Research on Mobile Based Scratch Card Saving System for Micro-Finance

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Declaration

I declare that, this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

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Acknowledgements

Abstract

The recent year's microfinance sector infrastructures were boomed than previous in sri lanka[1]. Government of sri lanka introduce major policies to develop micro finance sector. Under these policies various micro finance schemes introduce to citizens with help of finance ministry. Governments mainly focus to develop vulnerable people with less income. Government offers various credit schemes and interest subsidiaries for target low income families[1].

Financial inclusion of low-income households has a power to drive the economic and social development of the country [2]. Microfinance institutions play a key role in ensuring access to formal financial services especially for the low-income families [3].

This research has been focused on Mobile Based Scratch Card Saving solution for micro-finance sector to improve savings habit of people who don't have quick access to physical bank. By using this proposed System, people can do savings via mobile prepaid cards. The Low & Middle class income communities and local shops also can directly get benefited from this solution. The system can be accessed using devices such as basic mobile phones, Smart phones and device selling points and etc.

The main objective of this project is implementing a new system to make cash deposits and withdrawals without visiting the bank via mobile phone devices. This System can be used beyond the formal banking hours (24 x 7). It will help to reduce operational cost of funds in the bank's point of view.

Customer can deposit money via using scratch card. Not only can that customer withdraw money visiting local shop. The system gets inputs via SMS and the input data could be a scratch card number when deposit cash. The system gets the input via a SMS and the input data could be a merchant number, amount and Personal Identification Number (PIN). The proposed system consists of SMS gateway, Banking transaction core, Scratch Cards Authentication API.

Contents

1 Introduction

1.1 Prolegomena

The new technology platform is required to encourage micro savings in Sri Lanka. Most of the banks are located in the far from rural villages. Hence people who live in remote areas haven't been encouraged to visit bank to deposit their saving. This problem can solve by thinking different way of cash deposits and withdrawals. The proposed system will be enable efficient deposit and withdrawal, without visiting bank. Customer will be able to do deposit money whenever they required. It is low cost fund deposit solution for customer point of view. Travelling expenditure and time spend for transaction will be very low compare to the convention banking deposit and withdrawal.

1.2 Background and Motivation

The time and money spent to carrying out financial transactions can be a major obstruction to the financial system. The advances in computer and telecommunications technology (ICT) clearly have a major impact of transactions costs. The arrival of computers and cheap data transmission has led to a reduce transactions costs. The use of electronic payments technologies have been grown rapidly in recent years [4]. Automated Teller Machines (ATMs) are continuing expanding. Although this technology has been goes back to the middle of the 1980s[5]. The number of ATMs more than doubled between 1988 and 1998, and the number of transactions almost tripled over that period[6]. In addition, the use of credit cards and debit cards to make payments at the point of sale has grown very rapidly during the 2000s[6]. Credit card volume doubled between 1993 and 1997, and debit card volume increased by a factor of more than five over the same period[6].

Mobilization of deposits is one of the important functions of banking business[7]. It is an important source of working fund for the bank. Deposit mobilization is an indispensable act or to increase the sources of the banks to serve effectively. Mobilization of deposit

plays an important role in providing satisfactory service to different sectors of the economy. The success of the banking greatly lies on the deposit mobilization.

Regional development bank is major development bank in Sri Lanka. The bank introduced product for daily collection system branded as "Dorin Dora". This system operates through a dedicated set of agents, who on daily basis visit the business premises and the residences in the territory of respective branches. It provides great relief and convenience to the target group and saves their opportunity cost, as otherwise they would have to sacrifice their valuable time visiting the branch again and again for their banking transactions.

This service helped many small scale entrepreneurs and individuals to build up healthy account balances over periods of time without much effort and hassle[8].

The current Dorin Dora system agent visited only selected customers. But proposed system will be enable anyone who willing to save money. It will encourage people who have less income but willing save their money[8].

1.3 Problem statement

Above section we have discussed introduction of research area of this thesis, background of Mobile Based Scratch Card Saving System (MBSCSS). In Chapter 2 we have done comprehensive literature review of MBSCSS. We have got the evidence of unsolved problems during depth study of research. During our study, we found that, currently there is no such system for collecting savings in Sri Lanka. Some Scratch Card Payment solutions where implemented in United State, United Kingdome and Nigeria to settle payment during ecommerce transaction. It is required to implement an affordable solution which should be beneficial for the customers who intends to save their little money. Therefore, utilizing commonly available equipment's, technologies and infrastructure for a Mobile Based Scratch Card Saving System has been employed.

1.4 Hypothesis

We hypothesis Mobile Based Scratch Card Saving System is enable efficient way of deposit and withdrawal cash, without visiting bank.

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1.5 Objectives

Design and Develop Mobile Based Scratch Card Saving System

- Study of micro finance sector and behaviors of vulnerable group of low income families
- Deep study of technologies and methodologies use for cash deposit and withdrawals
- Develop a Core Banking System
- Develop a Short Message Service (SMS) Gateway
- Scratch Card Transaction Module
- Develop a Scratch Card Authentication Application Programming Interface (API)
- Develop report for decision support

1.6 MBSCSS approach

The system can access using very basic mobile phone or Smart phones. When customer required deposit cash using system required purchasing Scratch card (Mobitel, Dialog, Hutch, Etisalat or Airtel etc.). Service provider and customer must be register with bank for this service.

The Customer, Bank and service provider play major role of the system. Bank and service provider connected via Virtual Private Network (VPN). Bank will receive SMS from customer mobile (Scratch Card Number and Calling Line Identification Number [CLI]). System will check weather customer register with service and check validity of scratch card via Scratch Card Authentication API. All the variables are valid then transaction will proceed. System will send notification SMS to customer.

When Withdrawal proceeds, Registration process will be the same as Cash deposit. The Customer, Merchant (Local Shop) and Bank plays major role of the system. Customer sends SMS to dedicated number (Merchant No., Withdrawal Amount and Customer PIN). System will verify customer and Merchant then check customer account balance with amount requested, Daily total transaction amount limit, Maximum transaction Amount and daily transaction count etc. System will send One Time Password (OTP) number to customer's mobile phone to complete the withdrawal. Customer provides OTP to merchant and merchant send OTP via SMS to dedicated telephone number. System

checks the validity of OTP number. If variables match and valids, transaction will be completed and send notification SMS to Customer and Merchant.

1.7 Structure of the Thesis

The rest of the thesis is organized as follows. Chapter 2 critically reviews the literature on Mobile Based Scratch Card Saving and the research problems. Chapter 3 is about the technology for developing Mobile Based Scratch Card Saving. Chapter 4 presents new approach to use Mobile Based Scratch Card data transferring technique. Chapter 5 is about design of the system.

1.8 Summary

This chapter gave overall picture of the entire project presented in this thesis. As such we described the background and motivation, problem definition, hypothesis, objectives, and a brief overview of the solution. Next chapter presents critical review of literature on Mobile Based Scratch Card Saving.

2 Developments and Challenges in Mobile Based Scratch Card Saving System

2.1 Introduction

Chapter 1 gave a comprehensive description of the overall project described in this thesis. This chapter provides a critical review of the literature on microfinance considering definition of microfinance, current problems and latest developments.

For this purpose, the review of the past researches has been presented under three major sections, namely, early developments, recent developments and currently available systems.

At the end, we define our research problem, suitable technology and highlight the suitability of addressing the problem to development in microfinance and peoples` lives.

2.2 Early developments in microfinance

Micro finance is not a new concept. It was practiced by moneylenders, credit cooperatives, and credit unions since the 19th century. However, Professor Mohammad Yunus invented modern concept of microfinance in 1970[9]. According to modern concept microfinance is offer financial and non-financial services for the poor people, such as provision of microcredit, savings, insurance, remittance, health, education, skill training and social awareness etc[10].

Wakilur Rahman and co-workers have studied the Impacts, Sustainability and Outreach of the Microfinance[10]. This work based on reviewed journal articles on microfinance impacts, sustainability and outreach over the period of 1997 to 2011[11].This paper illustrates two main sections. Under the first section they reviews the most relevant articles related to microfinance impacts, sustainability and outreach. In the second section includes descriptive statistics of the peer-reviewed papers identified in the first section. In this research, Wakilur Rahman and his team tried to find the solutions for four main questions and examining aspect of microfinance impacts, sustainability and outreach. As such, nevertheless, this research is fails to discover a concrete relationship between

outreach and sustainability. Table 2.1 compares the outcomes and conclusions of the questions.

Question	Outcome	Drawbacks
Can microfinance reduce poverty?	Positive	such opportunities have not reached many of the poorest in the village
Can microfinance increase individual and household income?	Positive	Microfinance does not reach the poorest of the poor, and the poorest are excluded deliberately from microfinance programs
Can microfinance empower women?	Positive	Some services may be an extra problem for women (loan facilities).
Can microfinance increase access to health and education?	Negative & Positive	MFIs should provide supplementary services(health, education, insurance, remittance, etc.) to their clients
Relationship between Outreach and Sustainability	Negative	Fails to find the relationship between Outreach and Sustainability

Table 2.1 compares the outcomes and conclusions of the questions

Table1 indicates the need for feather the research in microfinance. Final conclusion of this research is microfinance institutes (MFIs) should extend financial and non-financial services to people normally ignored by traditional financial institution.

A research on Success Factors of Successful Microcredit Entrepreneurs: Empirical Evidence from Malaysia done by A.H.Fatimah Salwa and his group in University of Malaysia[12]. This paper present the successfulness of microcredit entrepreneurs is use as dependent by using independent variables. This work based on Khander and Pitt The Impact of Group-Based Credit Programs on Poor Households in Bangladesh [13] and others[14]. Fatimah's work associated with explores the profile of successful microfinance entrepreneurs and examines the key factors contributing to the success. Based on the result, study revealed the significant and positive contribution to the success of microcredit entrepreneurs, but the amount of substantially small compared to that other

financial institutions like bank. Accordingly it defined the research problem as less amount of financing, need to acquire inventors and increase productivity.

Marion Mbogo studied a Qualitative Analysis of The Impact of Mobile Payments on the Success and Growth of Micro-Business: The Case of M-Pesa in Kenya [15]. This paper illustrates how mobile based payments are enhancing the quality of the services and increase growth of Micro-business enterprises. The pace of conversion in the micro business sector has speeded up with more micro businesses realizing the impending of using the mobile payments in their service delivery. However, there are only a handful of studies on the application of digital technology for success and growth on micro business. This study has recognized some important factors that are attributable to the success of micro business operators using mobile payment services. More and more people are increasingly using the mobile payment services and a more extensive research should be conducted to bring out those factors that are necessary to ensure that the micro businesses embrace the digital technology in the conduct of their business and enhance their business performance.

Mohammad Salhab and Ali Abu Ali have studied a Qualitative Analysis of People Views of Microfinance in Lebanon[16] . This work is based on a quantitative approach to analysis the perception of the average Lebanese towards microfinance. The findings showed that the highest percentage of respondents for microfinance offers financial services are low income people. This paper conclude that, most Lebanese perceive microfinance as the process of just providing loans without specifying for whom it is intended. Most of the people doesn't have knowledge about other services that offered by the MFIs than micro credits. Due to time restrictions this study was failure to conduct a pilot study.

A research on Selecting high-income generating activities for micro-entrepreneurs by Norma Md Saad in International Islamic University Malaysia[17]. This paper illustrates that micro finance is proven to be an effective tool to fight poverty in many developing countries. This paper analyzes the various income generate activities taken by the biggest microfinance institution in Malaysia. In particular Amanah Ikhtiar Malaysia (AIM) has been selected for this. Base on the result, several problems that financial institutions face

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in microfinance, such as real profitability of microfinance, the high risk posed by small and short-term lending operations and the widespread belief that the poor are often poor due to a lack of skills.

Ficawoyi and his colleague have conducted a research on financial development and poverty reduction on developing countries [18]. During their study they mention that financial development and grown has received a lot of attention over past few decades. However not much attention is not given to poverty reduction. Moreover, most of the past studies focus on bank and stock market development. When consider on poverty reduction microfinance institutes (MFIs) can play a major role together with banks. Accordingly, importance of developing microfinance is major factor which should be considered on overall economic development of developing countries.

Since Sri Lanka is also still a developing country, poverty alleviation has been considered by past governments. However still could not be able to address it properly due to various reasons. Kaluarachchi and Jahfer have conducted a research on microfinance and poverty alleviation in Sri Lanka[19]. They mention that, commercial banks are limited in rural areas and it is difficult to poor people to reach the bank due to the cost, lack of knowledge and the time embarrassments. Also, when obtaining a loan, it need to fill many documents and there are some other barriers also. Due to those factors people prefer microfinance institutes since loans can be easily obtained from them. Therefore, more improvements in microfinance sector is directly and effectively affect the poverty alleviation/reduction in Sri Lanka.

Some important issues related to microfinance sector in Sri Lanka, have been identified through the research conducted by Ganga and Thilakaratne[20]. They also conclude that, microfinance services in Sri Lanka have wide geographical outreach when compared to commercial banks. However according to their study IMFs also should be more improved. Another important observation they found is that, not only poor people, some richer groups also use microfinance services.

