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Mitigating Security Threats in Virtualized Environments

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ABSTRACT

This paper reviews and provides clarification to the meaning and concept of cloud computing with particular reference to Infrastructure as a Service (IaaS) and its underlying virtualization technologies. The categories of cloud computing and key characteristics of cloud environment are also discussed. A review of virtualization technologies and approaches is presented with key vulnerabilities to security threats and mitigation strategies and countermeasures are also presented. This knowledge is imperative in making virtual Information Technology (IT) environment more secure and robust and can help improve the operational efficiency of Virtual Machines (VMs) in such a manner that organizations can benefit from virtualization technology in particular and the cloud computing systems in general.

Keywords: Cloud Computing, Hypervisor, Security, Threats, Virtualization, Virtual Machines.

1. INTRODUCTION

Hitherto a lot of audience and spectators in the Information Technology (IT) industry tend to see the term “Cloud Computing” as a „mumbo jumbo“. The lack of agreed upon single working definition of the term revealed this fact. This perception underscores the presentation of this paper which is intended to clear the air by restating the definition of Cloud Computing in a more concise number of ways.

According to [1], Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider’s interaction.

Jack [2] defines Cloud Computing as the ability to access data, software applications, storage, communications capabilities, and computer processing power from the “Cloud” of online resources.

In the context of cloud computing according to [2], the term “Cloud” is used to denote those computing resources that are remotely located. This concept of the Cloud dates back to the early days of the Internet; this makes the cloud computing to also be referred to as Internet Computing by some researchers and

technology experts. Cumulus Cloud is used by the Engineers to represent an abstraction of a network whose topology is too complex to be sketched [2].

For better understanding, this paper is organized in the following manner; section one introduced the paper, section two: literature review with clear discussions on the architecture, categorization and characteristics of cloud computing environment, service and deployment models. Sub-section 2.2 focused on virtualization and its approaches, hypervisors and its types, Virtualized Environment and its Associated Security Issues and countermeasures. Section three gives the summary and finally, section four is the conclusion to this paper.

2. LITERATURE REVIEW

To better understand the concept of Cloud Computing; the Architecture, Categorization and Characteristics of Cloud Computing environment, several approaches and models are adopted. Todd in [3] classified Cloud computing into two models namely; the Service Stack model and the Deployment model. Five key characteristics of Cloud environment were also identified.

2.1 Cloud Computing Service Models

The cloud computing service models consists of three stacks of functionalities; Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Like the conventional computer System in which the Users application seats on the Operating System which in turn seats on the Systems'' Hardware, in the service stack model the IaaS is the underlying Hardware, on which the PaaS seats on, and the SaaS seats on the Provisioned PaaS[3]. This service stack model is as illustrated in Fig. 1.

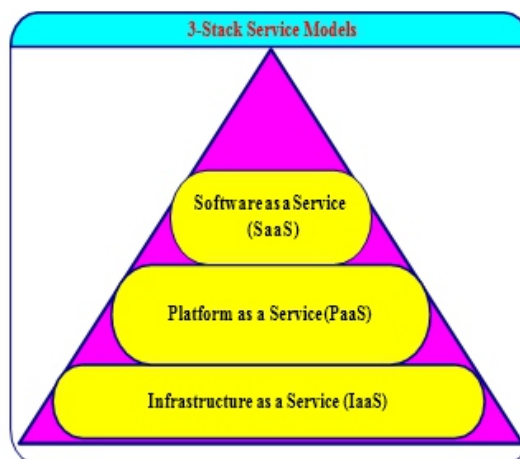


Figure 1: The Three-stack service Model of the Cloud

2.2 Cloud Deployment Models

According to [1] there are four deployment models of the Cloud namely;

- 1) Private Cloud: the infrastructure is provisioned to be utilized by a single corporate entity
- 2) Public Cloud: the infrastructure is provisioned for general public utilization
- 3) Community Cloud: the infrastructure is provisioned to cater for consumers that have shared concerns.
- 4) Hybrid Cloud: the infrastructure is a mixture of two or more distinct cloud infrastructures (private, public and community) that remain unique entities but, are bound together by standardized or proprietary technology that enables data and application portability.

2.3 Characteristics of Cloud Environment

As stated in[4], [3], [1] the five essential characteristics of Cloud environment are; Measured Service, Elasticity, Resource Pooling, On Demand Self Service and Broad Network Access, these are illustrated in Fig. 2.

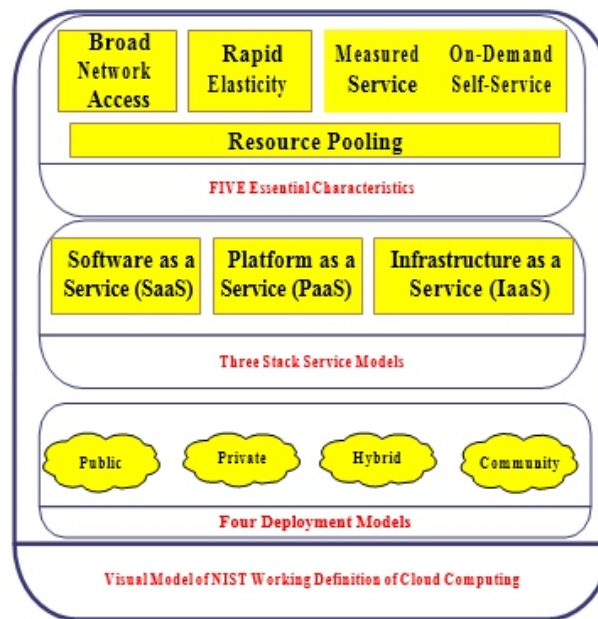


Figure 2: A Visual Model of NIST Working Definition for Cloud Computing [4].

2.3 Virtualization

The concept of virtualization stems from IBM Corporation in the mid-1960s[6] where virtualization at this time was synonymous with time sharing systems. As at that time, multiple computer programmers can seat at their designated terminals to access the same underlying hardware that is, the Mainframe Computer without having to wait for a time slice in order to gain access to the peripheral. Therefore, virtualization got its root from this concept. Consider Fig. 3 as a typical illustration of a virtual environment.

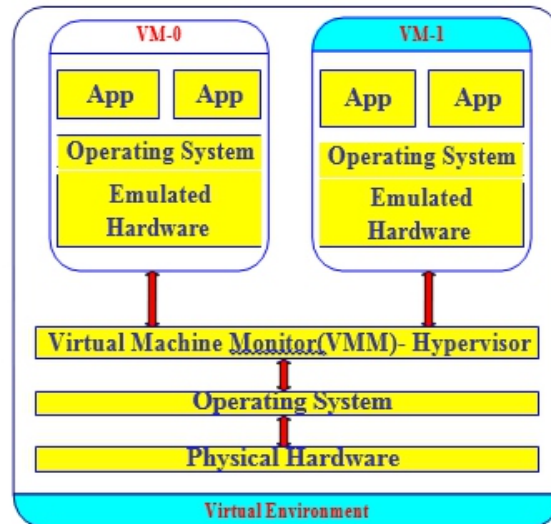


Figure 3: Illustration of a virtual environment [4].

Virtualization technology has today taken the center stage of Cloud Computing. From earlier predictions of Gartner which indicated that by 2012, fifty percent of servers would be virtualized worldwide [12], this has become more realistic today as more and more small to medium scaled businesses are adopting the technology.

In a lucid form, Virtualization is the underlying technology that lays in-between the physical platform or machine and the host Operating System (OS) that is, the interface between the underlying hardware and the OS. This includes the guest OS or Virtual Machine Monitor (VMM) together with the associated applications running on top of it that produces the software abstraction layer (SAL)[4]. The Virtualization Special Interest Group defines virtualization as the logical abstraction of computing resources from physical constraints [5]. One common abstraction is referred to as a virtual machine, or VM, which takes the content of a physical machine and allows it to operate on different physical hardware and/or along with other virtual machines on the same physical hardware. In addition to VMs, virtualization can be performed on many other computing resources, including operating systems, networks, memory and storage [5].

To make virtual IT environments more secure and robust, adequate knowledge of virtualization technologies is mandatory for the installation and audit of virtual systems. Basic audit techniques coupled with proper control over the unique aspects of virtualization technologies can help mitigate the security risks of virtual IT systems. The audit guideline provided can assist in identifying and fixing the weaknesses of virtual IT systems and can help improve the operational efficiency of VMs in such a way that organizations could benefit from virtualization technologies[12].

2.4 Approaches to Virtualization

There are basically three approaches to creating Virtual Systems [7]. Although the implementation to these approaches differs, there exist certain traits that are common to all. The three approaches are namely;

- 1) Full virtualization
- 2) Para virtualization and
- 3) Operating System level virtualization.

The physical server is called the host while the virtual server is called the guest. The guest behaves like the host but it is being hosted on the physical server meaning that the guest runs like any other applications on the physical server (host).

To attain full virtualization, special kinds of software known as Hypervisors are used. A hypervisor in its specialty has the ability to interact directly with the physical systems resources, such as the CPU, Network channels, I/O devices and Disk spaces. It provides a platform on which the virtual system's OS seats. Multiple Virtual Servers (guests) can co- exist on a single physical machine. They Run independently and are even unaware of the existence of one another except when they need to interact or communicate in some sort. The ability of a host to host or house multiple guests is enabled by the Hypervisor[7]. Interestingly, the guests need not run the same OSs, the guests which are virtual servers can be running different OSs such that one is running UNIX and another Windows [7].

The operation of the Hypervisor as explained by [7] is such that it monitors and manages the physical server's resources. As virtual servers run applications, the hypervisor relays resources from the physical machine to the appropriate virtual server. A fundamental issue of concern here is that some of the physical servers' processing power and resources are consumed by the hypervisor itself, which means that the physical server must reserve some processing power and resources to run the hypervisor application. This hinders the overall server's performance and slows down the amount of resources that could be available to run applications and the virtual servers [7].

Paravirtualization approach is slightly different. Unlike Full virtualization, the guest servers are aware of the existence of each another in Para virtualization technique. A Para virtualization hypervisor requires less processing power to manage the guest's operating systems, as each OS is already aware of the demands the other operating systems are placing on the physical server. The whole system works together as a cohesive entity.

The technique of virtualization is entirely different in Operating System level virtualization technique as it requires no hypervisor at all [7]. In view of the hypervisor, the virtualization capability is integrated as part of the host OS, which performs all the functions of a fully virtualized hypervisor. One major drawback of this approach is that it is required that all guest servers must run on a homogenous OS. Even though each virtual server remains independent from each other, their respective OS cannot be mixed and matched among the different independent running virtual machines [7].

2.5 Hypervisors

Hypervisor is a hardware virtualization technique that allows multiple guest OSs to run on a single physical (host) system concurrently [7]. The guest OSs shares the hardware of the host computer, such that each OS appears to have its own processor, memory and other hardware resources. A hypervisor is also known as Virtual Machine Manager or Monitors (VMM) [4]. The term hypervisor stems from IBM in the mid-1950s to refer to software programs distributed with IBM RPQ for the IBM 360/65.

The sharing of the computer's memory became possible as a result of the hypervisor program installed on the computer [4]. When installed on the server hardware, the hypervisor controls the guest operating system running on the host machine. The hypervisor is responsible for catering for the needs of the guest operating system and effectively managing it such that the instances of multiple operating systems do not interfere with one another.

