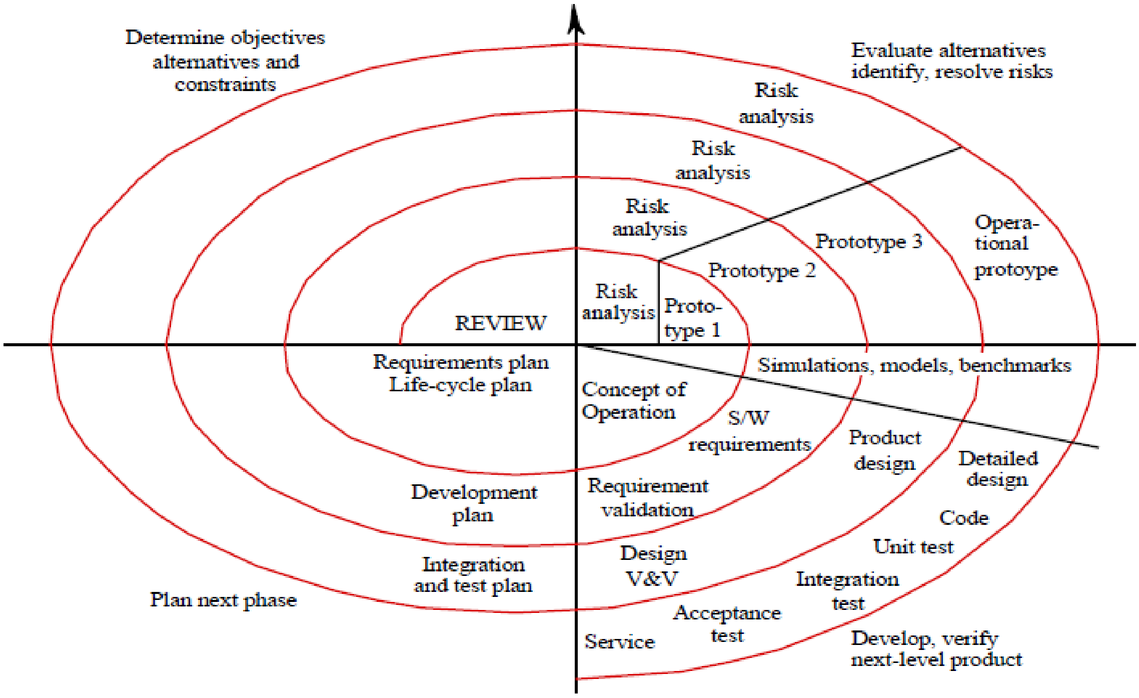
Under normal circumstances, a process model covers the entire lifetime of a product (Sommerville, 2011). Hence, a major risk that can emanate during software development is wrong choice of model. However, once the model is chosen right, the risk is already alleviated to a certain level. A generic software process model with such perception that risk may occur is the spiral model (Ali Munassar and Govardhan, 2010). Software risks were introduced for the first time in the Spiral model by Mr. Berry Boehm (Boehm, 1988; and Khan & Ghayyur, 2010) The spiral model as shown in fig 5 below, operates in loops with all the stages(or loops) of the spiral designed with at least an aspect of the requirement engineering which also include the verification and validation (known as V&V) and a perception of risk.

The development processes are represented as a spiral rather than as a sequence of activities with backtracking. Each loop in the spiral corresponds to a phase in the developmental process. Unlike other models such as the waterfall model, phases such as specification or design in spiral model are not fixed. The different loops of the spiral are chosen based on what is required and risks are explicitly addressed at every loop as they are encountered throughout the process.

Advantages of Using the Spiral model.

Based on the works of Sommerville(2011) and Ali Munassar and Govardhan (2010) amongst others, the following are the advantages of the spiral model.

1. *It is realistic:* the model accurately reflects the iterative nature of software development on projects with unclear requirements
2. *It is flexible:* it combines the advantages of the waterfall model and some evolutionary methods
3. It is a comprehensive model which decreases risk along the loop
4. It provides good visibility for the project



Source: (Sommerville, 2011)

Fig. 5: Showing the spiral model.

Disadvantages

1. It requires great technical expertise in risk analysis and risk management to function well.
2. Model is not so widely used because it is poorly understood by nontechnical management.
3. It involves high administrative overhead because of competent professional management involvement.
4. It may not work well for small project.

i) Review of Related Works

This section showcases previous works done in this area of study (using some other methods) to enhance the quality of software.