Since microfinance services mainly focused on low income people and generally women are in low income category, importance on entrepreneurial success on women in Sri

Lanka is highlighted trough the research conducted by Bernard and colleagues[21]. They further show that, the unemployment rate also can be reduced by improved microfinance services which can be easily accessed by women also.

Poor people in rural areas face many obstacles on saving. Since daily income is very low, they may be able to save very small amount of money such as Rs.50 or Rs.100 per day or week. It is practically difficult to visit the bank which is located far away, to deposit money. Due to lack of knowledge and patience, they cannot keep money with them since they tend to spend money for liquor and other things. Also in rural area, there are some negative attitudes in visiting banks regularly. If some solution can be given with the facility of easy micro-saving facility, those people can save little amount of money daily which would help to uplift their living conditions.

In microfinance there are main two problems. They are loan repayment/Saving and interest rates. For the traditional microfinance institutes have to employ many people (field force) for background checks, loan distributions, follow ups and collections. Due to high cost of this, interest rates for loans become high[22]. By using ICT (Information Communication Technology) cost on field force and documentations could be minimized enabling easy access and reasonable interest rates.

2.3 Modern Trends

Digital is transforming many traditional sectors in brilliant ways. In today's world, where technology is affecting everything and making it efficient, microfinance cannot remain untouched. Commercial banks have given their attention on ICT. Network of ATMs, Self-Banking units are rapidly growing. Each bank offering internet banking and mobile banking. All banks and financial institutes consider the utilization of ICT to reduce their cost and to improve client base [23]. To use this ICT enhanced banking solutions, some level of IT literacy or general knowledge should be essential. Most of banks enable mobile banking via mobile apps. People need smartphone to use those banking facilities.

Research on Understanding ICT's role in Microfinance to improve Financial Inclusion in Northern Sri Lanka conducted by Guganeshan and Suthaharan, highlight the importance of involvement of ICT for microfinance[24]. According to them, ICT can be utilized to

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reduce transaction costs and streamline loan management practices by improving efficiency and effectiveness.

In the modern world, commercial banks have realized that poor people's finance can be profitable, an increasing number have gone down market to tap lower income clientele. The World Bank's microfinance unit, the Consultative Group to Assist the Poor, estimates that there are currently around 225 commercial banks "engaged in microfinance" and that is increasing. The MFIs have enough knowledge on community while commercial banks have enough capital and ICT infrastructure[25]. So, collaboration of commercial banks and microfinance sectors are lead to considerable grown of both parties and giving many benefits to the clients.

Research on 'The impact of innovation and technology on microfinance sustainable governance' conducted by Roberto and Maria, analyses different sections including business models and IT related issues[26]. According to Usage of information technology for microfinance sector would be beneficial and the modern trend is to be going with the rapidly growing technologies.

In Sri Lanka, mobile telecommunication services are rapidly increased, they further enhance their coverage and services. Currently there are five cellular mobile telephone operators. According to the statistics report published by Telecommunications Regulatory Commission of Sri Lanka (TRCSL) , all most all rural areas also covered by cellular mobile operators . All cellular operators try to increase coverage and value-added services they provide. According to the report published by the TRCSL, there is a rapid growth of mobile subscribers in last few years and still it is growing. As a result of those factors, pre-paid cards of cellular mobile networks are available in any rural area retail shops. Accordingly, subscribers can easily purchase prepaid card even when he go to nearby retail shop to buy a loaf of bread.

Francesc and Javier have conducted a research on 'Use of prepaid cards for banking poor' [27]. This research is focused on Unites states and Europe. The prepaid products are especially designed for offering services demanded by the poor, such as micropayments, micro deposits or even microcredits. Finally, they allow users to

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control their cash flow by receiving statements or accessing balances through PCs, mobile phones, hand-held and set-top boxes. So, usage of mobile networks and modern ICT would be a new trend in microfinance.

2.4   Future challenges

Poverty alleviation is the major challenge in developing countries. For the poverty reduction, proper cash flow, saving mechanism should be introduced to the poor people. Micro-Savings, Micro-Credits which can be easily accessed should be introduced to attract the people to the development flow. In the rate of growing cellular networks and technology, knowledge and the poverty alleviation are not changing in proper direction. Accelerating poverty reduction by utilizing rapid growth of cellular networks would be a future challenge.

2.5   Problem Definition

The literature review has identified the usage of microfinance to overcome poverty, current microfinance services, method of operations and business models. Traditional methods and current trends in microfinance and banking were identified. Further, growth of cellular mobile networks and their coverage also considered.

We discovered that, most of poor people are not using banking due to various reasons such as difficulty in visiting bank branches, many complex processes in documentations etc. Some poor people using microfinance services which suit their needs when compared to traditional commercial banks. Due to some obstacles such as, difficulty in easy access, customized solutions, difficulty in saving/deposits, people are reluctant or does not attract to microfinance services.

We have further noticed that commercial banks are using some ICT solutions such as online banking, mobile banking etc. However rural poor people cannot use those solution due to lack of knowledge and/or devices such as smart phones. In Sri Lanka, microfinance sector is still only using traditional methods in their operations.

Finally, we have identified that, there is a gap between usage of growth of cellular networks and the poverty reduction by proper usage of microfinance services. Most of

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rural poor people using at least basic mobile phone and prepaid cards. We can use mobile prepaid cards on micro savings and microcredits to bridge the gap. Details of the technology behind the solution will be discussed in Chapter 3.

2.6   Summary

This chapter presented a comprehensive literature review on microfinance research and identified the research problem as utilizing of commonly used technology, easy accessed methods and infrastructure to enhance the use of microfinance in saving and credits .

We also identified that mobile prepaid cards and basic phone or any smartphone can be utilized to address the above problem. Next chapter will discuss the technology to be used for our solution.

3 Technology Adopted of MBSCSS

3.1 Introduction

In the previous chapter, various researches address specific issues were critically reviewed. Advantages, disadvantages and features of existing systems and proposed systems were analyzed and listed. In this chapter, technologies regarding Mobile Based Scratch Card Saving System will be described. The methods used to development, testing and implementation will be discussed.

3.2 Technologies Available

3.2.1 Operating System

CentOS (Community enterprise Operating System), It is a 100% free operating system distribution based upon the Linux kernel. It is derived entirely from the Red Hat Enterprise Linux (RHEL) distribution. CentOS is providing a free enterprise class computing platform and strives to maintain 100% binary compatibility with its upstream source, Red Hat [28].

This Operating System is one of the most popular Linux distributions in the hosting industry. Due to Most hosting control panels use CentOS as the preferred Linux distribution.

Perl has been inbuilt in CentOS. Perl is a general-purpose programming language originally developed for text manipulation and now used for a wide range of tasks including system administration, web development, network programming, GUI development, and more. Perls database integration interface DBI supports third-party databases including Oracle, Sybase, Postgresql, MySQL and others[29].

3.2.2 Common Gateway Interface (CGI)

Common Gateway Interface (CGI) offers a standard protocol for web servers to execute programs that execute like Console applications (also called Command-line interface programs) running on a server that generates web pages dynamically[30] . Such programs are known as CGI scripts or simply as CGIs. The specifics of how the script is executed

by the server are determined by the server. In the common case, a CGI script executes at the time a request is made and generates HTML. In brief, the CGI program receives HTTP forms data via Unix/Linux standard input, and most other data (such as URL paths, URL arguments, and HTTP header data) via well-known Unix/Linux process environment variables [30].(Figure 3.1)
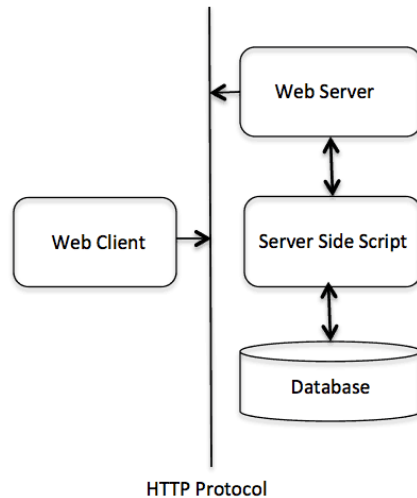
Figure 3.1 Transaction floor Diagram of Common Gateway Interface

3.2.3   Apache HTTP Server

Apache HTTP Server (usually just called Apache) is generally recognized as the world's most popular HTTP web server. It's fast and secure and runs over half of all web servers around the globe. Apache is also free software. The Apache web server provides a full range of features, including CGI, SSL, and virtual domains; it also supports plug-in modules for extensibility. There are a number of benefits to the Apache HTTP Server such as   IPv6, XML, FTP, Perl, Lua, PHP, WebDAV, HTTP/2,   Multiple Request Processing modes (MPMs), Session tracking, etc.[31]

3.2.4   PostgreSQL Database Management System

PostgreSQL is a great, open source object-relational DBMS. It has a strong reputation for reliability, data integrity, and correctness. It runs on all major operating systems, including Linux, UNIX (AIX, BSD, HP-UX, macOS, Solaris), and Windows. It is fully

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ACID compliant, has full support for foreign keys, joins, views, triggers, and stored procedures (in multiple languages). It includes most SQL:2008 data types, including INTEGER, NUMERIC, BOOLEAN, CHAR, VARCHAR, DATE, INTERVAL, and TIMESTAMP. It also supports storage of binary large objects, including pictures, sounds, or video. It has native programming interfaces for C/C++, Java, .Net, Perl, Python, Ruby, Tcl, ODBC, among others[32].

Linux web hosting with Apache web server andPostgreSQL databases suitable for our application since it is comparatively free and it can be scalable. We should install CPAN modules such as DBI, DBI:pg, for database connection. (Figure 3.2)

```
              |<- Scope of DBI ->|
             .-.  .--------------.  .--------------.
.--------.    | |---| XYZ Driver  |---| XYZ Engine  |
| Perl   |    | |   `--------------'  `--------------'
| script|  |A|  |D|   .--------------.  .--------------.
| using |--|P|--|B|---|Oracle Driver |---|Oracle Engine|
| DBI   |  |I|  |I|   `--------------'  `--------------'
| API   |    | |  |...
|methods|    | |  |... Other drivers
`-------'    `-'  |...
```
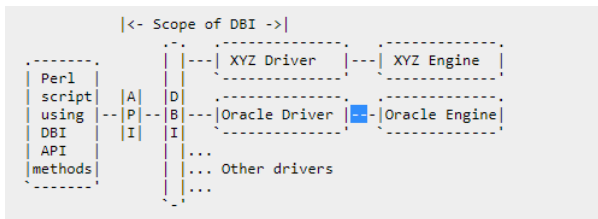
Figure 3.2 Detail Diagram of DBI

3.2.5 Mobile Scratch card

A scratch card is a small card, often made of thin paper-based card for competitions and plastic to conceal PINs, where areas contain concealed information which can be revealed by scratching off an opaque covering. In the mobile scratch card contain concealed the PIN number that refers to dedicated cash amount assigned by mobile service provider[33].

3.2.6 Simple Object Access Protocol (SOAP)

The Simple Object Access Protocol (SOAP) gives you the power of object-oriented web services by letting you construct and use objects whose class definitions exist at the other end of a URI[34]. You don't even need to know what programming language they use because the protocol magically turns the object's methods into a common, XML-based API. As long as the class is documented somewhere, with more details of the available class and object methods, you can hack away as if the class was simply another file on your hard drive, despite the fact that it actually exists on a remote machine.

3.2.7 Intelligent Network of Mobile operator (IN)

The Intelligent Network (IN) is the standard network architecture specified in the ITU-T Q.1200 series recommendations. It is intended for fixed as well as mobile telecom networks[35]. It allows operators to differentiate themselves by providing value-added services in addition to the standard telecom services such as PSTN, ISDN on fixed networks, and GSM services on mobile phones or other mobile devices.

The intelligence is provided by network nodes on the service layer, distinct from the switching layer of the core network, as opposed to solutions based on intelligence in the core switches or equipment. The IN nodes are typically owned by telecommunications service providers such as a telephone company or mobile phone operator.

3.2.8 HTTP Request Methods

The Hypertext Transfer Protocol (HTTP) is designed to enable communications between clients and servers. HTTP works as a request-response protocol between a client and server. A web browser may be the client, and an application on a computer that hosts a web site may be the server[36]. (Figure 3.3)

Request:

https://192.168.0.68/cgi-bin/telco-dialog/scratchcard?orig=86522245&func=scratchcard - check&subnum=0729300011&Scratchcard=254652456652545&paymthd=scratchcarddeposit& owner=testbank&cust_tid=12323212

Server Response:

```
<?xml version="1.0" encoding="utf-8"?>
<TCReply>
        <FUNC> Scratchcard </FUNC>
        <amt>100</amt>
        <subnum>0729400011</subnum>
         <result>0</result>
        <responsetext> Scratchcard number 254652456652545 value is
Rs.100.</responsetext>
        <datetime>2018-Feb-16 09:06:21</datetime>
        <fee>2</fee>
        <ref>0987654</ref>
        <errordesc></errordesc>
      <bal>98</bal>
        < cust_tid >12323212</ cust_tid >
</TCReply>
```

Figure 3.3 HTTP Request and the response

3.3　End User Communication Methods

3.3.1　Interactive voice response (IVR)

Interactive voice response (IVR) is a technology that allows to interact with humans through the use of voice and input via a keypad[37]. In telecommunications, IVR allows customers to interact with a system via a telephone keypad or by speech recognition, after which services can be inquired about through the IVR dialogue. IVR systems can respond with pre-recorded or dynamically generated audio to further direct users on how to proceed. IVR systems deployed in the network are sized to handle large call volumes and also used for outbound calling, as IVR systems are more intelligent than many predictive dialer systems.