2.6 Types of Hypervisors

There are two basic categories of hypervisors namely Type I and Type II hypervisors. The Type I also known as native or bare-metal hypervisors run directly on the host computer's hardware to control the hardware resources and to manage guest operating systems.

Examples of Type 1 hypervisors include VMware ESXi, Citrix XenServers and Microsoft Hyper-V hypervisors. Type II also known as hosted hypervisors runs within a formal operating system environment from where it runs as a distinct second layer while the operating system runs as a third layer above the hardware.

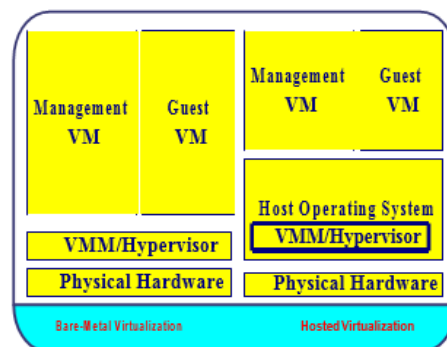


Figure 4: Types of Virtualization Architectures [4].

2.7 Security Issues of Virtualized Environment

One of the greatest set back to the adoption of virtualization technology is the inherent fear of the inherent security risks associated with it as pointed out by several IT industry spectators [8]. Despite the advancement in the way and manner this technology have been deployed over the years, there exist the likelihood that virtual systems are still deployed insecurely[8].

With the increasing adoption of virtualization technologies by different scales of businesses, and the continued existence of this likelihood, security breaches are a potential risk that could impede the rate of adoption in a considerable manner if not properly tackled. According to Kaspersky Lab [8] 69% of companies in the U.S are currently implementing or have already implemented server virtualization, while 46% plan to implement virtual desktop infrastructure and 51% plan to go for virtualized data storage. This shows that the perception of virtual security risks among businesses worldwide is alarmingly unsound. It is believed that virtual infrastructure has to be treated with the utmost attention in terms of security, and failure to do so could result in significant damage. Therefore, addressing the security risks associated with virtualization technologies will motivate and assures potential businesses in their adoption bid.

2.8 Vulnerabilities of Virtualization Technologies

Cox [9] identified Virtualization technology as a core feature where top Cloud Computing threats occur. He identified four areas of threat to Virtualization, these are reviewed as follows:

- 1) Trojanized Prebuilt Virtual Machines (VM)/virtual appliances that is, VM containing malicious codes;
- 2) Improperly Configured Virtual Firewalls or Networking;
- 3) Improperly Configured Hypervisors and
- 4) Data leakage through offline images

The need for the building of defense strategies to counter virtualization security risks cannot be over emphasized as the concept though trivial but often overlooked. The hypervisor and its guests are really one big pile of code in one physical box. There is no guarantee that the hypervisor is more secure or less buggy than any other software of comparable size unless evaluated and analyzed based on some criteria like the United State Government Department of Defense (DoD) Trusted Computer System Evaluation Criteria[9]. Undertaking critical analysis about security threats on virtual systems can no longer be leveraged upon the security features that used to exist at physical isolation/separation level , as such isolation/separation seized to be on virtual systems[9].

2.8.1 Trojanized Virtual Machines/Virtual Appliances

The top virtual environment security risks that should be addressed are checking the presence of untrusted virtual machines or Trojanized virtual appliances[9].The untrusted VM will manifest itself in public clouds that is multitenant, this scenario open up loophole that is capable of bringing up a malicious system that will attempt to identify proximity related vulnerabilities. The threats are created because the VM is either running on the same hypervisor or within the same cloud, and the cloud provider has created some level of “trust” between the virtual machines that the consumer is not aware of. If those vulnerabilities exist, the likelihood of exploit increases significantly[9].

Malicious virtual appliances (an appliance in this sense is anything that is pre-packaged which is downloadable and could be run as a VM) would be a threat in public or private cloud environments. Since these appliances could be downloaded, installed and used, there is an element of trust bestowed to them. The malicious system would then attempt to find vulnerabilities through its “trust” and exploit them. Once an attacker has a compromised machine in the environment, the intrusion and subsequently the attack will succeed. An instance of this scenario is the Amazon’s experience where their Elastic Compute Cloud (EC2) customers were notified that they had identified compromised Amazon Machine Images (AMI) in its community set of AMIs which is stacks of software created to help users deploy servers quickly in EC2. The notification reminded users about the danger of compromised AMIs.

Amazon realized that a compromised “appliance” or “build image” provides a trusted foothold in obtaining critical information, such as credentials for further exploit.

Counter Measures

The key to mitigating these threats are to use only verified and tested appliances/images, and have assurance that your cloud provider has properly configured hypervisor and networking configurations that do not create unintended proximity trust while keeping in mind the nature of physical isolation/separation in the virtualized environment and configure systems accordingly. In addition, users of these appliances should verify that a program running on the cloud is executing properly. This amounts to a guarantee that no malicious code is interfering with the programs execution [13].The same system also protects the data used by applications running in the cloud, cryptographically ensuring that the user won't learn anything other than the immediate results of the requested computation.

2.8.2 Improperly Configured Virtual Firewalls or Networking

In the conventional setting, it is the networking team that does all the configurations of networking devices and firewalls. They have the professional knowledge on the intricacies of security and

implication of VLANs, tagging, routing, stateful connections, how inbound vs. outbound apply to interfaces etc. This may or may not be true for many host administrators. In a virtual environment, many of the host administrators are now configuring and managing these network security devices. If these devices are not configured correctly, one can have traffic meant for one VM being seen or delivered to another VM or an outside entity.

While tools exist to do this right, it is primarily a “people issue” in that administrators are being asked to manage security devices they do not understand. Overlooking this will amount to security vulnerability that could be exploited by attackers.

Counter Measures

The key to minimizing this security risk in a virtualized environment is to have the network team handle the networking in the virtual environment, even though the virtual networking devices are not physical pieces of networking equipment. Alternatively customers should be provided with sets of configuration offers to select from the one that best suit their purpose. If these are not convenient, then training the host administrator in the security aspects of network configurations is the next best mitigation strategy.

2.8.3 Improperly Configured Hypervisors

The security of a hypervised environment is directly linked to the security of the hypervisor itself; any unauthorized access to the hypervisor compromises the environment. The main threat here is in access rights, permissions and privileges; a lack of control to limit who can gain access, and once in, what permissions they have to do what and to what extent. These are pretty straightforward threats in that allowing unrestricted access to hypervisors, especially one that can be reached from an untrusted network (e.g., the Internet) increases the threat of attacks. Secondly, if restrictions are not placed as to who and what legitimate users can access once they authenticate, it will become a vulnerability that could be exploited to carry out attacks.

The first vulnerability, according to [9] is easy to deal with by restricting what systems can get access to the management functions (GUI, API, login, etc.). The second is not quite as easy, because a robust access control mechanism to allow access/management of the user’s VMs (workloads), but not to the host is needed. Furthermore, it is likely that one want to allow certain operations on the host to some users, but not all operations. The underlying access control mechanism must be able to support this. Since many cloud providers (e.g., Amazon) are building hypervisors almost from the ground up, getting the necessary access control mechanisms is difficult.

Counter Measure

The key to minimizing this threat is the use of a more granular role-based access control mechanisms to the hypervisor and management applications [9].

2.8.4 Data Leakage through Offline Images

When guest images are suspended, unlike physical systems that would need physical access to pull data out of memory, the memory “footprint” now is in a file, and for all intents, searchable. Take an application securing Social Security or credit card numbers for instance, the VM may be solid and secured, however, when the system is suspended, any information put in memory is likely not protected and assumed to be volatile. The problem arises when the image suspends and writes that memory to disk. Also, with migration, information states that would never have existed before now exist which must also be protected [9].

Counter Measures

The nice thing about virtual security is that if there is a good security program in general, there will likely be a secure virtual environment as well. The fact is that if old system administration practices (as they relate to security) are applied to virtual environments, there will be better chances to minimizing virtualization security risks and a secure environment [9].

Although Malware for hypervisors are rare, they could have a significant effect on the trustworthiness of a system [10]. For hypervisor malware to increase in occurrence, it is likely that criminals would need to find ways to more easily monetize attacks on the hypervisors [10]. However, given the high level of access that could be gained by compromising a hypervisor, these types of attacks is one of several virtualization security concerns that are likely to increase in occurrence and could cause significant disruptions, such as denial-of-service (DoS) attacks or the compromise of sensitive data.

Also, some hypervisors are vulnerable to malware attacks because of the platform they run on. Microsoft Hyper-V, Virtual PC and certain versions of VMware, run on top of Windows, and other hypervisors are Linux-based systems. The Linux or Windows server components could be attacked to compromise the security of the virtual infrastructure[10] but as we all know, Linux systems provides better security than Windows platforms.

Apart from the methods specified by researchers at North Carolina State University and the IBM, new approaches exists that could be used to prevent malware from infecting hypervisors [10]. These approaches include isolating the management interfaces of, and connections to the hypervisor to only

the systems that need access, not running un-trusted code on the hypervisor, such as software not provided by the hypervisor vendor and keeping the hypervisor software up to date. This excludes security measures applicable to the guest OSs in the virtual infrastructure to ensure the guests cannot be used to attack the hypervisor.

2.9 New Generation Fire Walls as a Countermeasure

The list of the various threats/risks associated to this age long technology of virtualization is unending therefore there is no single solution to mitigate threats. However the use of New Generation Fire Walls (NGFW) is proposed as against the traditional firewall, which does not give a high level of granularity to the security controls.

The IT Project Center[11] gave the operational framework of NGFW. Firewalls are like bouncers or doormen. They stand at the entrance to coordinate network traffics, deciding what traffic comes in or out and what traffic gets prevented from doing so based on a set of rules. The traditional firewall uses port-based rules, blocking traffic to most ports, but allowing traffic in (and out) to specific ports for specific types of traffic. This approach was fine in the past, but the rise of Web 2.0 applications has highlighted a problem with port-based firewalling. Many Web applications especially social networks such as Facebook for example, run over port 80 (http) or port 443 (https). To block employees from using Facebook applications, ports 80 and 443 have to be blocked. And blocking ports 80 and 443 would not only block access to Facebook application but will also block the entire Web.

A next generation firewall provides far greater granular control over traffic coming in and out of the network. It provides standard firewall capabilities such as packet filtering, NAT, stateful protocol inspection and VPN capabilities, but in addition it offers application awareness with full stack visibility. This implies that a next generation firewall gives the capability to inspect exactly which applications are being used on the network. This may include previously undetected, bandwidth intensive applications such as streaming video and audio services and even peer-to-peer file sharing applications, which may be illegal.

More importantly, the next generation firewall also provides control to application usage by identifying the applications and enforcing network security policy at the application layer independent of port and protocol. For instance, one can

- 1) Allow Facebook but not Facebook applications such as Candy Crush Saga
- 2) Allow Skype for voice-over-IP but not for file sharing
- 3) Allow webmail attachment downloads but not attachment uploads
- 4) Simply apply application blacklists or whitelists

Next generation firewalls can also use external intelligence sources such as reputation systems to enhance blocking decisions. Most next generation firewalls integrate with corporate directories such as Active Directory which help one to apply firewall rules to some groups of employees but not to others. For example, one can create a rule allowing sales and marketing staff to use a certain set of Web applications, while contractors or temporary staff can only use a subset of those. At the same time, one can give board members unfettered Internet access.

