Title: IVR Application on Banking System

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled **"IVR Application On Banking System"**, submitted by Name : Salma Akther ID:151-15-4683 and Name : Meher Niger ID: 152-15-5566 and Name : Md. Sanuar Hossain ID : 152-15-5562, to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering (BSc) and approved as to its style and contents. The presentation has been held on 3rd MAY, 2019.

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Mr. Shah Md Tanvir Siddiquee, Senior Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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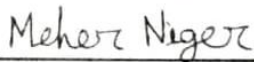Daffodil International University

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Finally, we must acknowledge with due respect the constant support and patience of our parents.

ABSTRACT

The aim to design and develop this project "IVR application on banking system" is to produce such a system that can make an easiest solution to provide banking customer care services. This application helps in such a way that its only need give input to the phone keypad to interact the system. To give input correctly in phone keypad customer can get this services any time. Many people gathered to the bank to collect their information like balance check, ATM card password change etc. To get this kind of short information lot of time left in the big queue. Many people call customer care by BTCL phone line but the line is maximum time busy and it takes many time. One by one give information is very trouble to the bank service employees. It also very time consuming. Mainly it is very painful to the user. In our system customer get their problem solution by our IVR system. They have also opportunity to calling customer care officer and there have many live agent to provide services. When one agent is busy the call is transferred another agent so its time saving. Some people get information to access internet but in our country everywhere internet speed is not good and it has high cost. So it is not very user friendly to all kind of people. In our proposed system a user can get his bank information services in anywhere at any time by dialing a specified number given by the bank. When connection established then following the instruction to press the keypad of his phone a user can easily get his bank information with very low cost. This system also make efficiency to give bank service.

TABLE OF CONTENTS

CONTENTS	PAGE NO

CHAPTER

iv

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
INTRODUCTION

1.1 Introduction

Interactive voice response IVR application is more popular technology in the world by giving the efficient customer service. It is a telephony technology that allow a computer interact with a human with the voice of the human or DTMF tones input via a keypad. It can make a bridge between the customer and computer database. IVR system widely improve call center effectiveness by accurately routing calls to handle caller inquiries. In the world IVR can be used multiple purpose and many company used it like customer care phone call, providing information in new product, providing account details, transferring calls to agent based on customer request, banking service, customer ticket booking, weather condition, travel information, call center etc. Customer can get the information from anywhere at any time simply press the phone of a specified number. IVR application uses pre-recorded menu option or playback dynamic audio for giving service. Day by day using this technology can be increased.

1.2 Motivation

To using new technology day by day our country will be more digital. People using new technology and get advantages in daily life. In our country all of the organization and bank can use BTCL phone lines. To receive customer services everyday thousands of people call them and so that it can be difficult to collect information in short time. In Bangladesh phone user is more than internet user. Everywhere internet are not available and phone use is easy than internet use. Everywhere internet speed is not good and there is high cost of internet. A people when need to check account information, he/she must need to go bank. Some people collect information though internet but every people don't access internet. Uneducated people don't access internet. Everywhere in our country not enough ATM booth. There is a lot of time left to get information in bank. To get short information like balance check people waste lots of time in traffic jam or bank line. Bank customer care officers also performs and wastes lots of time to given information.

1.3 Objective

Main objective of our project is give bank service easier way. All of the bank aims is provide a feasible solution to the user. By using IVR application user can interact the system by press their phone keypad. It provides best service though mobile. People can get information of his/her account anywhere, anytime without accessing internet. So it time saving. Bank provides 24/7 hours service availability. If the bank troll free the number than free calling facility and if don't troll free than must be reasonable cost. It provides IVR facility though Bangla and English languages. Illiterate people don't know English, but in our system they can easily access it by listening Bangla language. So educated and uneducated all category people properly benefits of our system.