3.3.2　SIM Application Toolkit (STK Application)

SIM Application Toolkit (commonly referred to as STK) is a standard of the GSM system which enables the Subscriber Identity Module (SIM) to initiate actions which can be used for various value-added services. The STK/SIM cards contain a basic application with a simple menu system that guides the user of the handset[38].

3.3.3　Unstructured Supplementary Service Data (USSD)

USSD (Unstructured Supplementary Service Data) is a Global System for Mobile(GSM) communication technology that is used to send text between a mobile phone and an application program in the network. Applications may include prepaid roaming or mobile chatting.

USSD is similar to Short Messaging Service (SMS), but, unlike SMS, USSD transactions occur during the session only. With SMS, message scan be sent to a mobile phone and stored for several days if the phone is not activated or within range[39].

3.3.4　Mobile applications (Mobile App)

A mobile app is a computer program designed to run on a mobile device such as a phone/tablet or watch. Mobile applications often stand in contrast to desktop applications that run on desktop computers, and with web applications which run in mobile web browsers rather than directly on the mobile device[40].

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3.3.5 SMSC (SMS centre)

System connects to SMSCs to receive SMS messages containing agent requests (plain or encrypted), and to send out plain-text SMS notifications[41].

Plain SMS

The system supports receiving of commands in plain SMS form.

Message encryption

Requests sent from handset devices from the system may be encrypted using specially provisioned SIM cards with a STK (SIM Tool Kit). Cryptographic system employed uses 3DES cryptography where the cryptographic key used to encrypt the message differs from handset to handset[42].

3.4 Automated Tasks

Handling real time services are not an easy task. Improve the service levels we need to schedule and automated some tasks.

Cron is application program that used to schedule our service run time and use automates some application services. Cron can be used to schedule the implementation of recurring tasks according to a combination of the time, day of the month, month, day of the week, and week. It will give great service automation experience in Linux systems[43].

3.5 Firewall ASA5505

Cisco ASA 5505 Adaptive Security Appliance ASA5505-BUN-K9 (Figure 3.4) is easy-to-deploy solutions for small business, branch office, and enterprise teleworker environments by integrating world-class firewall, Unified Communications (voice/video) security, SSL and IPsec VPN, intrusion prevention (IPS), and content security services in a flexible, modular product family. Designed to protect your networks, ASA5505-BUN-K9 features a flexible 8-port 10/100 Fast Ethernet switch with two Power over Ethernet (PoE) ports included, which can be dynamically grouped to create up to three separate VLANs for improved network segmentation and security[44].

Customers can install Security Plus upgrade license, enabling the Cisco ASA 5505 to scale to support up to 25 IPsec VPN users, add full DMZ support, and integrate into switched network environments through VLAN support. Furthermore, businesses can also extend the Cisco ASA 5505's VPN service by enabling Any Connect client and clientless VPN remote access to support various mobile.
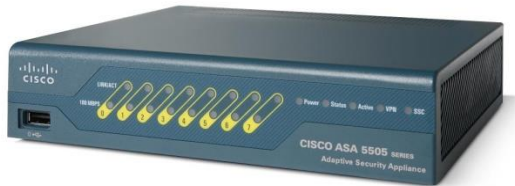
Figure 3.4 Firewall ASA5505

3.6   Back End

The back End refers to the bank core application. It contains all of the resources essential to provide client server architecture. It contains of huge data storage, automated services, security mechanism, services, communication channels, deployment models and servers etc.
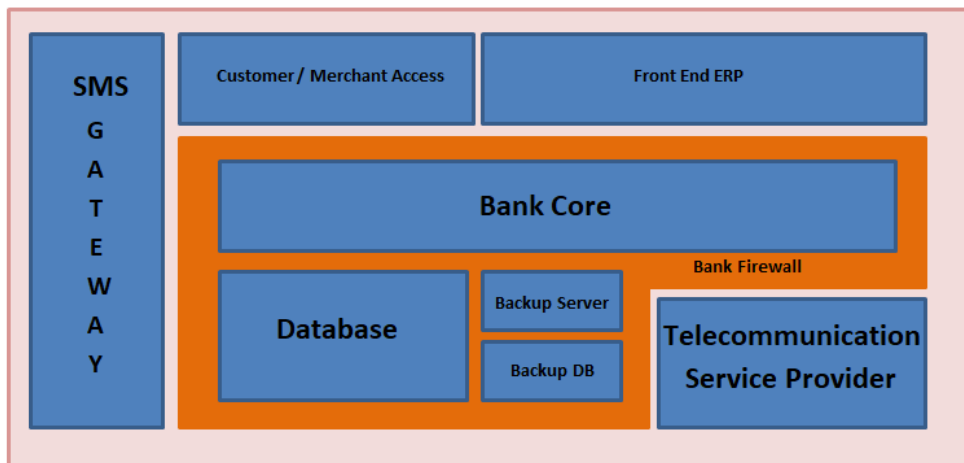
Figure 3.4 Technology block diagram need

3.7   Summary

In this chapter the technologies used for Mobile Based Scratch Card Saving System is described and reasons of use above relevant technologies also described. Advantages and disadvantages of technologies briefly described. In next chapter, the approach to implement MBSCS will be described.

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4 An approach to MBSCSS

4.1 Introduction

Using the technology mentioned in the previous chapter, we propose approach to MBSCSS, meaning of that traditional micro savings system has been replaced. The approach is defined under the hypothesis, input to the system, output of the system, process of convert input to the output, users and features of the system.

4.2 Hypothesis

We hypothesis Mobile Based Scratch Card Saving System is enable efficient way of deposit and withdrawal cash, without visiting bank.

4.3 Users

The many number of users can be benefited by the MBSCSS in multiple ways. Especially Customer, local shops, Bank and service provider are can be directly benefited by this solution. Individuals who are interested in micro saving solutions can also use this system for learning purposes.

4.4 Input

The system can access from devices including a computer connected to the Internet, Mobile phones. For registration, the inputs are username, password, customer information and mobile phone number. For saving and withdrawal purpose, the inputs are scratch card number, amount, merchant number, PIN and bank access number etc.

4.5 Output

Outputs of the system are available in the softcopy version such as SMS notification, message box, tool tips, etc. Decision support information are available as system logs, customize report html view.

4.6 Process

All the stakeholders required mobile number and it used to identify the user uniquely. All the users must be register and they were active before use the system. Each and every user has an authentication process before use the facilities of the system. Verification

processes required to run before access each and every feature such as available balance, transaction limits.

4.7   Features

In connection with the input, output, users and process the system include the following characteristics.

- User / Merchant registration
- Cash Deposit
- Cash Withdrawal
- Customized system transaction report generation
- System Logs
- User friendliness
- Easy accessibility

4.8   Summary

This chapter described overall solution for our research. We have mentioned problem definition and assumption of the solution to that problem. We described clearly inputs; outputs and process convert input to output. Stakeholders get benefit from this system and incredible features of the system. Next chapter we will describe in detail, extended design of our process and what system does.

5 Design of MBSCSS

5.1 Introduction

The previous chapter presented full picture of the entire solution. This chapter describes the design of solution for the process presented in the approach. We design the solution as a Client server system with a backend database. Here we describe the top-level architecture of the design by elaborating on the role of each component of the architecture.

5.2 Top Level Architecture of MBSCSS
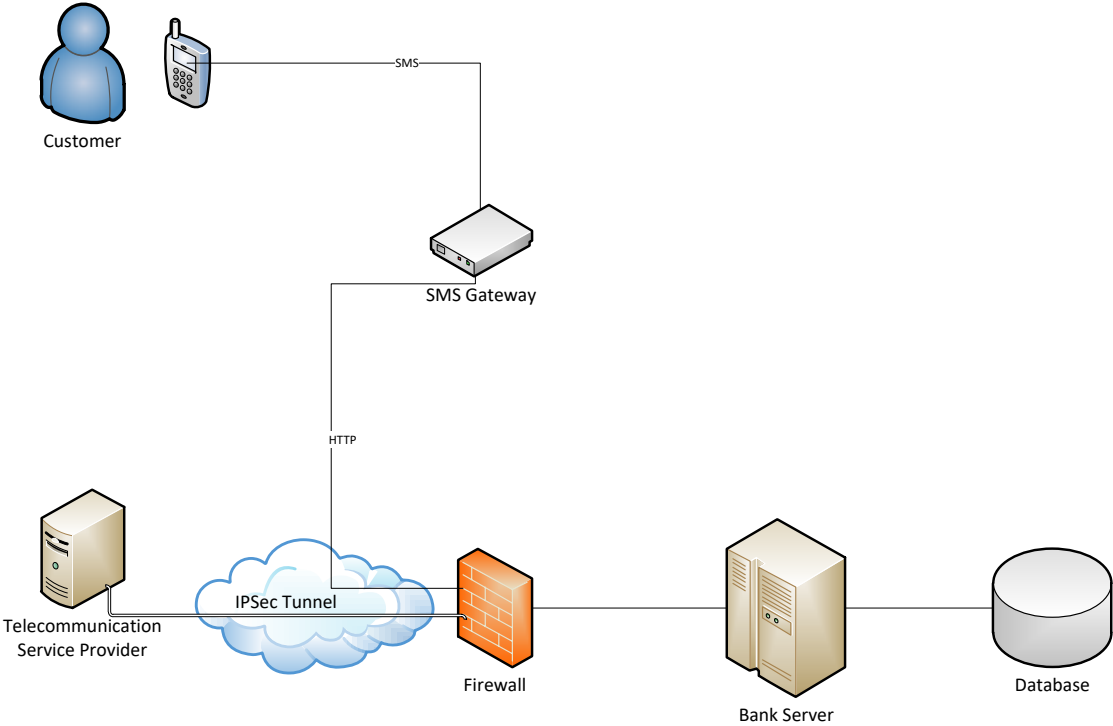
Figure 5.1 Component diagram with input and output

Above diagram illustrate input, output, major modules in system and relationship between each module. Bank server, database, firewall, SMS Gateway, telecommunication

service provider transaction core are major modules of the MBSCSS. Each and every module of the system will be described individually in this chapter.

5.3　Banking Core

Banking core is the main component of the system. It consists of firewall, Application server, main database and front end application. (Figure 5.2)
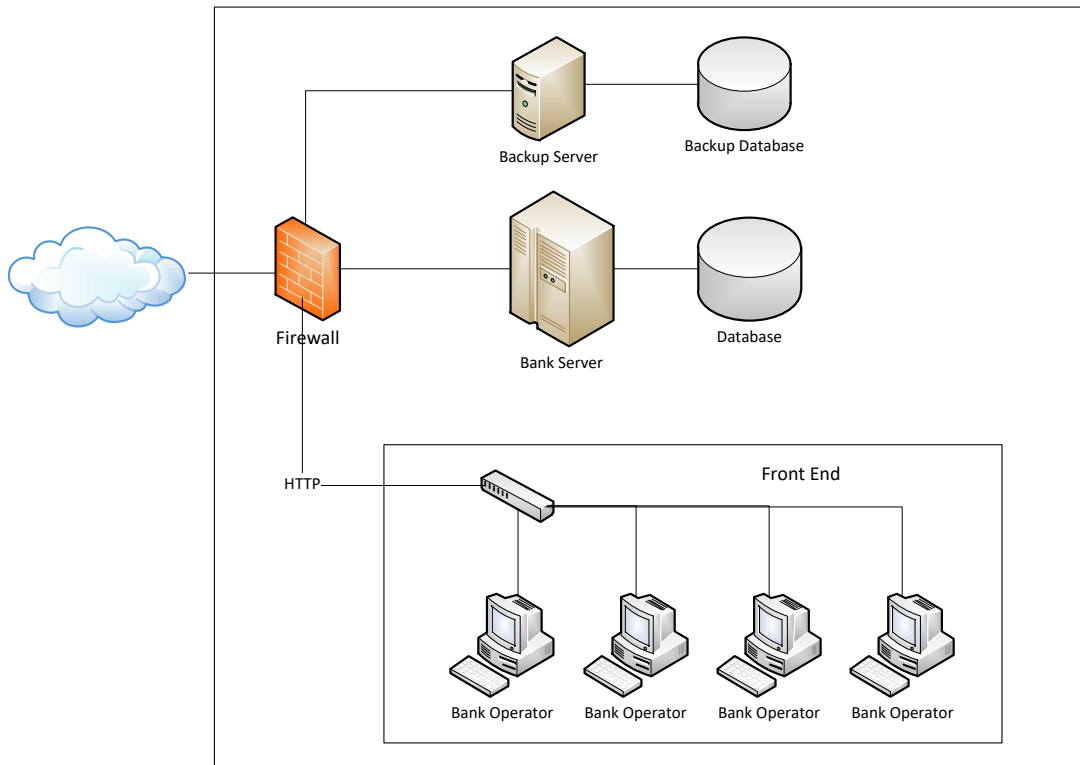
Figure 5.2 Component diagram in bank core

5.3.1　Bank Firewall

Firewall is doing the networking part of the system. It is linking banking main server with other communication modules such as all the telecommunication providers, SMS gateways, backup server and database and bank front users.