Next generation firewalls typically go beyond firewall functionalities by including a range of other security features. These can usually be enabled or disabled as appropriate. Some next generation firewalls include all the functionalities in the base price, while others offer a more flexible approach by including the basic firewall functionalities in the base price with additional functionalities available for an added license fee.

In this respect next generation firewalls share many characteristics with all-in-one security appliances, often called unified threat management devices or security gateways. The key features that distinguishes a next generation firewall apart from the application awareness is the integration of all these security functions into the firewall core, so that they can all be carried out at high speed in a single pass as traffic flows through the firewall.

By contrast, unified threat management devices generally combine a number of security functions in one box, with software that integrates the management of these functions to a greater or lesser extent. But each of these security functions is performed separately and in series, leading to performance that is generally lower than a true next generation firewall. Even so, enabling additional features such as IPS or even malware scanning in a next generation firewall can make a significant difference to the throughput capability of the device. A next generation firewall that is rated as having a maximum 1 Gbps throughput may only be able to handle 500Mbps or less when all the security services are enabled.

Other additional security features that next generation firewalls offers include:

Intrusion Prevention

Early next generation firewalls offered fairly rudimentary IPS capabilities, but more recent ones generally offer IPS on a par with standalone solutions.

Anti-malware Scanning

This involves centralized scanning of all traffic coming in to the network. This should not be seen as an alternative to endpoint anti-virus software; however, malware that passes undetected through the firewall may be spotted by endpoint software during a routine scan a few days later once anti-virus signatures have been updated to detect that particular piece of malware.

Secured Socket Layer (SSL) Inspection

Encrypted traffic can be a blind spot for many organizations. Next generation firewalls solve this problem using homomorphic cryptography and by issuing self-signed certificates to endpoints. By this, they can then work as a “man in the middle”, intercepting SSL transactions, decrypting them, inspecting the traffic and then re-encrypting them and sending them on to their destination[11].

3. SUMMARY

Virtualization is the underlying technology of Cloud Computing which has given the small scale firms in the IT industry the opportunity to rapidly setup and grow and relieving them of the burden of infrastructural acquisition as utilization of this pool of resources is measured, metered and paid for on a pay as you use basis. With the various security risks envisaged in the technology, it is believed by IT Professionals that the security risks in a virtual environment are significantly lower than those for physical infrastructure. While many are still skeptical about the adoption of the cloud system for fear of threats and attacks, it is noteworthy that the perceived vulnerabilities of virtualized environments could be mitigated with proper security measures and controls.

4. CONCLUSION

Cloud computing has come to stay as the computing technology of the next century with virtualization as its realization tool. In this paper, cloud computing with its underlying virtualization technology has been reviewed and possible security vulnerabilities that present threats in virtualized environment with countermeasures have been identified and discussed. The pace at which virtualization technology is being embraced by organizations can be a cause of concern if robust security features are not applied to the virtual IT systems. To make virtual IT environments more secure and robust, adequate knowledge of virtualization technology is mandatory for the installation and audit of virtual systems. Basic audit techniques coupled with proper control over the unique aspects of virtualization technology can help mitigate the security risks of virtual IT systems. The audit guideline provided can assist in identifying and fixing the weaknesses of virtual IT systems and can help improve the operational efficiency of VMs so that organizations benefit from virtualization technology optimally in trust without perceived threats of security risks.

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Analysis of Television and Internet Services at Rural Places in Pune District

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ABSTRACT

This study is based on questionnaires presented to people from rural places from Pune district. People were satisfied with Internet service available in their area but they are more satisfied with Television entertainment services.

Keywords: Television, internet, services, satisfaction.

I. INTRODUCTION

The role of telecommunication has changed dramatically in recent years, with respect to industry trends which are competitive vendors, carriers, alliances and network services and growth of Internet and World Wide Web. The technology trends which has Internet, digital fibre optic and wireless technology to create high speed local and global Internet-works for voice, data, and images, audio and video communications.

Telecommunications can be used for a wide range of applications for stores on rural main streets, for education, libraries, health care and social services, agriculture, tourism and other rural industries, and for other applications not yet discovered. The operative word is „can“ whether these applications will be widely implemented may depend on the vision of state and federal policy makers and regulators. The underlying rationale must be that universal access to information is critical to the development process. Mobile services, Mobile services also need to be universally available. Mobile communications can be particularly important to people who spend much of their time on the land far from their homes, or who travel long distances across the countryside.

Application trends towards use of Internet, enterprise intranet and inter-organizational extranets to support electronic business and commerce, enterprise collaboration and strategic advantages in local and global markets.

Broadcast TV, High-definition TV, Enhanced pay-per-view, Video-on-demand, Interactive TV, Interactive video games, Video catalogue shopping, Distance learning, Multimedia services, Image networking, Transaction services, Internet access, Telecommuting, Videoconferencing, Video telephony, Wireless access .

Information Technology has become major facilitator for human being, organizations, business and application. Information Technology is creating transformation in the way business is conducted, facilitating transitions to a digital economy. The digital economy refers to the convergences of computing and communication technologies on the Internet. Large numbers of well paid opportunities appearing in the emerging area such a Internet (Web page design and operation), e-commerce, network security, system development, telecommunication, multimedia design, artificial intelligent and document management.

Internet access through Public Switching Telephone Network (PSTN), it was there is only one telecommunication service which only provided Data Service through Public Switching Telephone Network (PSTN). Therefore Data Service was provided refer PSTN service. It was that telecommunication companies provided dial up connection while subscriber want to access Internet service with has limited bandwidth (64 kbps). Then it was upgraded to the latest DSL technology such as DSL (Digital Subscriber Line) such as ADSL (Asymmetric Digital Subscriber Line), SDSL (Symmetric DSL), HDSL (High Data bit rate DSL), and VDSL etc.

Connecting Internet via Local Area Network (LAN) Server (56 Kbps or faster) cost can be spared over multiple LAN users.

Connecting via Serial Line Internet Protocol (SLIP) or Point-to-Point Protocol (PPP), users have modem with specialized software to dial into a SLIP/PPP server through a service provider at \$30 per month or less, which is useful for employee working at home.

This study relates to IT services in India, major role of service provider as to give sustainable services with innovative way. Information Technologies and business systems that use to work more intelligently, efficiently, importance on people, organizational structure organizational strategy and management process. Information Technology focus on well paid opportunities such as the Internet (web based designed and operation), e-commerce, network security, system development, telecommunication, multimedia design, artificial intelligence and document management. Transition to E-government has six stages:

Information publishing and dissemination, Multipurpose Portals, Portal personalization, Clustering of common services, Full integration and enterprise transformation, Service Quality and Upgrading.

While quality of service is certainly not a uniquely rural concern, it is likely to remain a pressing rural issue because carriers for urban and rural areas are likely to invest more in upgrading and maintaining the potentially more profitable urban and suburban networks.

Rural disparities, in addition to rural or urban disparities, there may be disparities in service quality within rural areas, with high quality networks available only to some users. For example, in many states, the state lotteries have data communications links with every county, while rural residents, schools, and businesses may still be waiting for access to comparable facilities.

Digital switches can become platforms for a wide range of services, such as compressed digital video for teleconferencing and distance education. Another enhancement is Common Channel Signaling System 7 (Ss7), a digital switching enhancement that separates signaling and transmission functions, with several advantages including extending signaling information to subscribers and the ability to set up services through access to databases.

Rural users are concerned about price as well as quality of service, especially where LEC boundaries, intraLATA tariffs, and limited access to competing interexchange carriers (IXCs) may contribute to high costs in reaching their communities of interest.

Rural subscribers often have to pay toll charges to call places such as government agencies, doctors' offices, and stores and services that urban dwellers can reach with a local call. A way to reduce these disparities is to consider communities of interest in pricing of services. For example, local calling areas for rural residents can be designed to generate the same percentage of local calls compared to all intraLATA calls made by urban residents. Alternatively, toll free access can be provided to frequently contacted public services. Some specific solutions include:

Extended Area Service (EAS). EAS offers callers an option of discounted or flat-rate calling within a zone.

Toll-free access to government services. Various approaches can be used to offer toll-free calling to regional government offices or other important social services.

States including Colorado, Georgia, and Louisiana have extended local calling areas to enable rural citizens to reach county government offices with a local call.

II.METHODOLOGY

To study the various information technology services available at rural places in Pune district, and to understand problems of connectivity at rural places in Pune District.

The researcher has adopted Methodological approaches in research design of the topic. The study is focused on the availability of Information Technology Services and Network Connections at Rural

places in Pune District. The study is trying to find out the usage of Information Technology services in rural area also the study shall investigate the impact of IT services on the life of rural area. The study shall investigate the awareness, need, frequency of use, performance satisfaction of using, Benefits about IT services. Researcher shall investigate Internet connectivity and Mobile Services Network in rural area of Pune district and trying to understand the upcoming new technologies, and interest of rural people in using them in rural area of Pune district.

Research Hypotheses:

H1 The villagers are of the opinion that Internet services rather than entertainment services are essential and are satisfied with Internet services.

These questions, immediately correlate to the research objectives, are integral to the testing of the hypotheses and are essential for the answering of the research questions.

Researcher had to understand the problems and prospects of rural Information Technology Services and network problems and prospects. Since the requirements of Information Technology of various villages were to be understood and documented, an exploratory design was chosen to conduct the study.

Sample size and Sampling method:

As there are different types of IT requirements of in different people, looking at the universe stratified random sampling was done with the sample size of 150 (around 10% of total villages that is 1500) was selected as representation of population. The method of sampling used was non probability random sampling. Researcher has selected group of respondents like Student, Employee, Self Employee, Farmer and Other (daily wages, Landless etc.). Family structure whether joint / nuclear as well as Monthly Income (Below 3,000/ 3,000-5,000/5,000- 10,000/10,000-20,000/Above 20,000)

The purposes of gathering information were distributed among different respondents. They are designed for statistical analysis of the responses. Type were considered for the purpose i.e. some question are in the form of Yes/No type, some descriptive, for some scale was provided.

For this study researcher has selected 150 villages out of villages in Pune District and collected one questionnaire from each village. Researcher has collected basic information right from demographics as well as IT services available, usage, awareness, Need of service, benefit, Interest of using and opinion of village people.

Secondary Data Collection:

Secondary data for the study was taken from various Indian and Foreign surveys, manuals, websites, magazines, etc.

Analysis and Interpretation of Results:

Once the data is collected, analysis and interpretation of results is one of the important steps in research. This process is linked with various operations. Like - establishment of categories, the application of these categories to raw data through coding, tabulation and then drawing statistical inferences. There exist different categories through which new data can be classified like coding, editing and tabulation. After this classification, analysis of work is based on the computation of various percentages, coefficients etc., by using statistical methods and formulae. In the process of analysis, relationships or differences supporting or conflicting with original or new hypothesis should be subjected to tests of significance to determine with what validity of data can be said to indicate a conclusion.

Research Tools used:

Researcher assumed the Normal Distribution for interval estimation for the % of data with given attributes at the confidence level of 95%.

In probability theory and statistics, the normal distribution or Gaussian distribution is a continuous probability distribution that describes data that cluster around the mean. The graph of the associated probability density function is bell-shaped, with a peak at the mean, and is known as the Gaussian function or bell curve.

The normal distribution can be used to describe, at least approximately, any variable that tends to cluster around the mean. For example, the heights of adult males in the India are roughly normally distributed, with a mean of about 70 in (1.8 m). Most men have a height close to the mean, though a small number of outliers have a height significantly above or below the mean. A histogram of male heights will appear similar to a bell curve, with the correspondence becoming closer if more data are used.