1.4 Expected Outcome

In our system people can handle their bank account by any kind of mobile phone with reasonable cost. People check their balance, transaction history, bank account password change, by calling a specific number provide by the bank. If the user is unable to find the suitable option or solution then he has option to transfer his call into customer care officer, he can also calling live agent of customer care to know his account and curd information. No difficulties arise to talk customer care officer because there are many option. When one live agent of customer care is busy then call is transferred another agent. So No need to go bank, booth and internet access or waiting a lot of time to talk customer care officer. To developing this system increase the customer service and bank efficiency.

1.5 Report Layout

From this report a user can easily understood the aim of this project. This report consists of six chapter. What the need of this application, how it can be work, its model, feature, what result given this system etc included this report.

- First Chapter, provides our project introduction, motivation, objective and expected outcome
- Second Chapter provides background, related work, comparative studies, scope of problem and challenges
- Third Chapter provides requirement specification of our project. That is business process model, requirement analysis, block diagram, use case model and description.
- Fourth Chapter provides design specification of our project. Front-end and Back-end design that we used our project
- Fifth Chapter, our project implementation and result will be provided
- Sixth Chapter provided last conclusion and future scope of our project

CHAPTER 2

BACKGROUND

2.1 Introduction

In 1939 World's Fair, Bell Labs displayed a new device called Voder which was a speech synthesis project. Later they can developed DTMF (dual-tone multi-frequency) .In 1960 IVR technology developed by Bell system, which is based on the dual-tone multi-frequency. In 1961 to and the early 1970s when the American bell telephone company developed new telephone system using DTMF technology it created big breakthrough in speech technology. DTMF technology allowed the transmission of audio tones in the frequency range of the human voice. The blueprint for IVR was born as voice response system are based on Digital Signal Processing or DSP with limited word store. In the late 1990s when the call center began to multimedia then many company started to CTI (Computer Telephony Integration) to create a vital IVR system. Day by day this technology is more famous and many organization, call center started using this system.

2.2 Related Work

In Bangladesh all of the bank provide customer care service in BTCL (Bangladesh Telecommunication Company Limited). In this system need many wire to connection .In this system getting information is quite difficult and high cost. Because everyday hundreds of people call to customer care to their inquiries.so there phone line is always busy and takes many time to get short information.

In recent year, standard chartered bank started IVR based customer care services. That is more digital in the traditional system. They add few option to their IVR application to provide customer services. We get our project idea of this system. Their customer care number is16233. They provide services both Bangla and English language. Their services are:

- debit or credit card activation or to generate new number identification

- report lost stolen debit or credit card or check list

- access banking account or credit card

- know standard chartered product or services

- know client services group CSG

2.3 Comparative studies

To make a IVR system we need to know some topic that directly connected to make this system. They are DTMF, IP PBX, ASTERISK

2.3.1 DTMF

DTMF stand for Dual-Tone-Multi-Frequency. It is a core technology to build in IVR. It generated a ranges of audio signal when user press individual number in telephone keypad. Each key produce two tones in specific frequency. One is high frequency and another is low frequency. In IVR system when a user press any number on his phone keypad then it creates a sound at a certain pitch. This is the interactive part of IVR, where a caller either enters a choice from the phone menu or keys in a number in response to a prompt. As like to select a language, or to enter birth year or account ID is concludes prompts. DTMF give input when user press key and then check this input to the database in the IVR system.

2.3.2 IP PBX

VOIP (Voice Over Internet Protocol) is a IP telephony or internet telephony technology . It convert voice analog to digital signal. In the world VOIP technology is more popular because of its lower cost. In traditional phone call it has much lower cost. An IP PBX is a private branch exchange that switches calls between VoIP. An IVR system consists one or more Sip phones. When Sip user need to call they ask the IP PBX to establish

the connection. THE IP PBX has a directory of all phones and their corresponding addresses.so that it can be able connect an internal or route external call via VOIP service provider.