5.3.2　Bank Application Server

Bank Application server is the main component of the system. MBSCSS application is run on it. All user requests handle by specific server. It can be user registration, Scratch Card Deposit and Cash withdrawal. According to the request, MBSCSS application

communicated with services such as bank database, telecommunication service provider, SMS gateway etc. MBSCSS application is generate system logs as well.

5.4 Telecommunication Service Provider and SMS Gateway
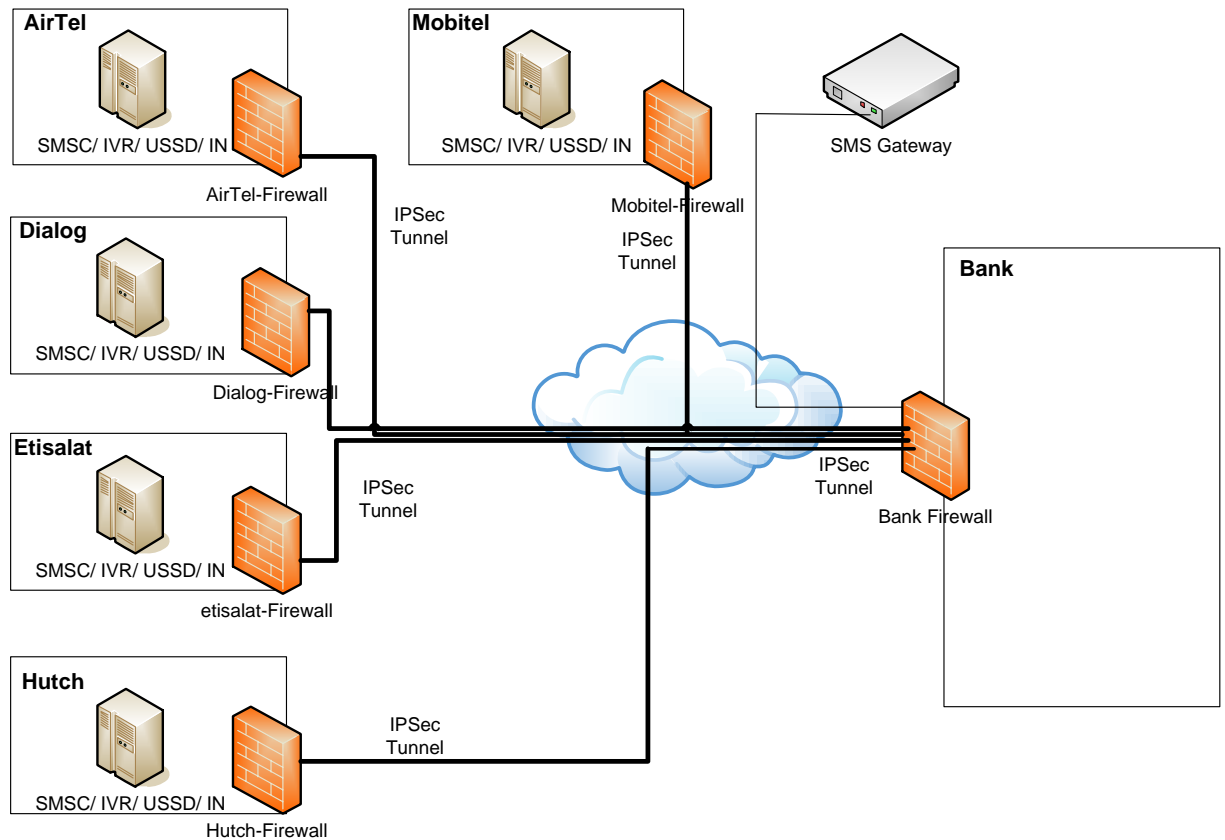
Figure 5.3 Component diagram in communication module

All the telecommunication service providers are connected to bank firewall via ipsec site to site VPN tunnel. Bank core can access the telecommunication provider's services, such as intelligent network (IN), SMSC, IVR and USSD through the VPN. SMS gateway communicates through HTTP with bank application server (Figure 5.3).

5.5 Operating System installation

CentOS release 6.8 (Final) installed to Banking main server and backup server. CentOS 6.8 is a popular choice for network-facing machines such as Web servers.

5.6   Web Server installation and configuration

Bank main server installs Apache/2.2.15 (UNIX) HTTP Server as a web server. Apache is free software. The Apache web server provides a full range of features, including CGI, SSL and virtual domains.

5.7   DBMS installation and configuration

The bank main server installed postgres (PostgreSQL) 8.4.20 DBMS, phpPgAdmin administrative GUI and installed CPAN modules such as DBI-1.641, DBD::Pg 3.4.2, for database connection.

5.8   Web application Design

We use web application for do the all administration works in the system. It includes user registration, Scratch Card Generation, Banking transaction processing, Report generation.

5.8.1   Design User Registration

It enables to bank operates to register customers and merchant. This module provides secure login, view user details, user authentication, search options etc. This module offers facilities register users, viewing user details, user's transaction history, edit user, active / de active users, etc.

5.8.2   Design Scratch Card Generating system

Through this module we can generate scratch cards. This module offers facilities generate scratch card batch, view generated scratch card, view scratch card status, etc.

5.8.3   Design Transaction Core

The bank sever works as the central point of the system. The server has connection to the backend database. This module can authenticate the user by detecting CLI. System takes user request and analysis it. Then system is process the requirement and doing accounting calculations. When the system is process the request it will communicate with telecommunication providers and SMS gateway. Finally system sends notifications to relevant parties such as SMS notifications, Front end notifications and back end notifications.

5.8.4   Design System Reports

This module provides all the analytical date to users. Bank web application provides users transaction reports, activity report and decision support report. This module provides customized report generation options.

5.9   Design System logs

This module is very important to the system. It writes a back end logs for all transaction. this logs are very important for tubule shooting proposers. This logs includes, date, time, session ids, user information, transaction numbers, description and result codes.

5.10   SMS Gateway

This module is the main communication method that customers having to access the banking services. Using this module, system can take the customer request, send notification SMS to customers, send transaction status, ect.

6 Implementation of MBSCSS

6.1 Introduction

Here we describe our Mobile Based Scratch Card Saving System design in detail according to the design discussed on previous chapter. This chapter will describe how to integrate all the modules with core banking system and code segment run on integration module.

6.2 Overall solution

Overall solution has three main components. They are Bank core application, telecommunication service provider and SMS Gateway. Bank core application use TCP / UDP protocol through IPsec VPN to communicate with telecommunication service providers. End users are used SMS to access the banking services through SMS gateway. SMS Gateway used HTTP protocol API to communicate with Bank core application. Bank staff use web browser to access bank core application it used HTTP protocol to communicate with Bank core application.

6.3 Implementation infrastructure

There are some legal difficulties to implement actual infrastructure in real environment. Those are, we need to have legal agreement to connect all the telecommunication providers with this system. The bank should not give permission to change their core banking system. Therefore we need real service provider to create ipsec VPN using firewalls.

To overcome this issue,

MBSCSS Bank application server should implement as separated server and it should connect to bank firewall through multi-channel gateway (MCG). (Figure 6.1)
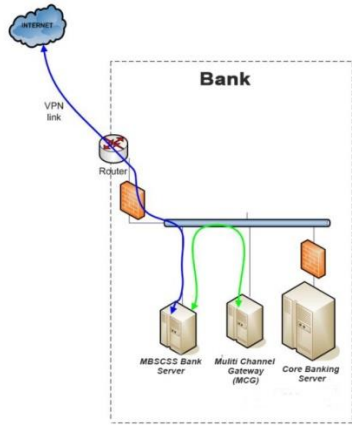
Figure 6.1 Detail Bank Core connectivity

I used single application server to developed bank application and telecommunication service provider's scratch card application. Then I change the top level architecture according to new solution.(Figure 6.2)
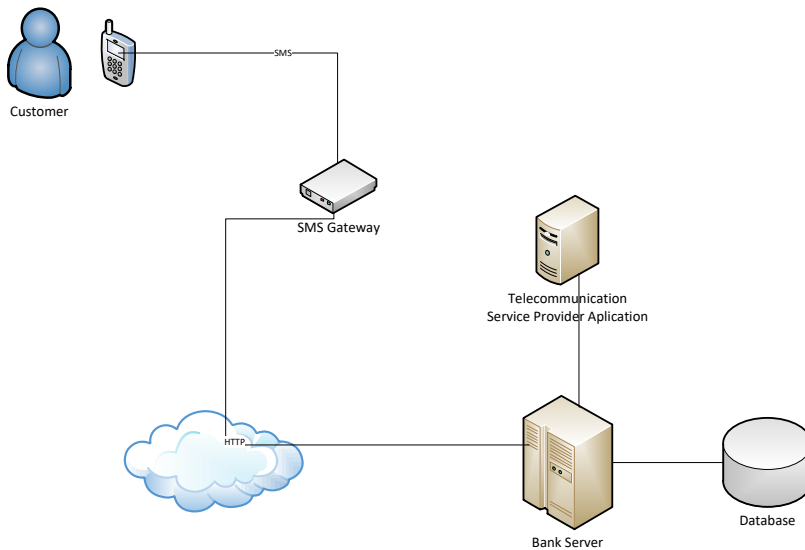
Figure 6.2 Component diagram of the Test Solution

6.4   Software and Hardware used

Bank core application is developed using VI editor. VI is a screen-oriented text editor originally created for the Unix operating system. Front end applications interfaces are developed by HTML and CSS.

Bank server which consists of apache, PostgreSQL with Perl was used to test and local development purposes of the banking application. perl CGI is the open-source perl CGI scripting language. CGI gives an interface between a webserver, such as Apache, and clients through a (CGI) script, which can be written in any Perl programming language. However, Perl CGI scripting languages are often used for client server web application developments. CGI Scripts take the request from client and will call appropriate functions to return the result to the requested clients. There are many language that could function as CGI language like Perl, C, C++, Tcl, Unix Shell Script, etc. However, Perl is without a doubt the most used languages for CGI scripting.

PostgreSQL database was used to keep record of customer information and transaction details. In the hosting environment consist of Apache/2.2.15 and PostgreSQL 8.4.20 database.

6.5   Implantation of Sever and DBMS

Bank application server implemented as Linux web based server using Centos, Apache web server, then install Perl / Perl CGI and set the CGI document directories by editing the apache conf file. Then install PostgreSQL and configure with phpPgAdmin administrative GUI. Finally Install CPAN modules such as DBI-1.641, DBD::Pg 3.4.2, for database connection.

6.6   Implantation SMS Gateway

SMS Gateway implementation I used third party sms gateway API. The payment gateway is own by "textit.biz" and it provides inbound and out bound SMS and MMS services via HTTP POST method (Figure 6.3). Access number of this gateway is 0777238111.

Variable	Usage	Description
id	Mandatory	User ID
pw	Mandatory	4 Digit Password
to	Mandatory	Recipient Phone number in international format
subject	Optional	Subject of MMS Message
text	Optional	MMS Message body text Upto 100,000 Charactors long
image	Optional	Base64 encoded JPEG image upto 100Kb
from	Optional	Custom Sender ID in the form of yourname@yourdomain.com

Note : Variable parse method POST

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Figure 6.3 SMS Gateway API Variable Description

6.6.1 API Request

HTTP API is the greatest simplest and the scalable method of programming your SMS integration to your website or application. HTTP API can be used for Broadcast (Send SMS Messages) or Check Balance of your account

Following code will send the SMS Request to SMS Gateway and take the response code (Figure 6.4).

http://www.textit.biz/sendmsg/index.php?id=000000000&password=0000&text=This+is+a+sample+message.&to=9876543210&from=OurCompany

Figure 6.4 SMS Gateway API Request for out bound SMS

In this example, a plain SMS "This is a sample message" is being sent to Mobile Number 9876543210 from sender ID 'Our Company' a random number will be displayed on unsupported networks.

6.6.2 API Response

Assuming that the Status check routine was executed successfully, the body of the API's response (Figure 6.5) will contains the Delivery Status, Unix Timestamp, Normal time in the format of (dd-mm-yy h:m:s).