Chi-square test is used by researcher to find out the dependency of the variables. This has also helped researcher to find out whether there is difference sector wise in the security requirements of the organizations.

III. ANALYSIS OF TELEVISION ENTERTAINING SERVICES AND INTERNET SERVICES

According to the census 2001, Pune District has population of around 4,485,000 (2005), 71 % population is literate, geographic area is 700 km² (270 sq mi). Pune District has 14 Taluka, there are around 1500 villages. Researcher has taken 12 Taluka and 150 villages as a sample for data analysis.

Table 1 Population of Villages:

Total Villages	150
Mean	2217
Minimum	1015
Maximum	6046

Table 2 Age Group of 150 respondents:

Age Group in years	15-20	20-25	25-30	30-40	40-45	Above 45	Total
Respondents	15	43	65	15	12	Nil	150

The researcher has collected data from respondents having age of 15 years and above.

Table 3 Profession of 150 respondents:

Profession	Student	Service	Self Employed	Farmer	Other	Total
Respondents	25	34	53	27	11	150

Maximum respondents contacted by the researcher were self employed. In villages most of the people are self employed or engaged with farming.

Table 4 Education level of 150 respondents:

Education	Secondary	Higher Secondary	Graduate	post Graduate	Total
Respondents	30	67	41	12	150

Table 5 Monthly Income of 150 respondents.

Monthly Income	Below 3,000	3,000- 5000	5,000- 10000	10,000- 20000	Above 20,000	Total
Respondents	14	81	42	13	0	150

It was observed that monthly incomes of people staying in villages are having less than Rs. 20,000.

Table 5 Family type of 150 respondents

Family Type	Joint	Nuclear	Total
Respondents	86	64	150

In villages researcher has observed joint families. Because of the old tradition and their convenience people stay in joint families.

Amenities available	Yes	No	Total
Internet	57	93	150
	38.00%	62.00%	
Mobile Phone shop	121	29	150
	81.20%	18.80%	
Cyber Café	37	112	150
	24.80%	75.20%	
Television	150	0	150
	100.00%		
Mobile Phone service	150	0	150
	100.00%		
Computer Training	64	86	150
	42.30%	57.70%	

It was observed that only 38% villages are having Internet facility, 81.2% villages are having mobile phone shop available. 24.8% villages are having cyber café. 100% villages are having television access. 100% villages are having mobile phone service shops. 42.3% villages are having computer training centres.

The researcher has found out that the villages in Pune district are not having good Internet services where as they have good mobile connectivity.

Table 7 Electricity available in 150 villages:

Amenity	Available	Percentage	Not Available	Percentage	Total
Electricity	150	100	0	0	150

All the villages were having electricity connections, but the continuous supply of the electricity is a major problem in rural parts of Pune district.

IV. COMPARING ATTRIBUTES IN TELEVISION ENTERTAINING SERVICES AND INTERNET SERVICES

Table 8 the Internet available in 150 Villages.

Amenities	Yes	Percentage	No	Percentage	Total
Internet	56	37.33	94	62.67	150

It was observed that only 37.33% villages are having Internet connections. This reveals that Internet services have not yet reached to the rural parts of Pune district.

V. UNDERSTANDING OF TELEVISION ENTERTAINING SERVICES AND INTERNET SERVICES

Table 9 Awareness of using Information Technology Services: Telephonic Communication, VOIP and PBX.

	Aware	Not Aware	Total
Information Technology Services Telephonic Communication	150 (100.0%)	0 (0%)	150 (100%)
Information Technology Services VOIP	9 (6.0%)	141 (94.0%)	150 (150%)
Information Technology Services PBX	25 (16.8%)	124 (83.2%)	149(100.0%)

100% population staying in villages is awareness about telephonic services. Majority of them not aware about various related services. They need to be told about various facilities like VOIP and PBX.

Table 10 Awareness of Television Services: Doordarshan (National Television), Cable TV, Accessing Information, Satellite TV, Entertainment Program, Learning Activities.

Television services	Aware	Not aware	Total
Doordarshan	150 (100.0%)	0 (0%)	150
Cable TV	87 (58.0%)	63 (42.0%)	150
Accessing Information	38 (25.3%)	112 (74.7%)	150
Satellite TV	64 (42.3%)	86 (57.7%)	150
Entertainment Program	150 (100%)	0 (0%)	150
Learning Activities	66 (43.6%)	84 (56.4%)	150

It was observed that most of the people in the rural do not know about various television services available and how to use them. They understand that television is only for entertainment. They are not aware about its other benefits like accessing information, learning activities, Internet usage etc.

Table 11 Awareness of Computer Services: Data Storage, Analysis of Information and Writing Reports.

Computer services	Aware	Not aware	Total
Data Storage	87 (58.4%)	62 (41.6%)	149
Analysis of Information	8 (5.3%)	142 (94.7%)	150
Writing Reports	86 (57.0%)	64 (43.0%)	149

There were 94.7% people who said that they are not aware about analysis of information on their computers. Most of the computer users from rural area are not aware of benefits of having a computer. They consider computer for data storages and only for writing reports. There is a greater need to make them understand the benefits of its other usage like information analysis etc.

Table 12 Awareness of Internet Services: Communication, Web Services, Information Retrieval, Internet Telephony.

Internet Services	Aware	Not aware	Total
Communication	56 (37.6%)	93	149
Web Services	56 (37.6%)	94 (62.4%)	150
Information Retrieval	56 (37.6%)	94 (62.4%)	150

Table 13 Useful Services to the 150 villages.

Tick the useful Service for your Village	Availability of Useful Services	Percentage
Telephone	150	100
Radio	150	100
Computer	112	74.66
Teleconferencing	8	5.333
E-mail	56	37.33
Online Ticket Booking	75	50
E-Governance	8	5.333
Mobile Phone	100	100
Television	100	100
Internet Services	112	74.66
Videoconferencing	8	5.333
E-Commerce	6	4
Online Banking	75	50
Kiosk Centres	15	10

It was observed that 100% villages are having telephone and radio facility for communication. Although most of them are aware about various information services like e mail, online ticket booking, and e-Governance. Either they don't understand how to use that or they are not aware of its benefits.

Table 14 Frequency of Telephone Usage per day response from 150 villagers.

Telephone (Calls) Data	Frequency of Usage per Day	Percentage
Up to 5 calls	87	58
Up to 10 calls	38	25.33
Above 15 calls	25	16.67

Majority of the respondents were making up to five calls from their telephones. There is a very low usage of telephone and they consider it costly affair.

Table 15 Television Usage per day response from 150 villagers.

Television(Hr.)	Frequency of Usage per Day	Percentage
Up to 2 Hr.	66	44
Up to 5 Hr.	35	23.33
Above 5 Hr.	45	30

Respondents were watching television up to 2 hours.

Table 16 Computer Usage per day response from 150 villagers.

Computer(Hr.)	Frequency of Usage per Day	Percentage
Up to 2 Hr.	85	56.67
Up to 5 Hr.	35	23.33
Above 5 Hr.	29	19.33

Majority of the respondents were using computer up to 2 hours. There is a greater need to create awareness about usage of computer so that they will get attracted towards using various Information Technology Services.

Table 17 Bandwidth availability

For Internet Connection	Bandwidth availability response from 150 respondents	Percentage
Dial Up (Phone line -Speed 56 kbps or slower)	14	9.33
ISDN (Phone line- Speed 128 kbps)	10	6.67
Satellite (Phone line to Wireless -Speed 400 kbps or slower)	0	0
Cable (Cable -Speed up to 2.5 mbps)	21	14
DSL (phone line -Speed up to 8 mbps)	11	7.33

It was observed that the 14% villages were having dial up facility for their Internet connection.

Dial-up service, subscriber chooses username and password, once the modem calls the phone number and makes a connection takes place in which information is exchanged between the computer modem and the remote server. Dial-up service is the least expensive but also the slowest type of Internet access. Due to the limited bandwidth, the ability for the modem to send and receive data - dial-up service can take up to five minutes to download just one megabyte of data. Dial-up transmits data across the telephone line using the standard analog frequency, making it impossible to use telephone while online. Dial-up Internet connection make one of the viable option for g Social networking site (Facebook or Twitter) because it required limited graphics and reduced functionality. Dial-up access as a cost alternative for rural or remote places users.

It was observed that wireless or satellite connection not present in the selected area.

It was observed that ISDN was just next alternative of dial-up connection. ISDN internet service was basically a telephone-based network system. There are two different types of ISDN line, Basic Rate

Interface (BRI) this line has two data channels that operate at 64 kbit/sec. Two or more ISDN-BRI lines can be combined as well and yielding speeds of 256 kbit/sec used for video conferencing. The second type, Primary Rate Interface (PRI) this line had 23 bearer channels and has a total speed 1,544 kbit/sec. It is used mostly for telephone communication rather than data transmission, particularly within companies that have large, private telephone exchange systems operating inside their business. It was observed that Cable (21%) an excellent choice for Internet access, faster than Dial-up, DSL and satellite. Internet and phone bill offering collective discount price. Cable user was not concerned about how many cable subscribers are actively using the network. Cable connections are always on, eliminating long waits to make a connection.

It was observed that DSL uses are 11%, standard telephone line for high speed broadband Internet access. DSL subscriber need to worry about how far they are from the main office, not worry about amount of Internet traffic during peak period. DSL was less common for rural area.

VI. CONCLUSION

The villagers are of the opinion that Internet services rather than entertainment services are essential and are satisfied with Internet services.

The Researcher was interested to investigate the opinion of the respondents regarding essential IT services in the villages. With the penetration of Internet at the village level different types of services which included Internet, entertainment and financial services were available in the villages. Researcher was interested to find out which services are essential in the opinion of the respondents. Researchers was further interested to find out satisfaction of the respondents while utilizing these services. Above hypothesis was statistically stated as follows:

H₀: There is no correlation between essential need of Internet services and satisfaction while utilizing these services.

Alternative hypothesis

H₁: Essential requirement of Internet services is positively correlated with satisfaction of using the services.

Test Statistic: Spearman's rank correlation coefficient (ρ). The researcher identified question Q_12 of the questionnaire that dealt with ranking the services the respondents felt were most essential variable

(V1) and Questionnaire Q_6 was identified as the 2nd variable. Wherein the respondents were requested to select the most appropriate answer for the given question (V2). Both the variables V1 and V2 were discrete categorical variables measured on ordinal scale. Therefore Spearman's rank coefficient was thought to be most appropriate test. Observations: It is observed from Table no. 5.20 that Internet Service, $\rho = 0.396$, $p = 0.001$, $\rho = 0.033$, $p = 0.685$ and $p = 0.084$, $p = 0.305$, for radio and Television respectively.

Inferences: Since $\rho = 0.396$ and $p = 0.001$ in case of satisfaction with Internet Services, there is positive association at 1% level of significance. There is positive correlation between Internet services being essential services and satisfaction of utilizing Internet services.

In case of entertainment services (Radio, Television), there is no significance value observed. There is no association between entertainment services like Radio, Television and satisfaction of these services.

Conclusion: Hence it can be concluded that the villagers are of the opinion that Internet services are essential services and villagers are satisfied with the performance of the Internet services. Hypothesis 1 is tested and validated.

Table 18 Nonparametric Correlations opinion of using Internet service.