2.3.3 ASTERISK

For building communication application asterisk is an open source framework in the world. Asterisk offer freedom, flexibility of its functionality. Asterisk includes a wealth of functions that make it a powerful IVR platform: audio playback and recording, digit collection, database and web service access, calendar integration, and optional speech recognition and synthesis. Asterisk powers IP PBX systems, VoIP gateways, conference servers and other custom solutions. IVR applications can be build using the dial plan language or through the Asterisk Gateway Interface and can integrate with virtually any external system. To run on Linux asterisk is primarily designed. In the IVR system asterisk has many advantages. In the world Asterisk is free software and it has no per con-current call license fee. Developing an asterisk system is less expensive because it runs on all important hardware and it has low cost PSTN (Public Switch interface hardware).

2.4 Scope of the problem

In banking sector this system is new. So there are many scope to this system. We can find out some of this.

- IVR setup for Bangla and English language
- Account information check through IVR
- Transaction history, current balance, ATM card password change etc though IVR.
- Provide many option to directly talk customer care officer though the system
- Provide more security for customer care
- Provide low cost to banking customer care
- Payment integration added though IVR

2.5 Challenges

To developing IVR application on banking system is very challenging task to us. Here we find out most challenges task. They are:

- Connection between asterisk and database
- Taking account information through mobile DTMF mode and cross checking that information with database system.
- IVR setup for Bangla and English language
- Balance IVR play with Bangla language like (ek hajar noi soto taka pochis poisha matro)

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 Business Process Modeling
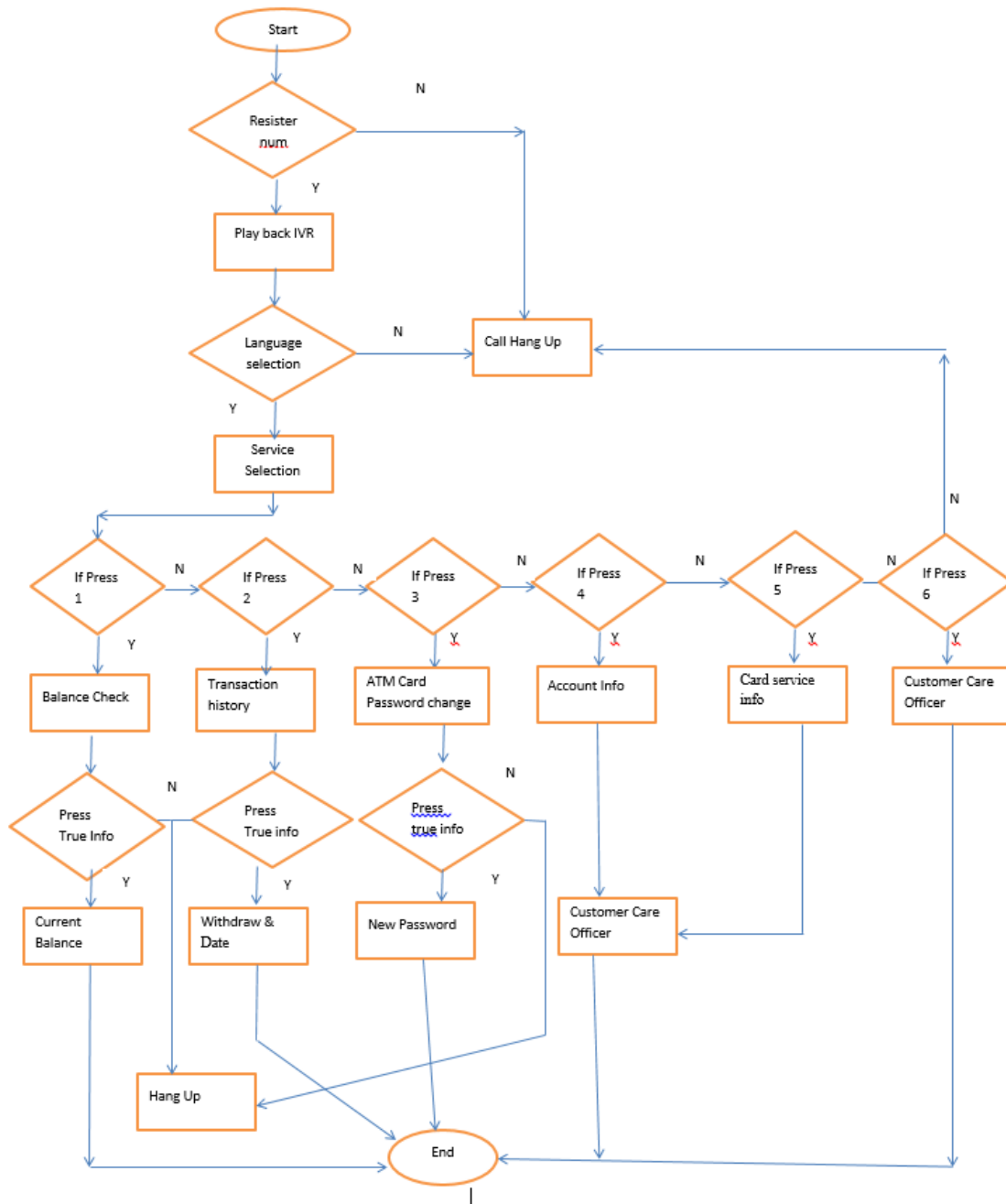
Figure-3.1: Business Process Model of IVR system