Eg. STATUS:DELIVRD-P,1461315850,22-04-16 09:04:10

Respond Code	Description
DELIVRD-P or DELIVRD	Message Successfully Delivered
SENT-P or SENT	Message Successfully Sent – No delivery report Received
FAILED –P or FAILED	Message Delivery Failed
PENDING-P or PENDING	Message Sent, Pending Delivery
QUEUED-P or QUEUED	Message Queued for sending

Figure 6.5 Respond code descriptions

6.6.3 Inbound SMS

SMS Gateway is post the inbound sms to MBSCSS application server. Application server will take the request and stored in the database (Figure 6.6).

HTTP Request for Inbound SMS

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https://64.150.189.22/cgi-bin/tcapp/smsin?phone=<number>&text=<message>

Figure 6.6 HTTP Request

6.7 Implantation of Web application

6.7.1 Database connection

Implementation of database connection is the first step of this stage. It need DBI cpan module to create the database connection. All the database connection details are located in the external files. Web application is access external files and creates the database connection(Figure 6.7).

```
my $db = 'DBI:Pg:host=' . $db_ip . ' dbname=' . $database;
my $dbh = DBI->connect($db,$username,$pass);
```

Figure 6.7 Database connection

6.7.2 Get Web Application Data

Web application use POST method to send data to main system. System will take web form request and chop it and stored in the array. Then request will process using the array data (Figure 6.8).

```
#  Parse from the web form
################################################################
read (STDIN, $buffer, $ENV{'CONTENT_LENGTH'});
@cgiPairs = split(/&/,$buffer);
foreach $cgiPair (@cgiPairs)
{
  ($name,$value) = split(/=/,$cgiPair);
  $value =~ s/\+/ /g;
  $value =~ s/%(..)/pack("c",hex($1))/ge;
  $form{$name} .= "\0" if (defined($form{$name}));
  $form{$name} .= "$value";
}
$remote_addr = $ENV{'REMOTE_ADDR'};
$remote_host = $ENV{'REMOTE_HOST'};
$timestamp = time();
$last_updated =localtime (time);

if ($INPUT{'submittype'} eq "url"){
$form{'client'} = "$INPUT{'user'}";
$form{'password'} = "$INPUT{'pas'}";

#print qq! user=$form{'username'}, pass=$form{'passwd'} !;
```

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}
Figure 6.8 chopping web form data

User login, Customer registration and merchant registration web applications are using this method to communicate with the system.

6.7.3   Get Data from External Source

External requests are comes as a web request. Then main system will take web URL data and chop it and stored in the array. Then request will process using the array data (Figure 6.9).

```
####### Parse from web page (URL_)
@pairs = ();
@pairs = split(/&/, $ENV{'QUERY_STRING'});
foreach $pair (@pairs)
{
local($name, $value) = split(/=/, $pair);
$name =~ tr/+/ /;
$name =~ s/%([a-fA-F0-9][a-fA-F0-9])/pack("C", hex($1))/eg;
$value =~ tr/+/ /;
$value =~ s/%([a-fA-F0-9][a-fA-F0-9])/pack("C", hex($1))/eg;
$value =~ tr/,/ /;
$value =~ s/<!--(.|\n)*-->//g;
$INPUT{$name} = $value;
}
```
Figure 6.9 chopping web URL data

6.8   Implementation of Automated Tasks

Cron application services can be used to schedule the implementation of recurring tasks according to a combination of the time, day of the month, month, day of the week and week. It use for automated and process inbound sms request with in one minute (Figure 6.10).

Process Inbound SMS

*1 0 * * * /www/lankareload.com/cgi-bin/smsrel > /dev/null 2>&1*

Figure 6.10 Crontab for process inbound SMS

6.9   Implementation of Scratch Card Saving

Method of saving Scratch Card first step is sending the SMS to SMS gateway. The SMS should have standard format (Figure 6.11). SMS Gateway access number would be 0777238111.

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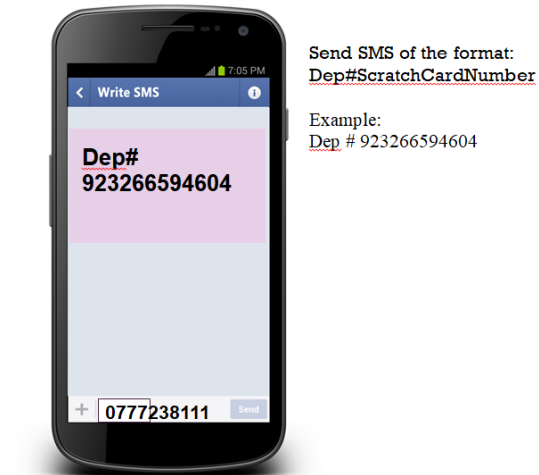
Figure 6.11 Scratch Card Saving SMS

SMS gateway sends HTTP Request to bank application server (Figure 6.6). It will store in the database as unread record. Cron programme is activating within next one minute and its check new inbound sms and precede the transaction.

6.9.1 Accounting entries of Scratch Card Saving

Telco-A Customer A sends a scratch card for Rs.100. (Bank Fee 0%, Telco Commission 0%) (Figure 6.12).

Accounting entries:

Bank Card Saving Account	Debit	Credit
A		100
Telco-A	100	
Bank Fee		0
Telco-A		0

Figure 6.12 Scratch Card Saving - No fee

* Bank Fee is similar to bank account, used when part of the fee is 'paid back' to merchant or Bank as commission.

Telco-A Customer A sends a scratch card for Rs.100. (Bank Fee 5%, Telco Commission 5%)(Figure 6.13).

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Accounting entries:

Bank Card Saving Account	Debit	Credit
A		90
Telco-A	100	
Bank Fee		5
Telco-A		5

Figure 6.13 Scratch Card Saving – 10% fee

* In this transaction bank getting 5% of commission fee and telecommunication service provider also getting 5% of commission.

6.10 Implementation of Cash Withdrawal

Method of Cash withdrawal first step is sending the SMS to SMS gateway including withdrawal amount and the merchant mobile number. The SMS should have standard format (Figure 6.14).

Figure 6.14 Cash Withdrawal via Merchant SMS

SMS gateway sends HTTP Request to bank application server (Figure 6.6). It will store in the database as unread record. Cron program is activating within next one minute and its check new inbound sms and precede the transaction.

6.10.1 Accounting entries of Cash Withdrawal

Customer A withdraw Rs.100 from Merchant X. (Bank Fee 0%, Merchant Commission 0%)(Figure 6.15).

Accounting entries:

Bank Card Saving Account	Debit	Credit
A	100	
Merchant X		100
Bank Fee		0
Merchant X		0

Figure 6.15 Cash Withdrawal - No fee

* Bank Fee is similar to bank account, used when part of the fee is 'paid back' to merchant or Bank as commission.

Customer A withdraw Rs.100 from Merchant X. (Bank Fee 5%, Merchant Commission 5%) (Figure 6.16).

Accounting entries:

Bank Card Saving Account	Debit	Credit
A	110	
Merchant X		100
Bank Fee		5
Merchant X		5

Figure 6.16 Cash Withdrawal - 10% fee

* In this transaction bank getting 5% of commission fee and merchant also getting 5% of commission.

6.11 Implementation of Scratch Card Generating system

Scratch Card having 12 digits unique pin number and it contain the value. When customer use the Scratch Card, the value of the scratch card will transfer to customer's account.

6.12 Implementation of System Logs

To generate system logs, application having a sub module. This module was use on every important point of the application. This module will write all the transaction data in to a file. Log files are named as date format (Figure 6.17).

sub write_msg_log{

my ($msg) = @_;

my ($msg_row,@msg_row,$msg_log,$senders_acid);

$msg_log = "/var/log/$path/$current_year$current_month$current_date";

push (@msg_row,$current_year,$current_month,$current_date,$current_day,$current_time,$next_trn_id,$progname,$msg);

$msg_row = join ("\/", @msg_row);

open (DATABASE, ">>$msg_log") || die print "File not found: $msg_log";

print DATABASE "$msg_row\n";

close (DATABASE);

}#### sub writ_ops_log

Figure 6.17 Message log write sub module

6.13 Summary

In this chapter, it was elucidated in detail how the implementation done for MBSCSS, based on the design which was describe in Chapter 5. In next chapter it will be discussed how this implemented system was evaluated by a selected set of users.

7 Evaluation of MBSCSS

7.1 Introduction

Here we describe our Mobile Based Scratch Card Saving System evaluation according to the implementation discussed on previous chapter. This chapter will describe how to evaluate integrated software modules, Bank web application, Scratch Card deposit through SMS and Cash withdrawal via merchant.

7.2 Evaluation Methodology

In order to evaluate the Bank web application functionality and performance randomly selected set of bank operators and they were used system and application as actual production environment. System presented to particular selected users and instructed them to used application as normal working environment. Methodology used to get feedback on system using a predefined set of question in a questionnaire. For this evaluation purpose, the system was deployed in a local environment. Since MBSCSS consists of one bank operator login, one telecommunication service provider login, one customer account and one merchant account, systems were evaluated separately, using the different set of questions. The following areas were evaluated in the system evaluation.

(a) Web Application Evaluation

- Usability
- System functionality
- Overall Impression

(b) Customer Scratch Card Deposit Evaluation

- Usability (5 questions)
- System functionality (5 questions)
- Overall Impression (5 questions)

(c) Customer Cash Withdrawal Evaluation

- Usability (5 questions)

- System functionality (5 questions)
- Overall Impression (5 questions)

Following the evaluation factors were assigned on system evaluation sections. 1 - Very poor (2), 2 – Poor (4), 3 – Average (6), 4 - Good (8), 5 - Excellent (10)

The evaluation is design using statistical analytical method. Evaluation data analysis is doing by   Microsoft Excel. By doing data analysis it check the critical line. To calculate the critical line is calculated average point for each question will be checked against the critical line to make a final decision. There are 10 customers, 10 Merchant and 10 Bank Operators participated survey and weighted ranked as follows.

$$\text{Average points for evaluation} = \frac{(\text{Very poor}*2+\text{Poor}*4+\text{Average}*6+\text{Good}*8+\text{Excellent}*10)}{\text{No. of Users}}$$

Critical line of score = 40%

7.3   Evaluation Forms
According to the evaluation methodology, please refer evaluation forms in Appendix F.

7.4   Final Evaluation Results
All the evaluation data has been analysis by Microsoft Excel. Final evaluation results are taken by doing data analysis on Usability, Functionality and Overall Impression.

7.4.1   Evaluation of Bank web Application
Table 7.1 shows how evaluation result on Bank web Application questioner and average score 77.4. Analysis results of the evaluation on Bank web Application illustrate on Appendix G.

Description	Score
Usability	74.80
Functionality	78.80
Overall Impression	78.80
Average	**77.47**

Table 7.1 Summary of Evaluation of Bank web Application

7.4.2 Evaluation of Scratch Card Deposit

Table 7.2 shows how evaluation result on Scratch Card Deposit questioner and average score 79. Analysis results of the evaluation on Card Deposit illustrate on Appendix H.

Description	Score
Usability	80.80
Functionality	78.40
Overall Impression	78.00
Average	**79.07**

Table 7.2 - Summary of Evaluation on Evaluation of Scratch Card Deposit

7.4.3 Evaluation of Cash Withdrawal

Table 7.3 shows how evaluation result on Cash Withdrawal questioner and average score 78.9. Analysis results of the evaluation on Cash Withdrawal illustrate on Appendix I.

Description	Score
Usability	80.80
Functionality	77.60
Overall Impression	78.40
Average	**78.93**

Table 7.3 Summary of Evaluation on Evaluation of Cash Withdrawal
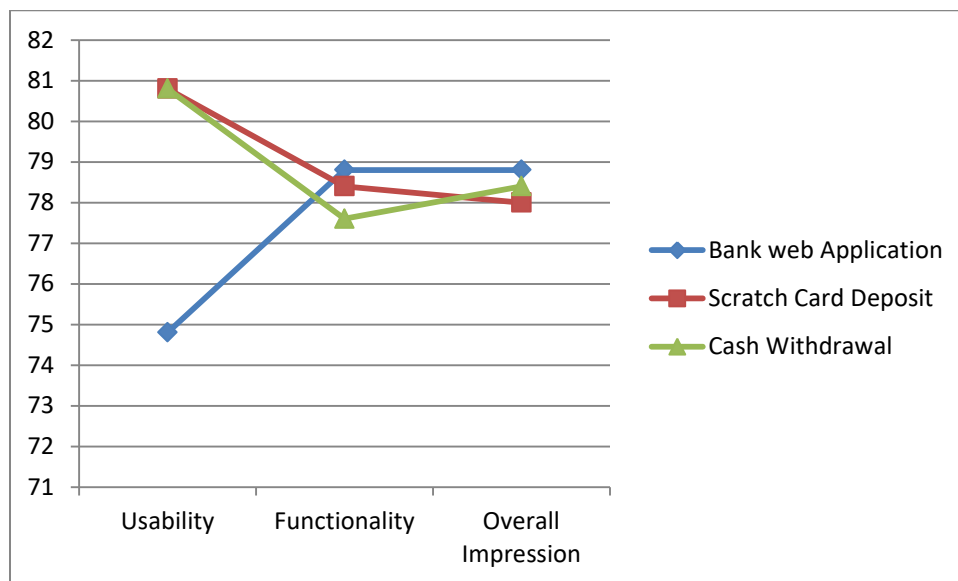
Figure 7.4 – Evaluation Chart

According to the evaluation chart in Figure 7.4, all the evaluation points are exceeding the defined critical point (Critical point = 40). Therefore, system is approach the targeted evaluation points.