Correlations				
Spearman's rho	These Services are essential part of my life	Satisfied with the Performance of following IT Services in your Village Radio	Satisfied with the Performance of following IT Services in your Village Television	Satisfied with the Performance of following IT Services in your Village Internet Services
	Correlation Coefficient	0.033	0.084	0.396(**)
	Sig. (2-tailed)	0.685	0.305	0.001

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Analysis of Banking Services Through Information Technology and its Impact on Rural Places in Pune District

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ABSTRACT

This study is based on questionnaires presented to people from rural areas in Pune district. Peoples provided financial information related Banking services or rural kiosks and access or use of ATM services in their village. People were eager to acquire new information because they always needed these service as compared with urban people. They feel that if these services are provided effectively as in urban areas they would also like to use all services like urban people. Also these people wants their sons and daughters to learn all these Information Technology Services.

Keywords: SHGs, MFCs, ICT, ATM

INTRODUCTION

In Rural India, Bank is most important medium for mutually beneficial distribution of capital from those with surplus capital to those who require it. According to National Bank for Agriculture and Rural development (Nabard) these has been good 30% growth in loan disbursement by Banks. Rs. 12,253/- crore in 2008-09 compared to Rs.8,849/- crore in 2007- 08 to Self –Help Groups (SHGs) which small borrower (90% are women). Outstanding loan amount Rs. 22,679 crore of 31st March 2009 from Rs. 17,000/- crore in same last year. SHGsmodel has been leading driver of microfinance in the country. Microfinance companies (MFCs) has been leading to small borrowers, disbursals were up by 94% to Rs. 9,500/- crore in previous fiscal, outstanding amount was up to Rs. 14,400/- crore as of 31 March 2009 from Rs.6,000/- crore as of 31 March 2008. Therefore indirectly lending to borrower. Recently strategies of SBI lending directly through the SHGs model and MFCs are attractive to small borrower because they offer funds at lower interest rate compared to private money lenders only problem is that poor people doesn't get identification card, house document , neighbors reference, they required some help desk, how to use technology such problems. Crisil estimates that at least 90% of all MFCs funds came from the Banks. According to a study by National council of applied Economic Research in 2008 on impact and sustainability of SHGs bank linkage programmers. Role of SHGs is that performing better not only providing of financial services in term of augmenting saving , lending and ensuring loan recovery but also awareness and empowerment.

Mr. Vijay Chandok, senior general manager and global head (SME), ICICI Bank say that “Bank is stragglng to build the right model to reach to make microfinance high growth, scalable and cost efficient”.

I. METHODOLOGY

The researcher has adopted Methodological approaches and research design of the topic. The study is focused on the availability of Financial Information from various Information Technology Services to get information related to ATM services at rural places in Pune District.

The study is trying to find out the usage of Information Technology services in rural area also the study shall investigate the impact of IT services on the life of rural area. The study shall investigate the awareness, need, frequency of use, performance satisfaction of using, Benefits about IT services. Researcher shall investigate Internet connectivity and Mobile Services Network in rural area of Pune district and trying to understand the upcoming new technologies, and interest of rural people in using them in rural area of Pune district.

Research Questions:

Researcher has set following questions to understand the problems and prospects of Information technology in rural area.

1. What is the role of ICT for rural India?
2. What are the government policies of ICT development in rural area?
3. To find out the awareness of IT services in Pune District villages.
4. What are the basic amenities available in rural area of Pune district?
5. What are the needs of IT services and impact are seen in the rural area?
6. To find out the frequency and performance of use of IT service in rural area?
7. What are the benefits that occurred from the IT services?
8. Which bandwidth is getting for Internet service?

Research Objective:

To study the various information technology services available at rural places in Pune district, and to understand problems of Financial Information available so that people will choose ATM service at rural places in Pune District.

Research Hypotheses:

People living in rural areas feel that the ATM Centres are essential for various financial transactions required by them and provides effective banking services.

Researcher had to understand the problems and prospects of rural Information Technology Services and network problems and prospects. Since the requirements of Information Technology of various villages were to be understood and documented, an exploratory design was chosen to conduct the study.

Sample size and Sampling method:

As there are different types of Information Technology requirements of in different people, looking at the universe stratified random sampling was done with the sample size of 150 (around 10% of total villages that is 1500) was selected as representation of population. The method of sampling used was non probability random sampling. Researcher has selected group of respondents like Student, Employee, Self Employee, Farmer and Other (daily wages, Landless etc.). Family structure whether joint / nuclear as well as Monthly Income (Below 3,000/ 3,000-5,000/5,000-10,000/10,000-20,000/Above 20,000).

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Cyber Café	37	112	150
	24.80%	75.20%	
Bank	67	83	150
	44.70%	55.30%	
ATM Center	5	145	150
	3.30%	96.70%	

It was observed that only 38% villages are having Internet facility, 24.8% villages are having cyber café. 44.7% villages are having banks in the villages. Only 3.3 % villages were having the ATM facility. There is need for more ATM service.

The researcher has found out that the villages in Pune district are having 44.7% Banks facility available. The financial information should available at Bank so that rural people will get usage of ATM service.

II.AVAILABILITY OF BANK AND ATM SERVICE AT RURAL

Table 7 Bank available in 150 villages

Amenities	Available	Percentage	Not Available	Percentage	Total
Bank	67	44.67	83	55.33	150

It was observed that the villages having banking facility are only 44.67%.Majority of the villages are not having banking facility and they have to depend on the nearby towns. With the help of Information Technology Services banking facilities can be made available to rural people.

Table 8 the ATM centre.

Amenities	Available	Percentage	Not Available	Percentage	Total
ATM Centre	5	3.33	145	96.67	150

It was observed that 96.67% villages are not having ATM facility in their villages in Pune district. Here is a greater scope of banking facility with the help of information technology. Major Banks can make available their services at rural places with the help of Information Technology tools. They can install their ATM centres in every village. Rural people can be taught about its usage.

III. UNDERSTANDING OF INTERNET SERVICE, BANK FACILITY AND ATM SERVICE

Table 9 Awareness of Internet Services: Communication, Web Services, Information Retrieval, Internet Telephony.

Internet Services	Aware	Not aware	Total
Communication	56 (37.6%)	93	149
Web Services	56 (37.6%)	94 (62.4%)	150
Information Retrieval	56 (37.6%)	94 (62.4%)	150

The researcher asked the respondents about the benefits of the various Information Technology Services and its importance for them..67% said that it's important for easy and fast communication. It shows that they are interested in speedy communication facilities which can be fulfilled by the Information Technology tools. The respondents felt that data analysis and data management services were not very important for them. They have not understood the importance of data analysis and data management tools.

Respondents have given importance to the benefits of IT like information availability, savings, and time available for family, services at doorstep, better academic performance, better quality of life and entertainment.

This shows that people at rural places are giving importance for various Information Technology Services and wish to avail those facilities for their benefits.

IV. CONCLUSION

People living in rural areas feel that the ATM Centres are essential for various financial transactions required by them and provides effective banking services .

Even the villagers feel that the ATM Centres are essential for the financial information required by them. Researcher was interested in the finding out the different amenities available in the villages and how these amenities were beneficial to the villagers. Therefore the researcher identified question Q_2, from the questionnaire where in respondents were requested to choose whether ATM Centres was essential and if it provides effective services.. This question was dichotomous, i.e. either they felt it was essential or not essential (V1) and similarly Q_7_7, enquired about the benefit the villagers derived by utilizing

the different IT services. Researcher was interest to find out whether there is any association between ATM Centres and benefit obtained from ATM Centres. The hypothesis was statistically stated as follows:

H0: Effective financial transactions are not dependent on efficient ATM services at rural places

H1: Effective financial transactions are dependent on efficient ATM services at rural places

Test Statistic: Pearson Chi-Square test dependent of variables as both the variables V1 and V2 where discrete categorical variables measured on nominal scale. Pearson Chi-Square test for dependent of variables has thought to be most appropriate test.

Observation: Chi–Square value = 14.368 with 1 df and p value = 0.001.

Inferences: Since Chi-Square value = 14.368 and p value = 0.001 < 0.05 , H0 rejected and H1 is accepted.

Table 10 Amenities available in the Village ATM Centres * Financial Information.

Cross tabulation

Chi-Square Tests

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	14.368	1	0.001

Conclusion: It may not require an expert’s opinion to accept the fact that in the cities ATM Centres are important source of financial information also in case of villages it is true. ATM Centres are emerging as source of financial transactions to people living there.

On-line banking facilities and ATM facilities should increase at rural places of Pune district with the help of Information technology.

The villages having banking facility are only 44.67%. Majority of the villages are not having banking facility and they have to depend on the nearby towns. With the help of Information Technology Services banking facilities can be made available to rural people.

Majority villages are not having ATM facility in their villages in Pune district. Here is a greater scope of banking facility with the help of information technology. Major Banks can make available their services at rural places with the help of Information Technology tools. They can install their ATM canter in every village. Rural people can be taught about how to use and make their banking and financial services efficient.

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Investigative Assessment on Customer Satisfaction with E-Banking Service Quality in Nigeria and Bangladesh

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ABSTRACT

It was agreed that the e-banking growth of a country depends on plenty of factors, such as success of internet access, new online banking features, household growth of internet usage, dependable services to the customers for which they may be relatively satisfied than of manual system of banking. This study was aimed to investigate the customer satisfaction with e-banking service quality in Nigeria and Bangladesh. A descriptive cross-sectional type of study was conducted among the total of 98 samples which were selected purposively on the basis of availability. The data was collected directly from the respondents using online self-administered semi-structured questionnaire. Data was analyzed using Statistical Package for Social Sciences (SPSS version 22.0). In the present study the mean age of the participants was 31.6±5.62 years. Most of the respondents (79.6%) were male and the majority (67.3%) had university (postgraduate) level of education. Slightly above two-fifths (40.8%) of the respondents were students and civil servants (40.8%). Little above half (55.1%) of the respondents were Nigerian and the rest of the portion were Bangladeshi. Most of the respondents (27.6%) mentioned that the major challenges facing effective implementation of e-banking system in both countries (Nigeria and Bangladesh) was not safe and secured. The finding of this study reveals that close to nine-tenths of the participants were satisfied with e-banking service quality.

KEYWORDS: Customer, E-banking service, Satisfaction, Security, Technology

INTRODUCTION

The Internet is an extremely important new technology in the present time. Banks and financial institutions are important application area of the internet (Anuar et al., 2012). Currently, the development of information technology and offering Internet services, network management issues and providing optimal service quality are considered as important issues (Neghab et al., 2013). Sometimes ago, the internet was a curiosity presenting interesting questions about the future directions of service operations management. Since then service delivered via the internet has quickly emerged as an important class of service operations (Field et al., 2004). E-banking growth of a country depends on many factors, such as success of internet access, new online banking features, household growth of internet usage, dependable services to the customers for which they may be relatively satisfied than of manual system of banking (Nupur 2010). Many organisations have started venturing into multifaceted approaches to improve the quality of their service (Sureshchandar et al., 2001). E-Service quality

evaluation results can be used as a basis for e-service quality improvement as well as the improvement of enterprise efficiency, competitiveness and attractiveness in the virtual market (Mekovec and Kero 2007).

The e-service quality dimensions were tangibility, reliability, empathy, customization, security and responsiveness. For e-services, the dimensions relating to reliability and security of the service deserve greatest attention (Van Riel et al., 2003). E-banking has become important phenomenon in the banking industry and it will continue as more progress and innovations are made in information technology (Gbadeyan and Akinyosoye-Gbonda 2011). E-services can be described as all interactive services that are delivered on the internet using advanced telecommunication, information and multimedia technologies (Boyer et al., 2002). Customer satisfaction is defined as a result of a cognitive and affective evaluation, where some comparison standard is compared to the actually perceived performance. If the perceived is less than expected, customers will be dissatisfied. On the other hand, if the perceived performance exceeds expectations, customers will be satisfied (Lin 2003).