Business process model is a process that provides how the process work and it function. Basically Business process modeling is the graphical representation of processes that is usually done by different graphical method such as flow chart, data flow diagram etc. To understand our process workflow above we given a flow chart of our IVR system. It shows how the system start and by different task how it ends.

When a number call in our system then at first it will check if the number is registered or not. If the number is not registered then the call is hang up. But if the number registered than it will playback IVR welcome. Then it give option to choose language. To choose wrong selection it will hang up. And choosing right selection it go to the next step. Here we provide six service to the customer. By giving true information customer get this services. Customer can be call live agent to solve their problem in our system. It is a user friendly system.

3.2 Requirement Collection and Analysis

A software requirement specification is a requirement specification for a software system. Requirement collection and analysis is an important phase in any project development. Basically it's a complete description of the behavior of the system to be developed and how the system will interact the user. To derive the requirement we need to clear understanding of the system to be developed. We prepare it after the detailed communication of project team. We think as a customer so that we can know their needs, problem to the proposed system. To describe this we use flow chart, block diagram, logical data model, use case model that show how the system interact with the user. In the design requirement we show the software requirement both user and server side.
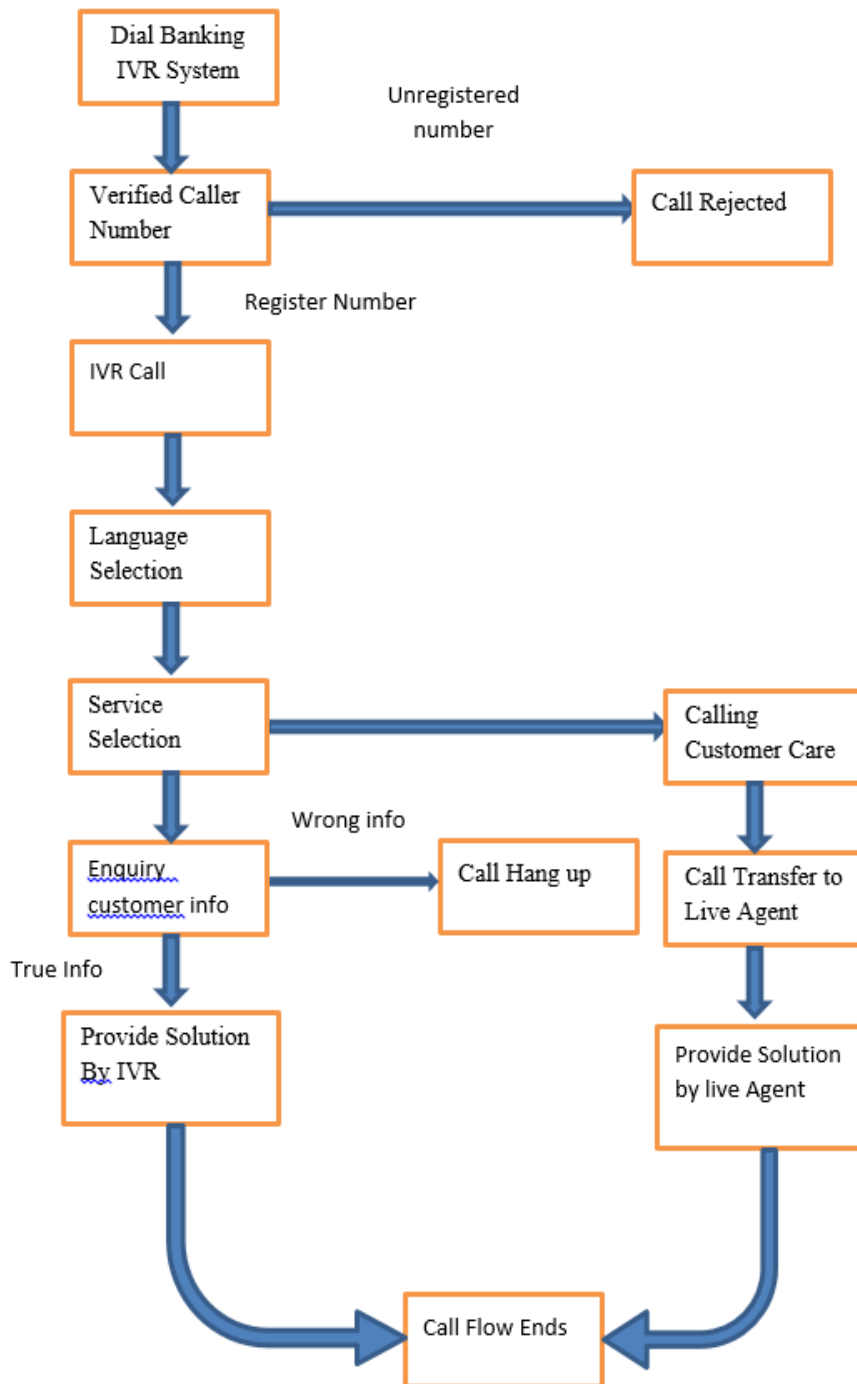
3.2.1 Block diagram of IVR system