7.5   Summary

According to the evaluation results, the system is having standard quality in all characteristics of the evaluation of bank web application, scratch card deposit system and cash withdrawal system. In the next chapter, conclusion and further possible enhancements for MBSCSS will be discussed.

8 Conclusion and further work of MBSCSS

8.1 Introduction

The System had been validated by selected set of users on the chapter 7. In this chapter discussed identified enhancements, features and further work.

8.2 Conclusion

The customers, Merchant, telecommunication service provider and bank staff are mainly benefited by the proposed system. Current bank system, customers are unable to do the bank transaction without visiting the bank. Advantage of new system, Customers will be able to get banking transactions any time, from any place and without visiting the bank. Bank can easily manage their stakeholders and they can explore their service level to next level.

Following features of MBSCSS given to the customers,

- Customers can do account savings using scratch card
- Customers can do account savings with our visiting the bank
- Customers can do account savings any time
- Customers can do cash withdrawal from local shop
- Bank can register the customer or merchant
- Bank can generate reports from scratch card saving and cash withdrawal

The main risk has been identified the system is SMS communication channel. When customers send SMS to bank, SMS content can be seen by third party. Therefore bank should thing about secure encrypted SMS method. MBSCSS is very simple and user friendly system therefore this system is directly close to people lifestyles. Therefore bank could be used to generate new trends and knowledge through this system.

8.3 Further work

In this beginner level bank system only gives cash deposit and cash withdrawal to customer. But bank can offer all the banking services to customers in near further. Such

as balance inquiry, maintain multiple bank accounts, Bill payments, Utility payment, and insurance payment. Bank can give number of communication channels, such as , encrypted SMS, USSD, IVR, IOS Mobile APP, Android APP, etc.

8.4   Summary

This chapter concludes the thesis by describing the mobile based scratch card saving system and how it can further improve with new features.

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Appendix A - Configuration and installing modules

Install Apache web server on centos 6

1. Run the following command:
2. sudo yum install httpd mod_ssl
3. Because the server does not start automatically when you install Apache, you must start it manually.
4. sudo /usr/sbin/apachectl start

   The following message is displayed:

   Starting httpd: httpd: Could not reliably determine the server's fully qualified domain name, using 127.0.0.1 for ServerName

   The IP address (shown in this example as 127.0.0.1) is used as the server name by default. In the following steps, set the server name for the next time the server is started.

5. Open the main Apache configuration file.
6. sudo nano /etc/httpd/conf/httpd.conf
7. Toward the end of the file, locate the section that starts with ServerName and gives an example.
8. #ServerName www.example.com:80
9. Enter your cloud server host name or a fully qualified domain name. In the following example, the host name is demo.
10. ServerName demo

    Reload Apache.

11. sudo /usr/sbin/apachectl restart

Install PostgreSQL on centos 6

Open the CentOS repository configuration file in a text editor:

nano /etc/yum.repos.d/CentOS-Base.repo

At the bottom of the [base] section, add a line that excludes the postgres packages:

[base]
name=CentOS-$releasever - Base
mirrorlist=http://mirrorlist.centos.org/?release=$releasever&arch=$basearch&repo=os
#baseurl=http://mirror.centos.org/centos/$releasever/os/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-6
exclude=postgresql*
Add the same line to the bottom of the [updates] section to prevent yum from updating postgres from the default repositories:

[updates]

name=CentOS-$releasever - Updates

mirrorlist=http://mirrorlist.centos.org/?release=$releasever&arch=$basearch&repo=updates
#baseurl=http://mirror.centos.org/centos/$releasever/updates/$basearch/
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-6
exclude=postgresql*
Control-click or right-click on the link that matches the most recent version of postgres and your version of CentOS. Choose "copy link address" or whatever similar option is available.
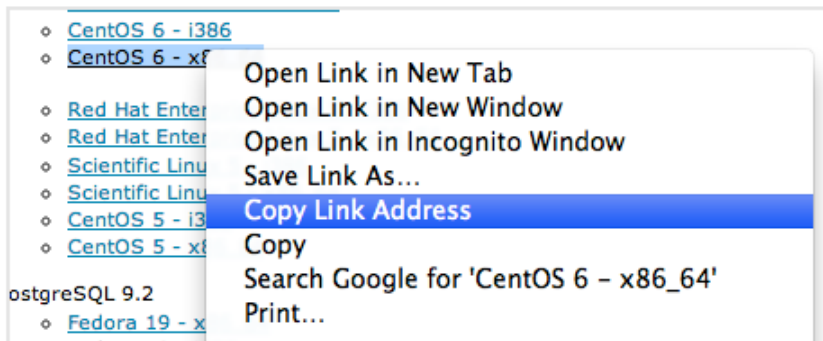
Back in your droplet session, change to your home directory. Type curl -O and then paste the download link:

cd ~

curl -O http://yum.postgresql.org/9.3/redhat/rhel-6-x86_64/pgdg-centos93-9.3-1.noarch.rpm

Install the package you just downloaded by typing the following command:

rpm -ivh pgdg*

We can see that in this case, all of the packages have "93" for version 9.3. We want to download the "-server" packages:

yum install postgresql93-server

Appendix B – User interfaces for MBSCSS

Figure 1 User Login

Figure 2 Bank Operators GUI

Figure 3 End-user Search

Figure 4 User registration

Figure 5 end user transaction reports

Figure 6 Scratch Card Generating GUI

Figure 7 Scratch Card Report

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Appendix F – System Evaluation Forms

Evaluation of Usability – Bank web Application

Participants – Bank Operator   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Can you understand function of the System					
2	Can you rasy to learn system functions by your self					
3	Are you happy with the time taken to system feedback when execute function					
4	Are you happy with the information provided by the system					
5	Is system give proper feedback and massages to guide you to achieve your					

Table 1 - Usability – Bank web Application

Evaluation of Functionality – Bank web Application

Participants – Bank Operator   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Does system provide the proper navigation throughout the application					
2	Does system giving clear output for your input					
3	Base on the system functionalities how you rank the system					
4	Did system giving you enough functions to do complete tasks					
5	Rank your expectation and system					

Table 2 - Functionality – Bank web Application

Evaluation of Overall Impression – Bank web Application

Participants – Bank Operator   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Does system provide the final result within your expected time scope					
2	Does system provide the final result within your expected quality					
3	Overall satisfaction with this application					
4	Do you want to use this system regular basis					
5	Rank your expectation and system functionality					

Table 3 - Overall Impression – Bank web Application

Evaluation of Usability – Scratch Card Deposit

Participants – Customer   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Can you understand function of the Scratch Card Deposit					
2	Do you understand the SMS format of the Scratch Card Deposit					
3	Do you understand what is the Scratch Card and how to use it					
4	Do you understand how to send SMS to system SMS gateway					
5	Is system give proper feedback and massages to guide you to achieve your					

Table 4 - Usability – Scratch Card Deposit

Evaluation of Functionality – Scratch Card Deposit

Participants – Customer   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Does SMS Properly send to the gateway					
2	Does system giving clear output for your input					
3	Base on the system functionalities how you rank the system					
4	Did system giving you enough functions to do complete tasks					
5	Do you get conformation SMS correctly					

Table 5 - Functionality – Scratch Card Deposit

Evaluation of Overall Impression – Scratch Card Deposit

Participants – Customer   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Does Scratch Card Deposit to your account within your expected time scope					
2	Does Scratch Card Deposit final result within your expected quality					
3	Overall satisfaction with this application					
4	Are you happy with time taken to cash deposit to your account					
5	Rank your expectation and Scratch Card Deposit functionality					

Table 6 - Overall Impression – Scratch Card Deposit

Evaluation of Usability – Cash Withdrawal

Participants – Customer, Merchant   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Do you understand what is the merchant number					
2	Do you understand the SMS format for Cash Withdrawal					
3	Do you understand what is the Scratch Card and how to use it					
4	Do you understand how to send SMS to system SMS gateway					
5	Is system give proper feedback and massages to guide you to achieve your					

Table 7 - Usability – Cash Withdrawal

Evaluation of Functionality – Cash Withdrawal

Participants – Customer, Merchant   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Does SMS Properly send to the gateway					
2	Does system giving clear output for your input					
3	Base on the system functionalities how you rank the system					
4	Did system giving you enough functions to do complete tasks					
5	Do you get conformation SMS correctly					

Table 8 - Functionality – Cash Withdrawal

Evaluation of Overall Impression – Cash Withdrawal

Participants – Customer, Merchant   No. of Participants - 10

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	1 Very	2 Poor	3 Average	4 Good	5 Excellent
1	Does cash withdrawal to your account within your expected time scope					
2	Does Scratch Card Deposit final result within your expected quality					
3	Overall satisfaction with this application					
4	Are you happy with time taken to cash deposit to your account					
5	Rank your expectation and Scratch Card Deposit functionality					

Table 9 - Overall Impression – Cash Withdrawal

Appendix G - Data Analysis - Evaluation of   Bank web Application

Participants – Bank
Operator   No. of Participants - 10

Usability

1 - Very poor, 2 – Poor, 3 – Average, 4 -
Good, 5 – Excellent

	Evaluation criteria	Marks offered					Out of 100	%
		2	4	6	8	10		
		Very	Poor	Average	Good	Excellent		
1	Can you understand function of the System	0	0	30	24	20	74	
2	Can you rasy to learn system functions by your self	0	0	24	32	20	76	
3	Are you happy with the time taken to system feedback when execute function	0	0	12	32	40	84	
4	Are you happy with the information provided by the system	0	4	12	32	10	58	
5	Is system give proper feedback and massages to guide you to achieve your	0	0	18	24	40	82	
	Usability						374	74.80

Participants – Bank
Operator   No. of Participants - 10

Functionality

1 - Very poor, 2 – Poor, 3 – Average, 4 -
Good, 5 – Excellent

	Evaluation criteria	2	4	6	8	10	Out of 100	%
		Very	Poor	Average	Good	Excellent		
1	Does system provide the proper navigation through out the application	0	0	30	24	20	74	
2	Does system giving clear out put for your input	0	0	12	40	30	82	
3	Base on the system functionalities how you rank the system	0	4	6	40	30	80	
4	Did system giving you enough functions to do	0	0	18	16	50	84	

	Evaluation criteria						Out of 100	%
	complete tasks							
5	Rank your expectation and system	0	0	24	40	10	74	
				Functionality			394	78.80

<div align="center">Table 2 - Data Analysis of Functionality – Bank web Application</div>

Participants – Bank
Operator   No. of Participants - 10

Overall Impression
1 - Very poor, 2 – Poor, 3 – Average, 4 -
Good, 5 – Excellent

		2	4	6	8	10	Out of 100	
	Evaluation criteria	Very	Poor	Average	Good	Excellent	100	%
1	Does system provide the final result within your expected time scope	0	0	18	40	20	78	
2	Does system provide the final result within your expected quality	0	0	12	40	30	82	
3	Overall satisfaction with this application	0	4	18	32	20	74	
4	Do you want to use this system regular basis	0	0	18	24	40	82	
5	Rank your expectation and system functionality	0	0	24	24	30	78	
				Overall Impression			394	78.80

<div align="center">Table 3 - Data Analysis of Overall Impression – Bank web Application</div>

Appendix H - Data Analysis - Evaluation of Scratch Card Deposit

Participants – Customer   No. of Participants - 10

Usability

1 - Very poor, 2 – Poor, 3 – Average, 4 -
Good, 5 – Excellent

	Evaluation criteria	2 Very	4 Poor	6 Average	8 Good	10 Excellent	Out of 100	%
1	Can you understand function of the Scratch Card Deposit	0	0	30	16	30	76	
2	Do you understand the SMS format of the Scratch Card Deposit	0	0	6	40	40	86	
3	Do you understand what is the Scratch Card and how to use it	0	0	6	48	30	84	
4	Do you understand hoe to send SMS to system SMS gateway	0	0	30	16	30	76	
5	Is system give proper feedback and massages to guide you to achieve your	0	0	18	24	40	82	
	Usability						404	80.80

Table 4 - Data Analysis of Usability – Scratch Card Deposit

Participants – Customer   No. of Participants - 10

Functionality

1 - Very poor, 2 – Poor, 3 – Average, 4 -
Good, 5 – Excellent

	Evaluation criteria	2 Very	4 Poor	6 Average	8 Good	10 Excellent	Out of 100	%
1	Does SMS Properly send to the gateway	0	0	24	24	30	78	
2	Does system giving clear out put for your input	0	0	30	16	30	76	
3	Base on the system functionalities how you rank the system	0	4	12	24	40	80	
4	Did system giving you enough functions to do complete tasks	0	0	30	16	30	76	