The first to consider in this group is Hossain, Kashem and Sultana(2013) work on "Enhancing Software Quality Using Agile Techniques"; their work depicts agile as a capable technique for ensuring good quality in software through measuring the "traditional quality factors" against how they are handled using agile technique. The work began by first Identifying the software quality factors (SQF) and Quality Assurance (QA), then went ahead to describe the agile techniques with special reference to software quality evaluation with agile technique. It however, did not analyse agile flavours, which may make the work a little too broad and difficult to know which one really helps in achieving quality. More on this will be discussed under the gap in research.

In another view by Vashisht, Lal and Sureshchandar (2016) on "Defect Prediction Framework Using Neural Networks for Software Enhancement Projects", they argue that though various approaches have been proposed in the past for effective and accurate prediction of software defects but most are not easily adopted in real life situations. Hence, their work aimed (majorly) at providing a more user-friendly, effective and acceptable framework which will help in predicting the defects in the phases across software enhancement projects. The work began with an analysis of the Software enhancement project life cycle, and then followed by the overview of the neural networks stressing their automatic learning ability over the traditional expert system. The design or proposed framework was later presented. The work is a clear approach to identifying defect and thereby enhancing the quality of the end product. The only set back here is not analyzing other methods such as fuzzy or other classification models to see if or not a neural network is better.

Poth and Sunyaev (2013) research an "Effective Quality Management: Risk- and Value-based Software Quality Management "by designing effective quality management (-EQM) to help software quality management (-SQM) to negotiate acceptable quality targets (based on standard quality factors) with all stakeholders - and to adjust them as the development progresses if need be. Based on their work, the main stakeholder parties are the end users or customers, the development team or department, and the operational management. Most often in software projects some stakeholders, like users or customers, do not personally participate in the quality assurance (-QA) planning process, and make only a review of the QA strategy and plan. In this case, in the first step, the SQM has to substitute for the missing stakeholders in the QA planning meetings. In the second step, the SQM has to legitimate the plan for the stakeholders to accept. The same happens if changes with the planned QA activities are required to react to unexpected occurrences which cause adjustments to the planning.

The authors went further to describe the stages of the IPDCA-cycle of EQM which guides the SQM during the product life cycle. Three different models – the V-model, the Scrum and Spice were presented and analysed in details. The "V-model example is based on the electric/electronic development of an engineering company, while the SCRUM (scrumalliance.org) example is based on the software for an airline's customer benefit program and the spice (ISO/IEC 15504) example is based on the electric/electronic product development organization of an automotive supplier". In all cases, the authors were able to establish its main aim. However their work did not link their findings with other notable metrics for quality.

III. Gaps

After the analysis of the existing works both in the area of problem solving techniques and the closely related works the following were identified as major gaps in their works.

1. From the work of Hossain et.al(2013) agile strength and technique for enhancing quality were clearly outlined; but very little or nothing was mentioned on how agile handles risk when used in software development and how this could help in quality.

   Again the work treated agile technique as a broad topic and did not say much on its different flavours. Although all agile product must conform to agile manifesto but special attention to a particular one among the different flavours (which according to *Ferreira and Cohen, (2008)* include - "eXtreme Programming (XP), crystal methods, scrum, dynamic systems development methodology (DSDM), feature-driven development (FDD), and pragmatic Programming") would have made it easier to know the exact flavor with the strength in making the quality better.
2. Vashisht, Lal and Sureshchandar(2016) view of enhancing quality through defect prediction framework using neural networks-: The work was able to achieve the set objective. It however did not

analyse other methods such as fuzzy or other classification models to see if or not they would have done better than the neural networks in the paradigm being considered.

The work is more like an extension of what they already have in use; it did not demonstrate that risk has a direct impact on quality, it rather infer it and the work did not link their findings with other notable metrics for quality.

Aside these gaps, most of the researchers have only dwelt purely on the generic models. Although they seems to have handled some (NOT ALL) of the identified risk one way or the other, but we don't know if or not other methods could have done it better. For instance, the risk analysis graph (presented as riskit) worked on by Freimut et.al.(2001), is very strong and unique in its approach to risk management and as stated earlier, it is rooted on sound theoretical foundations, helps in overhead reduction of cost and can be applied in real, time-constrained project. However, RAG as a method is a broad risk management process which may not be suitable for medium or small projects such that would be considered as the prototype later in this work

We believe to test their strength and forestall any problem along developmental process, some of the models or methods may have to be combined as hybrid to ensure smooth running e.g spiral and prototyping used vis-à-vis a problem solving method. Another aspect is combining the strength of agile for handling small project and that of the CMMI (though normally used in big projects) for documentation.