Figure-3.2: Block Diagram of IVR system
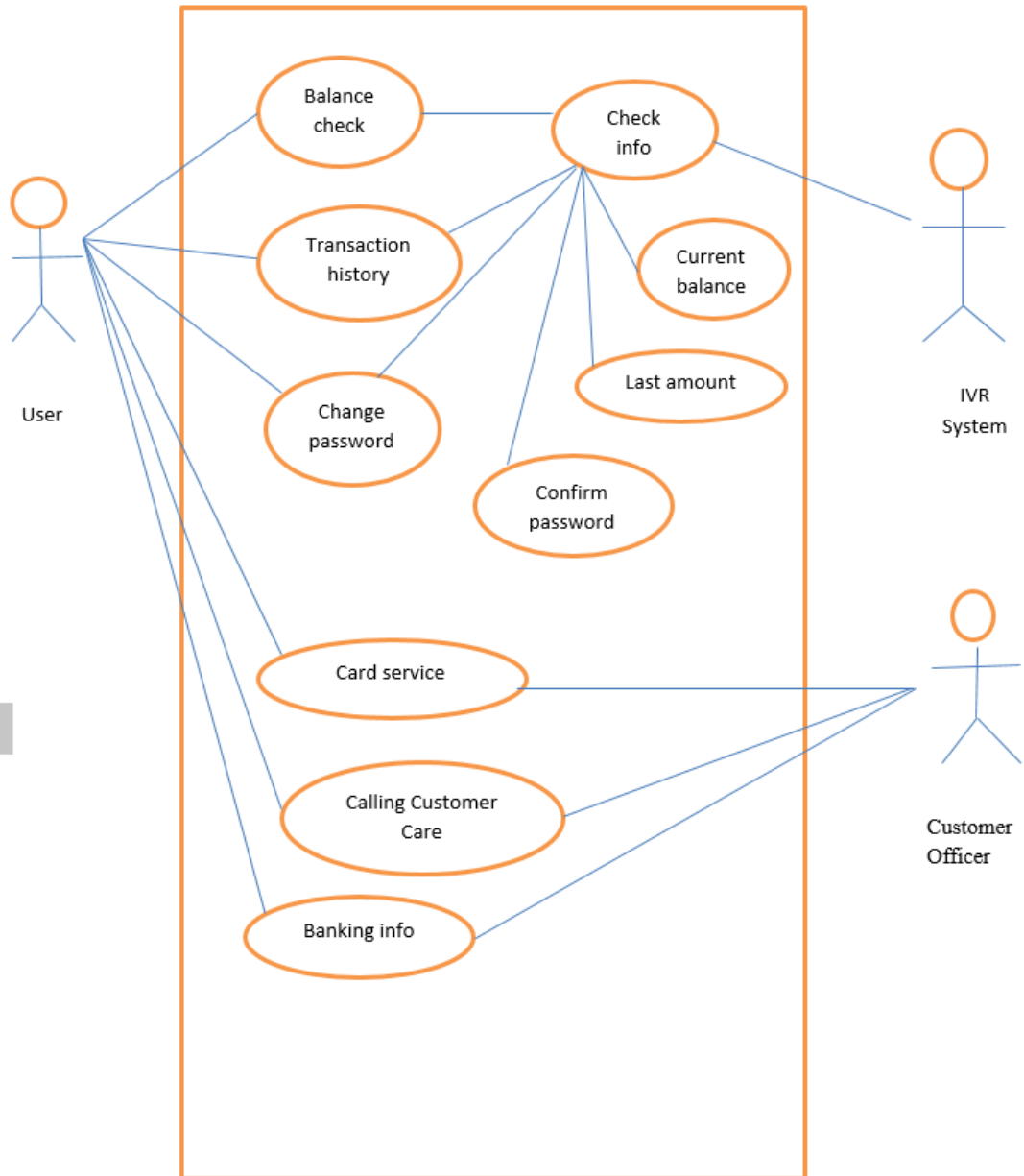
3.3 Use Case Modeling and Description