In line with this development, the Central Bank of Nigeria (CBN) in 2003 issued comprehensive guidelines for the operation of e-banking (Central Bank of Nigeria, 2003) while interoperability of shared ATMs/ POS was established in 2004 (Olasanmi, 2010). Also in 2006 the Federal government of Nigeria through the apex bank initiated a new payment system strategy 2020, which is part of the overall financial sector strategy 2020 (Federal Republic of Nigeria, 2006). These are meant to make the Nigerian payments system effective, efficient, technology-driven and in line with emerging global trends (Central Bank of Nigeria 2003). The banking sector in Bangladesh is clearly recognizing the importance of information technology to their continued success (Huda et al., 2004). In Bangladesh, banking industry is mature to a great extent than earlier period. It has developed superb image in their various activities including electronic banking. Now modern banking services have launched by some multinationals and new local private commercial banks. Electronic banking is one of the most demanded and latest technologies in banking sector (Shamsuddoha, 2008). The Governor of Bangladesh Bank argued that Bangladesh Bank has achieved a historic milestone in the trade and business arena, departing from conventional banking with the introduction of e-commerce recently; against stride towards digital Bangladesh (Rahman, 2010). This study was aimed to investigate the customer satisfaction with e-banking service quality in Nigeria and Bangladesh.

METHODS

A total of 98 samples were purposively chosen on the basis of availability. The research population consisted of all the customers who have an account in the selected commercial banks at the two

countries. Therefore, all the banks customers were called and invited to participate in the present research.

The data was collected directly from the respondents using online self-administered semi-structured questionnaire. The questionnaire used for this study was divided broadly into sections, i.e. the socio-demographic section, customer satisfaction, safety section, electronic and the service quality section. The socio-demographic section consist of variables such as age, gender, marital status, educational level and country of the respondent etc. The researcher used the questionnaire because the population was mixed up with different categories of people. The researcher developed closed – ended questions because they are easy to fill, save time and keep the respondents focused on the subject. Data was analyzed using Statistical Package for Social Sciences (SPSS version 22.0). A chi-square test was conducted to explore the association between different variables. A p-value less than or equal to 0.05 was considered to be significant.

RESULTS

Socio-demographic characteristics of the participants

In this study about 61.2% of the respondents were in the age group of 25-35 years and the mean age of the participants was 31.6 years. Close to eight-tenths (79.6%) of the respondents were male and more than half (58.2%) of the respondents in the present study were unmarried and the rest of them were married. Above three-fifths (67.3%) of the respondents had university (postgraduate) level of education, followed by university/polytechnic (undergraduate) (29.6%), professional diploma/college (2%). The majority (40.8%) of the respondents were students and civil servants (40.8%). However about 17.3 percent of the participants were business holders and the rest does not work at all (1%). According to country distribution of the respondents, slightly above half (55.1 percent) of the respondents were Nigerian and the rest of the participants were Bangladeshi.

Table 1: Socio-demographic characteristics of the participants (n=98)

Variables	Frequency	Percentage
Age (years)		
18-24	15	15.3
25-35	60	61.2
36-44	17	17.3
45-54	6	6.1
Mean ±SD	31.6±5.62 years	
Gender		
Male	20	20.4
Female	78	79.6
Marital status		
Married	40	41.8
Unmarried	58	58.2

Education		
Secondary school	1	1
Professional diploma/college	2	2
University/polytechnic (undergraduate)	29	29.6
University (post graduate)	66	67.3
Profession		
Business	17	17.3
Civil servant	40	40.8
Student	40	40.8
Does not work	1	1
Country of the respondents		
Bangladesh	44	44.9
Nigeria	54	55.1

Challenges facing effective implementation of electronic banking system in Nigeria and Bangladesh

From the Table 2 it was observed that among the major challenges facing effective implementation of electronic banking system in Nigeria and Bangladesh, it was found that “Not safe & secured” is the major occurring challenges that occupies almost 27.6% of the respondents. “The idea of making an incorrect operation” was the second major occurring challenge with 26.5% of the respondents, the third most occurring challenge was “bank branch should be in front of me during the process” occupies almost 23.5% of the respondents. The fourth most occurring challenge was “not have sufficient knowledge about e-banking” occupies almost 19.4% of the respondents, while the last challenge was “The absence of the habit of using the internet” as they contribute only 3.0% to total sampled.

Table 2: The reasons for not using E-banking service (n=98)

Variables	Frequency	Percent
Bank Branch should be in front of me during the process	23	23.5
The idea of making an incorrect operation	26	26.5
Not have sufficient knowledge about e-banking	19	19.4
The absence of the habit of using the internet	3	3.1
Not safe & secured	27	27.6
Total	98	100

The impact of electronic banking on customers' service delivery

From the Table 3 it was generally agreed that the impact of E-banking on customer’s service delivery is to “provides E-banking quality services” it was observed that about 63.3% of respondents “agreed” with this technique in combating E-banking challenges among Nigerian and Bangladeshis customers. While 36.7% of the remaining respondents were either disagreed or undecided. About 65.3% of the respondents agreed that their bank “Is processing the transactions accurately and on time”. Nevertheless the rest (34.7%) of the respondents were either undecided or disagreed. The third the impact of E-banking on customer’s service delivery was that close to six-tenths (59.2%) the respondents agreed that “Is fair with its E-banking customers”. The fourth impact of E-banking on customer’s service

delivery, was that about 40.8% of the respondents agreed that Bank “Will repay any money taken from my account through unauthorized transactions”. And the last impact was that more than half (55.1%) of the respondents agreed that Bank “...is acting in my best interest”. However the remaining (43.9%) respondents were either undecided or disagreed.

Table 3: Distribution of the respondents according to opinion on “I believe that my bank...”

Item		Agree	Not certain	Disagree	Total
...provides E-banking quality services	n	62	11	25	98
	%	63.3	11.2	25.5	100
...is processing my transactions accurately and on time	n	64	11	23	98
	%	65.3	11.2	23.5	100
...is fair with its E-banking customers	n	58	15	25	98
	%	59.2	15.3	25.5	100
...Will repay any money taken from my account through unauthorized transactions	n	40	30	28	98
	%	40.8	30.6	28.6	100
...is acting in my best interest	n	55	17	26	98
	%	56.1	17.3	26.5	100

Possible solutions to E-banking challenges in Nigeria and Bangladesh

From the Table 4 it was observed that most of the respondents (60.2%) agreed that the possible solutions to E-banking challenges in Nigeria and Bangladesh is to “Confirm the identity before disclosing account information” this technique can help in combating E-banking challenges among Nigerian and Bangladeshis customers. The rest of the respondents (39.8%) were either undecided or disagreed about the above mentioned strategy. Another technique employed for possible combating this E-banking challenges was that “confirm customer’s identity before processing transaction” as agreed by little above six-tenths (61.2%) of the respondents. About 60.2% respondents agreed that another possible solution to E-banking challenges in Nigeria and Bangladesh was “the system will not allow unauthorized changes to a transaction “. The fourth possible solution to E-banking challenges in Nigeria and Bangladesh was that the “the system stop any unauthorized changes to a transaction” as stated by about 59.2% respondents and the last possible solution to E-banking challenges was to “Provide a secure environment in which to bank “ as mentioned by about 13.3% respondents. While 86.7% of the remaining respondents were either undecided or disagreed.

Table 4: While using E-banking, I believe that E-banking system

Item		Agree	Not certain	Disagree	Total
Will confirm my identity before disclosing account information	n	59	11	28	98
	%	60.2	11.2	28.6	100
Will confirm my identity before processing transactions	n	60	13	25	98
	%	61.2	13.3	25.5	100
Does not allow unauthorized changes to a transaction	n	59	8	31	98
	%	60.2	8.2	31.6	100
Stop any unauthorized changes to a transaction	n	58	13	27	98
	%	59.2	13.3	27.6	100
Provides a secure environment in which to bank	n	31	13	54	98
	%	13.3	31.6	55.1	100

Customer satisfaction on E-banking quality service in Nigeria and Bangladesh commercial Bank

Most of the target customers (88.8%) were satisfied with E-banking quality services in Nigeria and Bangladesh commercial banks, only little above one-tenths (11.2%) were not satisfied with the quality of E-banking services in Nigeria and Bangladesh (Figure 1).

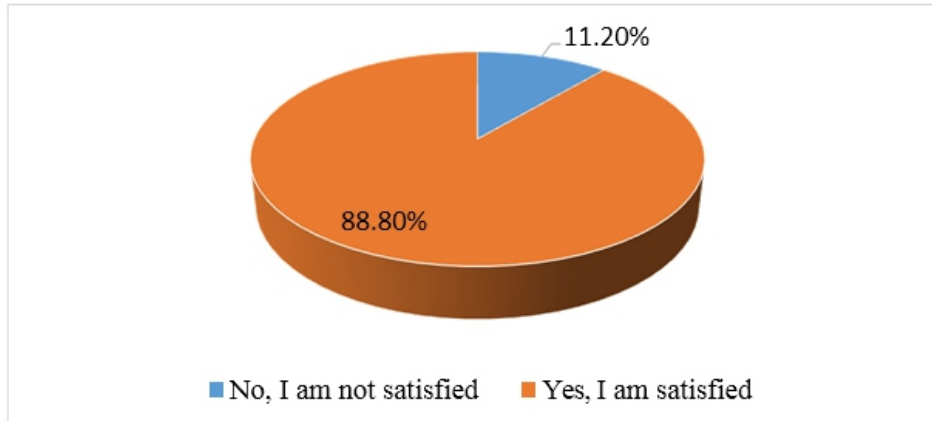


Table 1: Customer Satisfaction on E-banking quality services (n=98)

Pearson Chi-Square Tests

A person chi-square test was conducted to find out the possible association between some variables. It has been observed that type of banking channel use, frequency of using e-banking, educational status and profession was found to be associated with using e-banking (Table 5).

Table 5: Pearson Chi-Square Tests

Variables	Do you use E-banking service	
		Chi-square
Type of banking channel use	Df	5
	Sig.	0
	Chi-square	35.47
Frequency of using E-banking	Df	3
	Sig.	0
	Chi-square	17.168
Educational Status	Df	3
	Sig.	0.001
	Chi-square	8.165
Profession	Df	3
	Sig.	0.043

DISCUSSIONS

In this study it was reported that among the major challenges facing effective implementation of electronic banking system in Nigeria and Bangladesh, it was found that “Not safe & secured” was the major occurring challenges that occupies almost 27.6% of the respondents. A similar study reported that security had a significant influence on customer satisfaction (Ahmad and Al- Zu` bi, 2011). Every customer is hoping to have a bank that can protect his financial and personal information more especially regarding the e-banking transactions. Another study also reported that the privacy had a

strong influence on customer satisfaction (Zhao and Saha, 2005). It was generally agreed that the impact of E-banking on customer's service delivery was to "Provides E-banking quality services" it was observed that about 63.3% of respondents "agreed" with this technique in combating E-banking challenges among Nigerian and Bangladeshis customers. Customer satisfaction is described as the result of a comparison of the customers' expectations and their upcoming perceived performance of service quality (Herington & Weaven, 2009).