IV. Conclusion

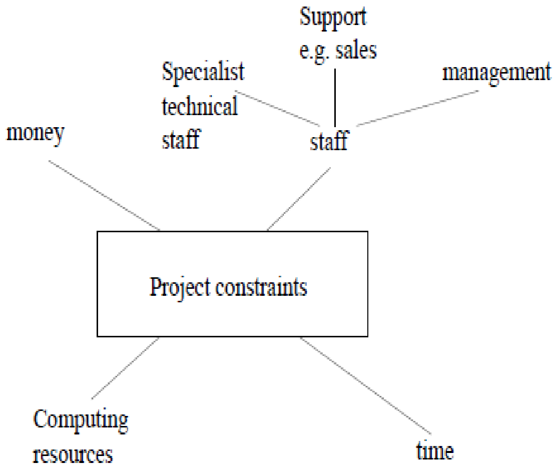
Software development takes a lot of planning, money, team work and energy. The interaction of these basic things called the constraints in Sommerville (2011) is shown in fig 6 below. However, it must be noted that no matter the amount of these factors put into it; it takes just one thing to go wrong for the whole process to go wrong and end up in lesser product quality. Conversely, it takes a combination *of at least three things* to have a quality product. These three things include: tools, technology and methods.

Moreover, after attaining the "initial or presumed quality", measuring it to confirm if actually it is the intended or proposed quality level is another major concern. Hence, some certain metric needs to be put in place to ascertain if or not the end product is qualitative. To this end, Chappell (2012) reports on how the quality of software product can be measured. Going by the report, the following basic and cogent parameters must be looked out for.

a) *Functionality* - this involves factors such as the performance, ease of learning and ease of use plus other things that have to do or fall under the functional requirements of the developed system.

b) *The process that births the software.*

c) *Structure:* this involves code efficiency, maintainability, security, testability, understandability etc.



Source : (Sommerville, 2011)

Fig. 6: Showing software project constraints.

Aside these, the system and other components must meet specified requirements by the client as stated by both parties in the memorandum of understanding (MOU). Again, the development must ensure that the system and other component meet client needs. By monitoring quality risks and product evolution over its life cycle, quality assurance team can make right choices and enhance the quality of product.

The concept of software risk is broad and generally risk abounds in virtually every aspects of software project development. The more we are able to predict them, the easier and smoother the process and the better the quality of software produced at the end of the developmental process.

a) *Future work*

In the future we intend to :

1. Improve on RAG (expand an aspect to capture aspects relating to data during system migration)
2. Do a comparative analysis of two software models - possibly two that were not already analysed here (using some basic factors) to test their suitability and possibly acceptance in software projects.
3. Apply the developed model in identifying and pre-empting risk that may occur in a particular software project area or task.
4. Implement and evaluate the efficiency level of the present models compared with proposed one.

b) *Further proposition on tools to employ in this work*

1. Set theory.
2. Fuzzy logic and;
3. Bayesian algorithm/nearest neighbor (to Hazard /risk) in this case we set conditions for a project entity (say the critical path).

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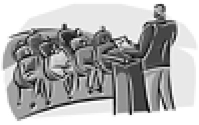
- The “FARSC” is a dignified title which is accorded to a person’s name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

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.

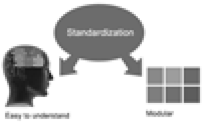


You may join as member of the Editorial Board of Global Journals Incorporation (USA) after successful completion of three years as Fellow and as Peer Reviewer. In addition, it is also desirable that you should organize seminar/symposium/conference at least once.

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 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).

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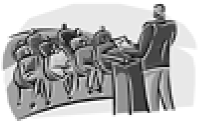
The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

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%.



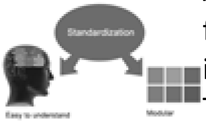
The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

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. 〃

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.

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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
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- 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.

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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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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.

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

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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.

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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.

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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).

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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

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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.

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(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.

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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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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.

The Administration Rules

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.

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

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals Inc. (US).

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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