		0	0	18	24	40	82	
5	Do you get conformation SMS correctly							
				Functionality			392	78.40

Table 5 - Data Analysis of Functionality – Scratch Card Deposit

Participants – Customer   No. of Participants - 10

Overall Impression

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	2 Very	4 Poor	6 Average	8 Good	10 Excellent	Out of 100	%
1	Does Scratch Card Deposit to your account within your expected time scope	0	0	24	24	30	78	
2	Does Scratch Card Deposit final result within your expected quality	0	4	18	24	30	76	
3	Overall satisfaction with this application	0	0	36	16	20	72	
4	Are you happy with time taken to cash deposit to your account	0	0	12	24	50	86	
5	Rank your expectation and Scratch Card Deposit functionality	0	0	24	24	30	78	
				Overall Impression			390	78.00

Table 6 - Data Analysis of Overall Impression – Scratch Card Deposit

Appendix I - Data Analysis - Evaluation of Cash Withdrawal

Participants – Customer, Merchant
No. of Participants - 10

Usability

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	2 Very	4 Poor	6 Average	8 Good	10 Excellent	Out of 100	%
1	Do you understand what is the merchant number	0	0	30	16	30	76	
2	Do you understand the SMS format for Cash Withdrawal	0	0	18	24	40	82	
3	Do you understand what is the Scratch Card and how to use it	0	0	12	40	30	82	
4	Do you understand hoe to send SMS to system SMS gateway	0	0	18	32	30	80	
5	Is system give proper feedback and massages to guide you to achieve your	0	0	12	32	40	84	
	Usability						404	80.80

Table 7 - Data Analysis of Usability – Cash Withdrawal

Participants – Customer, Merchant
No. of Participants - 10

Functionality

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

	Evaluation criteria	2 Very	4 Poor	6 Average	8 Good	10 Excellent	Out of 100	%
1	Does SMS Properly send to the gateway	0	4	18	24	30	76	
2	Does system giving clear out put for your input	0	0	36	16	20	72	
3	Base on the system functionalities how you rank the system	0	0	30	16	30	76	
4	Did system giving you enough functions to do complete tasks	0	0	18	32	30	80	

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		2	4	6	8	10		
5	Do you get conformation SMS correctly	0	0	12	32	40	84	
	Functionality						388	77.60

Table 8 - Data Analysis of Functionality – Cash Withdrawal

Participants – Customer, Merchant   No. of Participants - 10

Overall Impression

1 - Very poor, 2 – Poor, 3 – Average, 4 - Good, 5 – Excellent

		2	4	6	8	10	Out of 100	
	Evaluation criteria	Very	Poor	Average	Good	Excellent	100	%
1	Does cash withdrawal to your account within your expected time scope	0	4	24	16	30	74	
2	Does Scratch Card Deposit final result within your expected quality	0	0	18	32	30	80	
3	Overall satisfaction with this application	0	0	18	32	30	80	
4	Are you happy with time taken to cash deposit to your account	0	0	24	16	40	80	
5	Rank your expectation and Scratch Card Deposit functionality	0	0	24	24	30	78	
	Overall Impression						392	78.40

Table 9 - Data Analysis of Overall Impression – Cash Withdrawal

```perl
#!/usr/bin/perl -w
$| = 1;

$progname="login";

use CGI;
use DBI;
use Business::CreditCard;
use Authen::PIN;

print "Content-type: text/html\n\n";

#################### READ IN PARAMS ##########################
    $conf_file = "params/conf";
    open (CONFFILE, "$conf_file") ;

     while (<CONFFILE>){
          $row = $_;
          chop $row;
          @pair = split (/\=/, $row);
          $var = "$pair[0]";
          $value = "$pair[1]";
          $$var = "$value";


     }
     close (CONFFILE);
#################################################
####### Parse from web page (URL_)

@pairs = ();
@pairs = split(/&/, $ENV{'QUERY_STRING'});
foreach $pair (@pairs)
{
local($name, $value) = split(/=/, $pair);
$name =~ tr/+/ /;
$name =~ s/%([a-fA-F0-9][a-fA-F0-9])/pack("C", hex($1))/eg;
$value =~ tr/+/ /;
$value =~ s/%([a-fA-F0-9][a-fA-F0-9])/pack("C", hex($1))/eg;
$value =~ tr/,/ /;
$value =~ s/<!--(.|\n)*-->//g;
$INPUT{$name} = $value;
}

# Parse from the web form
##############################################################
read (STDIN, $buffer, $ENV{'CONTENT_LENGTH'});
@cgiPairs = split(/&/,$buffer);
foreach $cgiPair (@cgiPairs)
```

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```perl
{
  ($name,$value) = split(/=/,$cgiPair);
  $value =~ s/\+/ /g;
  $value =~ s/%(..)/pack("c",hex($1))/ge;
  $form{$name} .= "\0" if (defined($form{$name}));
  $form{$name} .= "$value";
}

$remote_addr = $ENV{'REMOTE_ADDR'};
$remote_host = $ENV{'REMOTE_HOST'};

$timestamp = time();
$last_updated =localtime (time);


if ($INPUT{'submittype'} eq "url"){
$form{'client'} = "$INPUT{'user'}";
$form{'password'} = "$INPUT{'pas'}";

#print qq! user=$form{'username'}, pass=$form{'passwd'} !;
}
## SPLIT TIME
#####################################
@time_updated = split (/\ /, $last_updated);

    $current_day=$time_updated[0];
    $current_month=$time_updated[1];
    $current_date=$time_updated[2];
    $current_time=$time_updated[3];
    $current_year=$time_updated[4];

@current_time = split (/\:/, $current_time);
$current_time_hhmm = "@current_time[0]:@current_time[1]";

### if date is one character
if ($current_date eq "")
{
$current_date=$time_updated[3];
    $current_time=$time_updated[4];
    $current_year=$time_updated[5];

push (@current_date_dd, "0", $current_date); ### Add a 0 to front
$current_date = join ( "", @current_date_dd);
}
open (FILE, "path") || die print "cannot open database ";
$path = <FILE>;
chop $path;
close (FILE);


write_msg_log("=================================");
```

```perl
write_msg_log("START $progname");

write_msg_log("===================================");
open (FILE, "/var/www/cgi-bin/gdz/db_ip");
$db_ip = <FILE>;
close (FILE);

open (FILE, "/var/mhetc/db_ip") || die print "cannot ";
$db_ip = <FILE>;
chop $db_ip;
close (FILE);


open (FILE, "/var/mhetc/database") || die print "cannot open database ";
$database = <FILE>;
chop $database;
close (FILE);

open (FILE, "/var/mhetc/usrnm") || die print "cannot open Username ";
$username = <FILE>;
chop $username;
close (FILE);

open (FILE, "/var/mhetc/dwp") || die print "cannot open database ";
$pass = <FILE>;
chop $pass;
close (FILE);

my $db = 'DBI:Pg:host=' . $db_ip .  ' dbname=' . $database;

my $dbh = DBI->connect($db,$username,$pass);

my $sth = $dbh->prepare("SELECT password, account_id, group_id,
user_type,id,reseller_id,reseller_discount,dealer_id,merchant,agent,bdo,reseller_iii_id FROM
webusers WHERE username = '$form{'client'}'");
$sth->execute;
my @array = $sth-> fetchrow_array;


#print "ddd = @array";
#########print "sddfd@array ";
$sth->finish;

$accountid = $array[1];
$group_id = $array[2];
$user_type = $array[3];
$webuser_id = $array[4];
$reseller_id = $array[5];
$reseller_discount = $array[6];
$dealer_id = $array[7];
$reseller_III_id = $array[11];
```

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```perl
$merchant = $array[8];
$agent = $array[9];
$bdo = $array[10];
#!;
write_msg_log("Read user data for :$form{'client'}, accountid:$array[1],
group_id:$array[2],user_type:$array[3], webuser_id:$array[4], reseller_id:$array[5], ");
############################# check if user exists
#if (@array == () ){
if ($form{'client'} eq ""){
    $err_msg = "Please enter  Username ";
    $login_fail = "yes";
}

if ($form{'password'} eq ""){
    $err_msg = "Please enter a password ";
    $login_fail = "yes";
}

if ($form{'client'}eq ""){
    $err_msg = "Username does not exist";
    $login_fail = "yes";
}else{
#print "ddd=$array[0]";
    ###  check password
    if ($array[0] ne "$form{'password'}"){
        $err_msg = "Password mismatch";
        $login_fail = "yes";
    }
}

print qq!
<head><link rel="stylesheet" href="../../agent/style-post.css" type="text/css" /></head>
<body>



<form method=POST action="login.cgi" autocomplete=on  target="_self">

<center>
<br><br><br>

<\!-- <font color=#ffffff size=5 face="MS Sans Serif"><strong>
$path</strong>
</font>
<br ><br> -->
<div style="margin: auto;">
<img src="../../agent/images/loginLogo2-v2.jpg">
<table width=420 bordercolordark=#ffffff bordercolorlight=#000000 cellspacing=0
cellpadding=1 border=0 bgcolor=#4da9f1 >
```

```
                <tr>
                  <td width="100%" colspan="3" bgcolor="#279cf5" class="CalcCaptionBack"><table border="0"
              cellpadding="0" cellspacing="0" width="100%">
                    <tr>
                      <td width="17"><img src="../../agent/images/icon-1.png" width="15"
height="15"></td>
                      <td><font color=#ffffff size=1 face="MS Sans
Serif"><strong>Login</strong></font></td>
                      <td align="right"><table border="0" cellpadding="0" cellspacing="0"
                      style="border: 1px outset">
                        <tr>
                        <td class="CalcTable" bgcolor="#0479d3" align="center"><a
href="../../$path/blank.html" target="_self"><img
                          src="../../agent/images/close.png" alt="Close" border="0" width="13"
height="11"></a></td>
                        </tr>
                      </table>
                      </td>
                    </tr>
                  </table>
                  </td>
                </tr>
                <tr>
<tr>
<td>
<ul><font size="1"face="MS sans serif" color=#fe1111><b>LoginFailure, $err_msg</b></font>
<p><font size="1"face="MS sans serif">Enter your authentication information</font>
<br>
<br>

<center>
<table border="0">
    <tr>
      <td><center><font size="1"
      face="MS sans serif">Username</font></td>
      <td>

<input name="client" type="text" size="12" maxlength="25">

</td>

  </tr>
    <tr>
      <td><font  size=1
      face="MS sans serif">Password</font></td>
      <td>

<input name="password" type="password" size="12" maxlength="25"">

    </td>

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```

```
        </tr>
      </table>
    </center></div><p align="center"><input type="submit"
    name="pass" value="   Login   "></p>
</form>

</td>
</tr>
</table>
</body>

!;
die;
}
```

```
###############################################################################
###############
######### session control log######
write_msg_log("Session control logging..");
$session_log = "/var/log/webuser_acc/$current_date$current_month$current_year";
@session_log_row = ();
          ###  generate session id
               $template = "PPHHHHHHHHHHHHV";
               #$mhpin = new Authen::PIN('PPHHHHHHHHHHV');
               $mhpin = new Authen::PIN($template);
               $session_id = $mhpin->pin($last_updated, $form{'client'});   ####  we use prefix
+ acid serial
               # print "new_pin=$new_pin <br>";gent007


      write_msg_log("Generated session_id:$session_id");


if ($login_fail ne "yes"){
push (@session_log_row, $last_updated, $form{'client'}, $user_type,
$remote_addr,$session_id,$timestamp,"Active",$group_id,$reseller_id,"EOL" );  #
}
  $session_log_row = join ("\|", @session_log_row);

#print "<br>$access_log_row";

######  > is delete existing data and write,  >> is append to existing data
     #open (DATABASE, ">>$session_log") || die print "cp";
     open (DATABASE, ">>$session_log") || die print "cannt open $session_log";
     print DATABASE "$session_log_row\n";
     close (DATABASE);
####################  end log  ##########
```

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```
write_msg_log("Wrote to session Log");
###############################acccess log #######################################

#print "ut=$user_type, gid=$group_id, rid=$reseller_id";
####   kill if auth fails
```