About 65.3% of the respondents agreed that their bank "Is processing the transactions accurately and on time". Nevertheless the rest (34.7%) of the respondents were either undecided or disagreed. This might be due to currently most of the banks use internet banking as it is one of the cheapest delivery channels for banking products (Pikkarainen et al, 2004). Most of the respondents (60.2%) agreed that the possible solutions to E-banking challenges in Nigeria and Bangladesh was to "Confirm the identity before disclosing account information" this technique can help in combating E-banking challenges among Nigerian and Bangladeshis customers. Security and privacy are related items that affect the confidence to adopt e-banking services (Wolfenbarger and Gilly, 2003).

Most of our targeted customers were satisfied with E-banking quality services in Nigeria and Bangladesh commercial banks, only little above one-tenths (11.2%) were not satisfied. Normally the customer get satisfied if the performance exceeds expectations, the customer is highly satisfied and delighted (Rahman, 2014). It has also been observed that type of banking channel use, frequency of using e-banking, educational status and profession was found to be associated with using e-banking service. Perceptions of service, product quality, prices, personal and situational factors, are also factors that may influence or affect the customer satisfaction (Zeithaml and Bitner, 2003; Zeithaml et al., 2006).

CONCLUSIONS

The finding of this study reveals that the major challenge facing effective implementation of electronic banking system in Nigeria and Bangladesh was found to be "Not safe & secured". However it also reveals that close to nine-tenths of the participants were satisfied with e-banking service quality.

RECOMMENDATION

- The network provider should be reliable and of high integrity so as not to compromise the security of the system as well as to provide with strong service mechanism to grab cyber issues and challenges.
- Customers should be warned about the dangers of sharing any account information to anyone. Government of both countries should provide adequate regulatory framework that will ensure

customer protection, and security of transaction. That way, bank customers' confidence in electronic banking would be safe and secured.

- Awareness to customers should be created when new products are introduced the services to be offered and the prices to be charged for each service offered. This will ensure customers appreciate the preferential rates offered without complaining of hidden charges.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

ETHICAL CONSIDERATIONS

Ethical approval for the study from the Department of Computer Science, Faculty of Science & Information Technology; Daffodil International University was obtained.

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Survey on Student Project Management System

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ABSTRACT

Student Project Management System (SPMS) is essential for an institution or to a college or to a university, which effective use of computer, also which reduces manpower. Student Project Management System manages all the activities of the final year projects. It is a system for supervision, controlling, monitoring the final year projects of students. It is a web based portal or application which is useful for students, Head of the department, project coordinator and project guide. The main objective is to digitalize the whole process of project approval process by introducing an application as an update to the existing conventional model. This minimizes lot of time and it would be convenient for both the staff and the student. Initially all the students require to register into the system using registration form. Then registered students can login into the system using their id and password to get authenticated. When the students login to the system, then they will form the groups by their own. Similarly, project guide needs to login into the system using their id and password. SPMS also allows the group of the students to provide at least three project domains and then system will automatically assign the guides to the group of students based on project domains. Project coordinator is main characteristic of the system which will allocate different tasks to the students. Project coordinator and project guide is co-ordinate with each other and finally results should be intimated to Head of the department as well as required parameters to the students. Depending upon the different parameters, the work is assigned by the coordinator and the progress plan of the group is created. For creating progress plan, the marks will automatically get assigned for particular group of the students. To take advantage of the latest technology and to facilitate students to make online inquiries about their project status a different tools are developed in SPMS.

I. INTRODUCTION

In today's world, no one takes an initiative to look for notices which are displayed on the notice boards. Many students miss the information about some important notices and updates related to their final year projects. Also, the students are not able to keep track of their project related activities. It becomes very easy if all the details and updates of the project from guides and coordinator are readily available for the students. Supervising the final year projects manually is very stressful job. Nowadays the different tool is initiated to manage all the projects effectively and ensure that projects cycle goes on smoothly and they are completed on time. While accepted student's requirements, all necessary validations should be performed. In existing system project coordinator should generate the Student's list with group, Staff_name list with student group, Project domain name details, Project title list reports and project coordinator work to report status of the student project manually.

But using simple web portal anyone can carry out their project related work which is the main aim of Student Project Management System (SPMS). Project management is the process of planning,

scheduling, resource management, requirement analysis, designing and testing to achieve project goals and objectives. Without student project management system it is difficult to complete projects in given time. Therefore, student project management system is required to remove such barriers in project development and to achieve specific goals. It provides students, Project coordinator and Project guides a simple web portal to manage and monitor the overall project activities. All the modules of the system have a unique user id and password. Then any module can login into the system using their id and password to get authenticated further. SPMS allows the group of students to provide project domains and then the system will automatically assign the guides to the groups of students. Project coordinator is the main module of the system which assigns various tasks to the students. Project coordinator and Project guide are interacted with each other. Depending upon the different parameters related to the work assigned by the coordinator, the progress plant of the group is created and grades will get automatically assigned for the particular group of the students. E-mail notifications are sending to the groups about the important notices and updates related to their final year project.

II.LITERATURE SURVEY

Anthony [3],Ackoff[1], Koontz and O'Donnell [7], and McGuire [8] discuss about general management literature. This literature has ad-vocated basic principles of management, but they are far too wide to be of express use in collecting data for the review of an existing management system and they do not link the theory to the design of better management systems. However, the structure provided by these principles is necessary for the orderly development of our approach.

Glans, et al.. [6] and Couger [5] explains about systems analysis. These authors have tended to confer very detailed questions about systems operations. They often include checklists, paperwork flow analysis dealings, flowcharting, and other techniques which are used to analyze the clerical or operating subsystems of an organization. The approach tends to be ad hoc in nature and it presumes the type of improvements which are needed. Moreover, the systems analysis approach has notion the past concentrated sufficiently on the planning and control functions of management. Rather, it has been primarily concerned with improving operations. There is a need for the development of better methods for the review of management systems. In developing the review phase, the thrust is to provide an approach which is based on data collection and analysis and is systematic in nature. The next section provides a general description of the review phase structure which forms a basis for the development of specific data collection methodology.

Sanket Kale et.al 2017 implement a system which can manage project cognate all work consummated by utilized and Project coordinator or guide. Coordinator updates project cognate information, view work

done by a student at which time and view progress chart of work done by student, progress chart is developed utilizing WBS (—Work Breakdown Structure). Student retrieved the given work information updates and consummates this work at given time and submits into the project management system.

Xian Shannxi et.al 2010 introduce the model, which drives the entire system architecture to the brand new software growing ideological system that put forward faces to item control organization. On this paper, the complex hassle oversimplifies and abstract problem pictorially as base. It takes software venture manages process visualization and controllable as simple intention.

Roy Oberha user et.al 2011 proposed a model that extends the goal-question-Metric technique and automates the tracking of satisfactory desires via a multi-agent system with the assist of competitive bidding agent conduct for proactive vs. cooperative vote casting for reactive measures.

Sue Newell et.al 2012 has defined mini-music, which makes a specialty of numerous areas of IT Enterprise and assignment control which can be a hobby to diverse lecturers and practitioners.

Violeta Bozhikova et.al.2009 gives an introduction of the art of software project management and fixes its place in the scope of project management discipline. The development of Project Management Software (PMS) is an active research area in the field of Project Management. A classification of the existing PMS is proposed manually. There are in need of development web based and collaborative PMS is commented in comparison with other PMS.

Gabriele Bavota et al 2012 presented a practical approach for teaching two different courses of Software Engineering (SE) and Software Project Management (SPM) in an integrated way. The two courses are taught in the same semester, thus allowing to build mixed project teams composed of five-eight Bachelor's students (with development roles) and one or two Master's students (with management roles). In this paper is insufficient to simulate a real-life development scenario giving to the students the possibility to deal with issues arising from typical project situations, such as working in a team, organizing the division of work and coping with time pressure and strict deadlines.

Iulian Intorsureanu, et al 2009 describes a design model for an integrated document system for project management, which takes into account the key requirement of ensuring consistent and high-quality project management documentation. The model is based on structured documents which rely on a static model of project management-relevant entities.

Michael M. Marti, P.E., et al 2005 designed PMS to make the job of a project manager easier and more efficient, providing applications to aid in planning, to manage project costs, and to track activities and monitor schedules. As more and more public works departments face the realities of increasing workloads and shrinking resources, finding technology applications that allow productivity gains becomes ever more important. The use of project management software as a tool for managing and organizing work has grown and continues to grow at a rapid pace in all industries. This paper reviews the ways in which it is currently being used in the course of transportation project delivery in Minnesota, and provides a tool to assist in choosing the right application to meet a local city or county's needs.

III. EXISTING SYSTEM

Existing system of student project management system is maintained manually. Project coordinator or guide gives assignment for student manually. Student complete the work which is given by coordinator or guide and submits manually, in this system all work is done by manually so it can take more time to complete project related work. Project coordinator or guide requires remembering in mind when and which student completed the task. In the existing system does not help users to get project information at right time.

Limitations of existing system

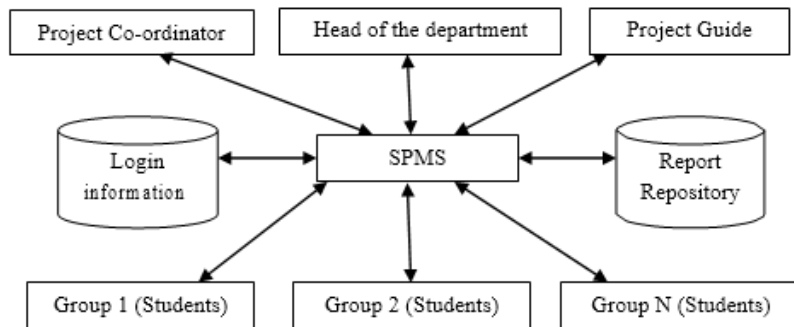
1. It is time consuming.
2. Project information is not retrieved at right time.
3. Any updates by team members or the Project coordinator or guide cannot remember immediately by the rest of the team.
4. All work is done manually.

IV. PROPOSED SYSTEM

Summarizes these problem, in this proposed system can implement a system which can manage project related all work consummated by Project coordinator or guide. Project coordinator updates and associated information, view work done by a student at which time and view progress plan of work done by student, progress plan is developed. Student retrieved the given work information updates and consummates this work at given time and submits into the SPMS as shown in fig 1. To take advantage of the latest technology and to facilitate clients to make online inquiries about their project status a tool need to be developed. The tool should accomplish the following functions:

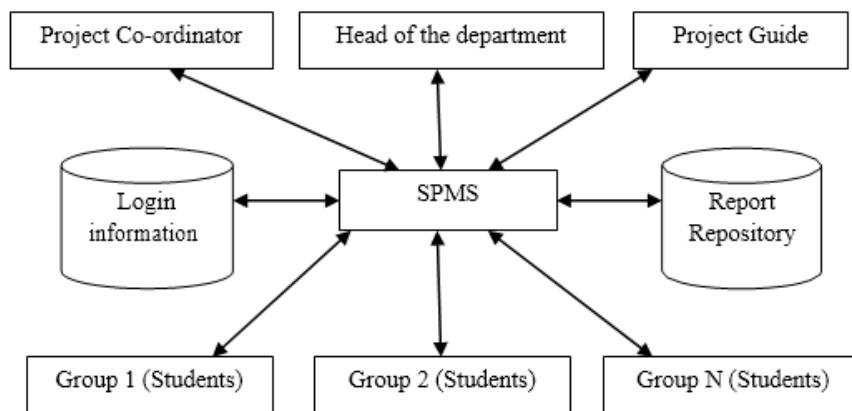
- Record different phases of a project.
- Facility to interact between student and guide.
- Define phase wise tasks.

- Keep a track of project schedules.
- Update the information about report .
- Phase wise project closures.
- Assign resources to a project.
- Access control for resources.
- Take daily efforts from each status



V. DISCUSSION

Developing the SPMS has helped as web based tool instead of manual in development procedures. In future it can be developed with chat module between student and staff. The UI of this dashboard can be modified for user comfort. This can also be developed as an application. SPMS is a very effective application which can be used to a great extent. When all the students register to our portal, the group formation takes place and the next step includes assigning of guides according to their domains which are provided by the groups this unique assigning of guides to the groups is done which is frequently used technique in DotNet. Admin, Hod, Project- in-charge, Project Guide and Student modules are described in following diagrams sequentially.



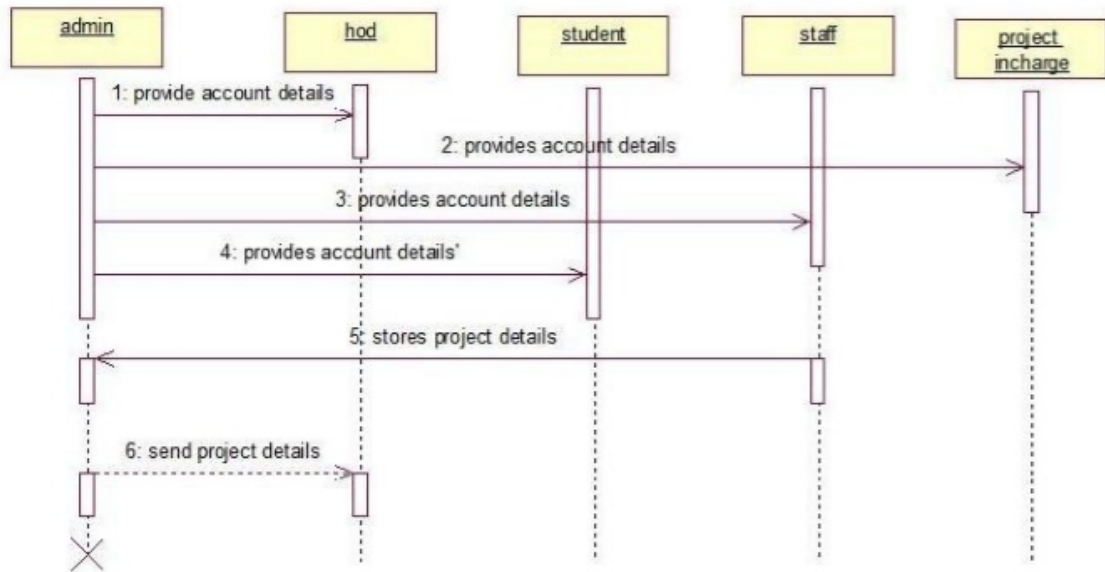


Fig 2 Admin module

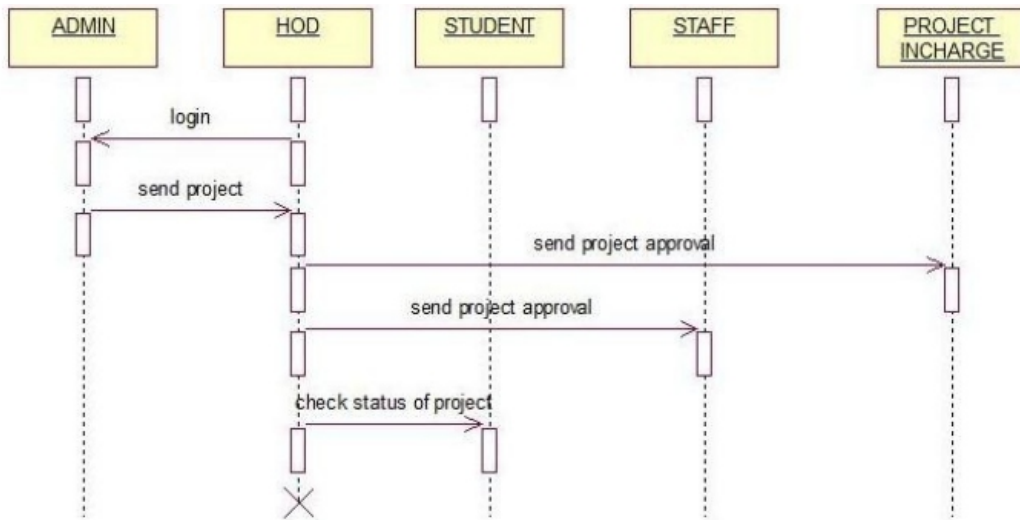


Fig 3 HOD module

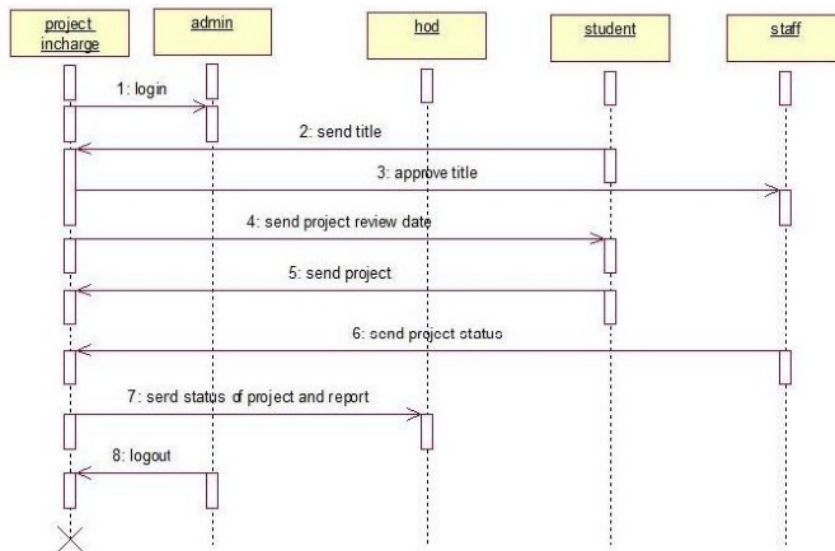


Fig 4 Project –in-charge module

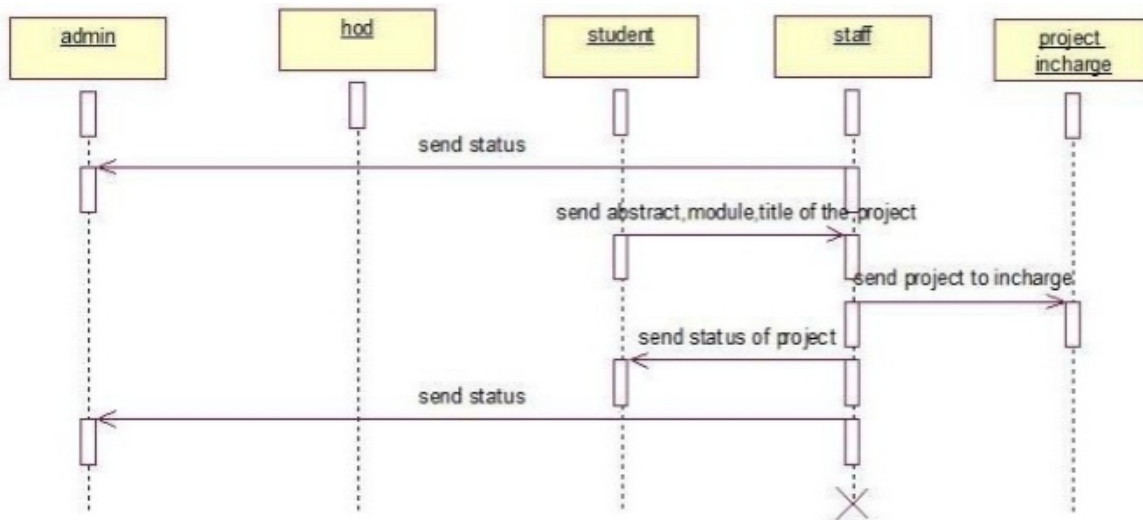


Fig 5 Project Guide(staff) module

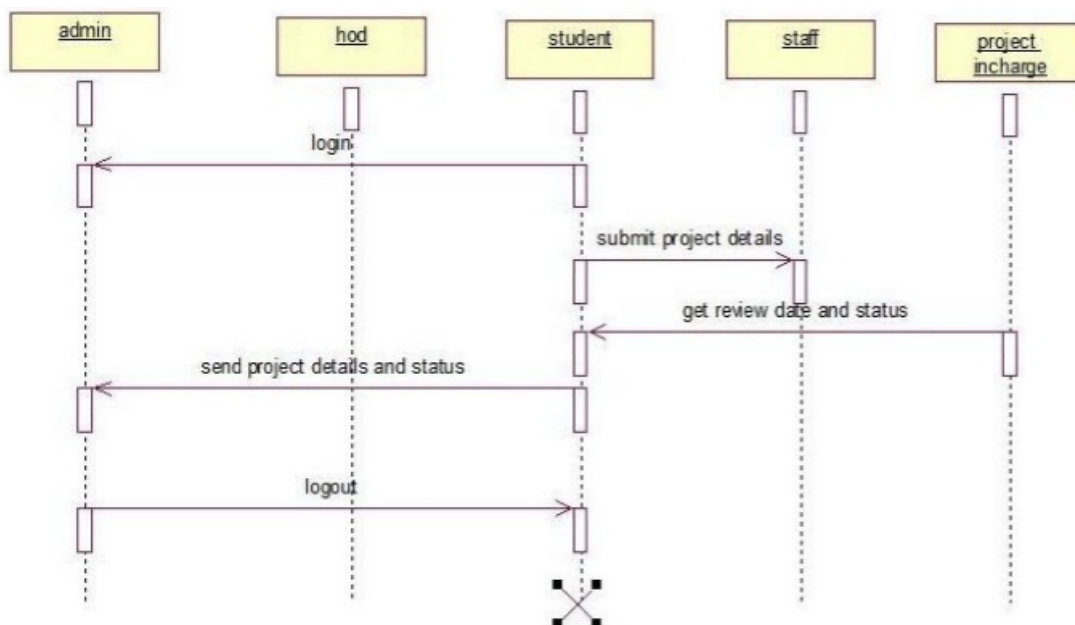


Fig 6 Student module

VI. CONCLUSION

Objectives that had been charted out in the initial phases were achieved successfully. System has strong security by providing user id and password. System is fully GUI based. It is easy to operate and user-friendly. Platform includes the in built back-up and recovery facility. It can be helpful to communicate and better understand the importance of planning and designing as a part of software development. The concept of peer-reviews helped to rectify the problems as and when they occurred and also helped to get some valuable suggestions that were incorporated. SPMS have many advantages over the traditional system. Some of these advantages are centralized data, up-to-date status reporting, E-mail notification, ease of use, backups etc. The use of this application reduces the extra time and efforts required to manage and monitor the final year projects in colleges. Feature of DotNet technology automatically assign the

guides to the groups of students and different phases of JBC (job breakdown construction) for grading of the particular group. It also provides a good interface which is easy to understand by the users and helps in adapting to the use of this web application.

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