Appendix L – Source code for Enduser Application

```perl
#!/usr/bin/perl -w
$| = 1;

my $progname = "reseller_II_enduser_account_manager2";

use CGI;
use DBI;
use Business::CreditCard;
use Authen::PIN;

##################### READ IN PARAMS ##########################
    $conf_file = "params/conf";
    open (CONFFILE, "$conf_file") ;

     while (<CONFFILE>){
          $row = $_;
          chop $row;
           @pair = split (/\=/, $row);
          $var = "$pair[0]";
          $value = "$pair[1]";
          $$var = "$value";
     }
      close (CONFFILE);
open (FILE, "path");
$path = <FILE>;
chop $path;
close (FILE);
####### Parse from web page (URL_)
@pairs = split(/&/, $ENV{'QUERY_STRING'});
foreach $pair (@pairs)
{
local($name, $value) = split(/=/, $pair);
$name =~ tr/+/ /;
$name =~ s/%([a-fA-F0-9][a-fA-F0-9])/pack("C", hex($1))/eg;
$value =~ tr/+/ /;
$value =~ s/%([a-fA-F0-9][a-fA-F0-9])/pack("C", hex($1))/eg;
$value =~ tr/,/ /;
$value =~ s/<!--(.|\n)*-->//g;
$INPUT{$name} = $value;
}
#  Parse from the web form
################################################################
read (STDIN, $buffer, $ENV{'CONTENT_LENGTH'});
```

```perl
@cgiPairs = split(/&/,$buffer);
foreach $cgiPair (@cgiPairs)
{
  ($name,$value) = split(/=/,$cgiPair);
  $value =~ s/\+/ /g;
  $value =~ s/%(..)/pack("c",hex($1))/ge;
  $form{$name} .= "\0" if (defined($form{$name}));
  $form{$name} .= "$value";
}
#$remote_addr = $ENV{'REMOTE_ADDR'};
$real_time_sourceip = $ENV{'REMOTE_ADDR'};
$remote_host = $ENV{'REMOTE_HOST'};


################ TIME ###################

$last_updated =localtime (time);
## SPLIT TIME
######################################
@time_updated = split (/\ /, $last_updated);

     $current_day=$time_updated[0];
     $current_month=$time_updated[1];
     $current_date=$time_updated[2];
     $current_time=$time_updated[3];
     $current_year=$time_updated[4];

### if date is one character
if ($current_date eq "")
{
     $current_date=$time_updated[3];
     $current_time=$time_updated[4];
     $current_year=$time_updated[5];

push (@current_date_dd, "0", $current_date); ### Add a 0 to front
$current_date = join ( "", @current_date_dd);
}

@current_time = split (/\:/, $current_time);
$current_time_hhmm = "$current_time[0]:$current_time[1]";
write_msg_log("==================================");
write_msg_log("START: $progname") ;

write_msg_log("==================================");

################ read in vars #########
if ($INPUT{'invokeby'} eq "url"){
$user= $INPUT{'user'};
$user_type = $INPUT{'user_type'};
$webuser_id = $INPUT{'webuser_id'};
$group_id = $INPUT{'group_id'};
```

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```
$frun = $INPUT{'frun'};
$reseller_id = $INPUT{'reseller_id'};

$tg_id = $INPUT{'tg_id'};
$tg_description = $INPUT{'tg_desc'};
$ag_id = $INPUT{'ag_id'};
$ag_desc = $INPUT{'ag_desc'};
#$balance = $INPUT{'bal'};
#$balancelimit_reseller = $INPUT{'ballimit'};
#$currencysym_reseller = $INPUT{'cursym'};
$reseller_discount = $INPUT{'reseller_dis'};
$accountid = $INPUT{'accountid'};
$search_fn = $INPUT{'search_fn'};
$search_sn = $INPUT{'search_sn'};
$search_cli = $INPUT{'search_cli'};
$search_ac = $INPUT{'search_ac'};
#$sourceip = $INPUT{'sourceip'};
$session_id = $INPUT{'session_id'};
$func = $INPUT{'func'};
$resellerII_type = $INPUT{'resellerII_type'};
$r1_accountid = $INPUT{'r1_accountid'};

}else{
$user = $form{'user'};
$user_type = $form{'user_type'};
$group_id = $form{'group_id'};
$reseller_id = $form{'reseller_id'};

$tg_id = $form{'tg_id'};
$tg_description = $form{'tg_description'};
$ag_id = $form{'ag_id'};
$ag_desc = $form{'ag_desc'};
#$balance = $form{'balance'};
#$balancelimit_reseller = $form{'balancelimit_reseller'};
#$currencysym_reseller = $form{'currencysym_reseller'};
$reseller_discount = $form{'reseller_discount'};
$accountid = $form{'accountid'};
$search_fn = $form{'search_fn'};
$search_sn = $form{'search_sn'};
$search_cli = $form{'search_cli'};
$search_ac = $form{'search_ac'};
#$sourceip = $form{'sourceip'};
$session_id = $form{'session_id'};
$func = $form{'func'};
$resellerII_type = $form{'resellerII_type'};
$r1_accountid = $form{'r1_accountid'};

$new_cli = "$form{'new_cli'}";
}

##############################################################
```

```perl
open (FILE, "/var/mhetc/db_ip") || die print "cannot ";
$db_ip = <FILE>;
chop $db_ip;
close (FILE);


open (FILE, "/var/mhetc/database") || die print "cannot open database ";
$database = <FILE>;
chop $database;
close (FILE);

open (FILE, "/var/mhetc/usrnm") || die print "cannot open Username ";
$username = <FILE>;
chop $username;
close (FILE);

open (FILE, "/var/mhetc/dwp") || die print "cannot open database ";
$pass = <FILE>;
chop $pass;
close (FILE);



my $db = 'DBI:Pg:host=' . $db_ip .  ' dbname=' . $database;


my $dbh = DBI->connect($db,$username,$pass);
print "Content-type: text/html\n\n";
print qq!
<\!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head>
    <meta http-equiv="content-type" content="text/html;charset=UTF-8" />
<title>Godzila</title>

<link rel="stylesheet" href="../../css/style.css" type="text/css" />
<link rel="stylesheet" href="../../css/layouts.css" type="text/css" />
<link rel="stylesheet" href="../../css/mnlayout.css" type="text/css" media="screen" />
<link rel="stylesheet" href="../../css/mnprint.css" type="text/css" media="print" />

</head>
<body bgcolor="#FFFFFF" TOPMARGIN=0 LEFTMARGIN=0 MARGINWIDTH=0
MARGINHEIGHT=0>
<center>
<form method=POST action="reseller_II_enduser_account_manager2.cgi" autocomplete=on
target=_self>
<input type=hidden name=r1_accountid value=$r1_accountid>
!;
print qq!
```

```
<table cellspacing=2 width=100%><tr>
<td>
      <b>$resellerII_type Accounts: </b>
<input name=new_ac2_disable value="Add" type="hidden">


<input name=new_ac value="Add" type="submit">
<input name=browse_ac  value="Search " type="submit">
<\!--<input name=browse_ac  value="Search active" type="submit">-->
<\!--<input name=browse_ac_incomp  value="Search all" type="submit">-->
</td>
<td>


Account# <input type=text size=5 name=search_ac value=$search_ac>
FirstName <input type=text size=6 name=search_fn value=$search_fn>
Surname <input type=text size=6  name=search_sn value=$search_sn>
CLI <input type=text size=6  name=search_cli value=$search_cli>
PageSize <input type=text size=3  name=page_size value=$page_size>
</td>
!;
print qq!
<td bgcolor=#c0c0c0 align=right> New CLI <input type=text size=6  name=new_cli
value=$new_cli>
<input name=add_cli value="Add CLI" type="submit">
</td>
!;
print qq!
</tr>
</table>

<input type=$textorhidden name=tg_id value = $tg_id>
<input type=$textorhidden name=tg_description value=$tg_description>
<input type=$textorhidden name=ag_id value=$ag_id>
<input type=$textorhidden name=ag_desc value=$ag_desc>
<input type=$textorhidden ame=reseller_id value=$reseller_id>
<input type=hidden name=balancelimit_reseller value=$balancelimit_reseller>
<input type=hidden name=balance value=$balance>
<input type=hidden name=currencysym_reseller value=$currencysym_reseller>
<input type=hidden name=reseller_discount value=$reseller_discount>
<input type=$textorhidden name=accountid value=$accountid>
<input type=$textorhidden name=session_id value=$session_id>
<input type=$textorhidden name=resellerII_type value=$resellerII_type>
<input type=$textorhidden name=reseller_II_id value=$reseller_II_id>
<input type=$textorhidden name=r2_accountid value=$r2_accountid>


<input name=user value="$user" type="$textorhidden">
<input name=user_type value="$user_type" type="$textorhidden">

<input name=reseller_id value="$reseller_id" type="$textorhidden">
```

```
<input name=group_id value="$group_id" type="$textorhidden">

!;
   print qq!


<div align="center"><center>

<table border="1" cellspacing="0" width="760" bgcolor="#C0C0C0"
bordercolordark="#FFFFFF" bordercolorlight="#000000">



      <tr>
           <td width="100%" colspan="3" bgcolor="#003399" class="CalcCaptionBack"><table
border="0"
           cellpadding="0" cellspacing="0" width="100%">
            <tr>
             <td width="17"><img src="../../images/icon.gif" width="15" height="15"></td>
             <td><font color=#ffffff>
<strong>Create New Account </strong> </td>
             <td align="right"><table border="0" cellpadding="0" cellspacing="0"
             style="border: 1px outset">
              <tr>
              <td class="CalcTable" bgcolor="#D4D0C8" align="center"><a
href="../blank.html" target="_self"><img
              src="../../images/iconclose.gif" alt="Close" border="0" width="13"
height="11"></a></td>
               </tr>
             </table>
             </td>
            </tr>
           </table>
           </td>
         </tr>
         <tr>
  <tr>
  <td><div align="center"><center><table border="0"
    cellpadding="0" cellspacing="1" width="660"
    bgcolor="#C0C0C0">
      <tr>
        <td width="25%"> Customer No. </td>
        <td width="25%"> <input type="text" size="15"
        name="Cus_No" value="$form{'Cus_No'}"> </td>
        <td width="25%"> Balance </td>
        <td width="25%"> <input type="text" size="4"
        name="ac_balance" value="$form{'ac_balance'}"> </td>
      </tr>
      <tr>
        <td width="25%"> First Name </td>
        <td width="25%"> <input type="text" size="20"
```

```html
                    name="firstname" value="$form{'firstname'}"> </td>
                    <td width="25%"> Balance Limit </td>
                    <td width="25%"> <input type="text" size="4"
                    name="ac_balance_limit" value="$form{'ac_balance_limit'}"> </td>
                </tr>
                <tr>
                    <td width="25%"> Last Name </td>
                    <td width="25%"> <input type="text" size="15"
                    name="surname" value="$form{'surname'}"> </td>
                    <td width="25%"> Currency </td>
                    <td width="25%"> <input type="text" size="4"
                    name="currency" value="$form{'currency'}"> </td>
                </tr>
                <tr>
                 <td width="25%"> Company </td>
                    <td width="25%"> <input type="text" size="15"
                    name="company" value="$form{'company'}"> </td>
                    <td width="25%">  Account Group
                    </td>
                    <td width="25%">
                    <select name=acctgrp_desc ><option>$form{'acctgrp_desc'}</option></select>

                        </td>
                </tr>
                <tr>
                    <td width="25%"> No. </td>
                    <td width="25%"> <input type="text" size="6"
                    name="Add_No" value=$form{'Add_No'}> </td>
                    <td  width="25%"> Rate </td>
                    <td width=25%><select name=rate_package
><option>$form{'rate_package'}</option></select></td>
                </tr>
                <tr>
                    <td width="25%"> Street 1 </td>
                    <td width="25%"> <input type="text" size="18"
                    name="Add_St1" value="$form{'Add_St1'}"> </td>
                    <td valign="top" rowspan="6" colspan="2"
                    width="50%">

                    <table border="1" cellpadding="0"
                    cellspacing="0" width="330" bgcolor="#C0C0C0"
                    bordercolordark="#FFFFFF"
                    bordercolorlight="#000000">
                    <tr><td>
                    <table border="0" cellpadding="3"
                    cellspacing="0" width="330" bgcolor="#C0C0C0"
                    bordercolordark="#FFFFFF"
                    bordercolorlight="#000000">
                      <tr>

                        <td width="50%" valign=center>
```

```
                    <input type="text" size="4" maxlength="4" name="uid_prefix"
value="$form{'uid_prefix'}">

                    <input type="text"
                    size="8" maxlength=8 name="pin" value="$form{'pin'}">

                            <input type=submit name=add_uid_prefix value=" ">
                             Add prefix

                        </td>
                </tr>
                <tr>
                   <td width="50%"> Web User ID $err_userid

                         </td>
                   <td width="50%"> <input type="text"
                   size="10" name="webuserid" value="$form{'webuserid'}"> </td>
                </tr>
                <tr>
                   <td width="50%"> Web Password $err_webpass </td>
                   <td width="50%"> <input type="text"
                   size="10" name="webpassword" value="$form{'webpassword'}"> </td>
                </tr>
                <tr>
                   <td width="50%">  </td>
                   <td width="50%">
                    </td>
                </tr>
                <tr>
                   <td width="50%">  </td>
                   <td width="50%"> <input type="hidden"
                   size="18" name="Email_Addr" value="$form{'Email_Addr'}"> </td>
                </tr>
                <tr>
                   <td width="50%">  </td>
                   <td width="50%">  </td>
                </tr>
            </table>
            </td></tr>
        </table>
```