Figure-3.3: USE CASE Model of IVR system

In the following use case model we see the user interaction with the IVR system to get banking services. We see when a user wants to get service then our IVR system check their information. In our system we have provided six service. They are:

1. Balance check provided by IVR
2. Transaction history check provided by IVR
3. ATM card password change provided by IVR
4. Account service provided by live agent in customer care
5. Card services provided by live agent in customer care
6. Calling customer care officer

To get the services of balance check, transaction history check and ATM card password change a user or customer must need to give input 16 digit card number, 4 digit ATM card pin, 4 digit card expire date, 4 digit of birth year. After giving input correctly a user can get the services. If user can give wrong input than the call hang up. When user need to know his account then he has to give option to press 4.if a customer card can be stolen or any kind of problem of card then he has to choose option to press 5. And the last option user can directly call customer care to talk customer care officer. Option 4, 5, 6 services provide by live agent of customer care and this time the call can be recorded in further inquiry.

3.4 Logical Data Model
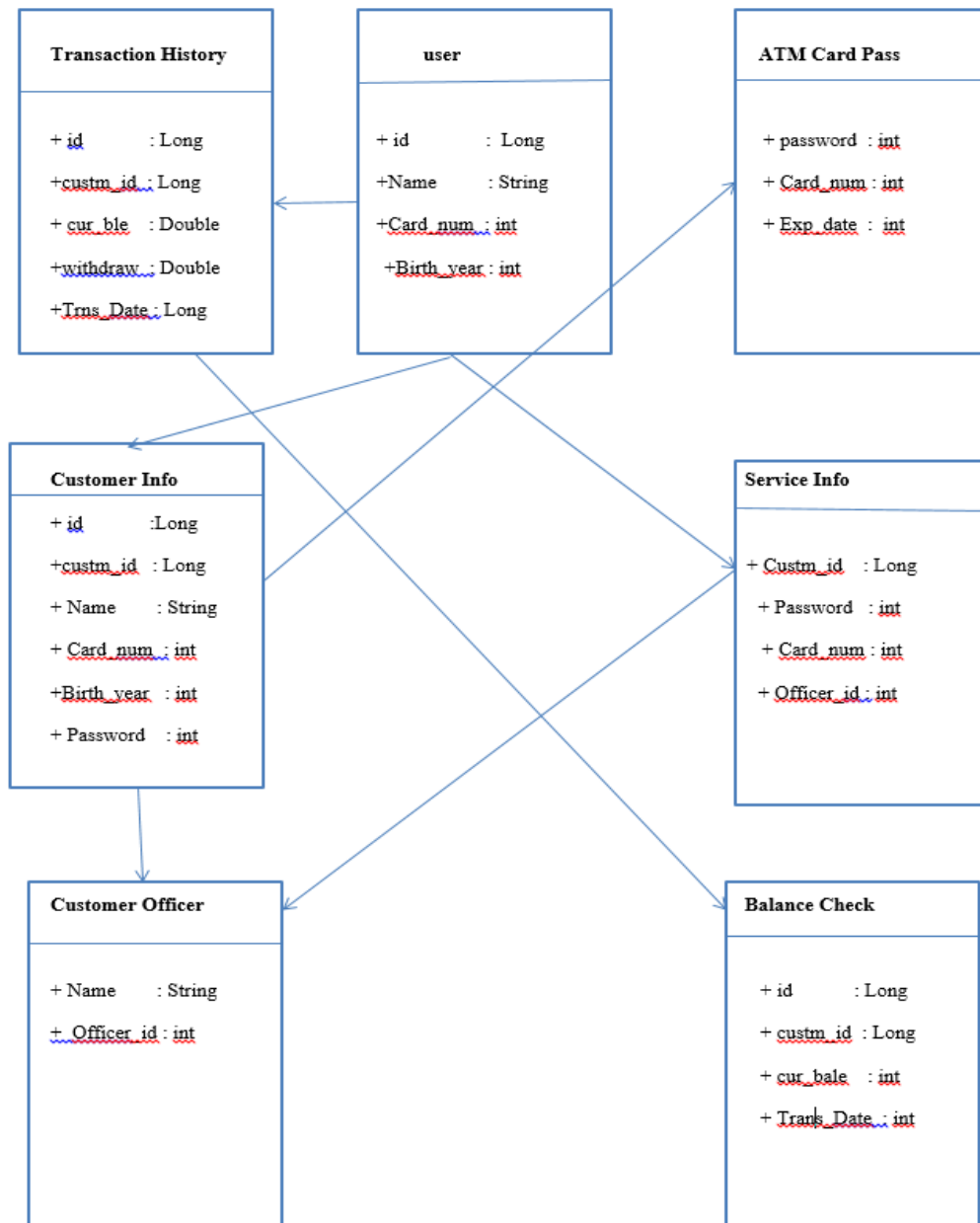
Figure-3.4: Logical data model of IVR system

3.5 Design Requirement

To develop a project many requirement needed. To study more and more to the IVR system and discussing our group member we know our actual requirement of developing the project.

User requirement:

- User must be valid account in bank
- User must be a valid card
- User must be need a registered softphone

Software requirement:

Client side: softphone (ZOIPER, 3CX, XLITE)

Server side :(Front-End)

- Operating system: Centos 6.5(Linux distribution)
- Tools   : SSH(Secure shell)
- Technology   : Asterisk

Server side :(Back-End)

- Database   : PHP, MySQL
- Networking device   : Wi-Fi Router

CHAPTER 4

DESIGN SPECIFICATION

4.1 Front-end design

Softphone setup

We can use various kind of softphone. A softphone is an application program that enables voice over Internet Protocol (VoIP) telephone calls from computing devices. In the enterprise, softphones are sometimes referred to as soft clients. In this project we use ZOIPER, 3CX and CSIP SIMPLE softphone. We registered the softphone phone in our system sever IP. We registered six specific number in our softphone. This phone number can be registered in our asterisk sip files.
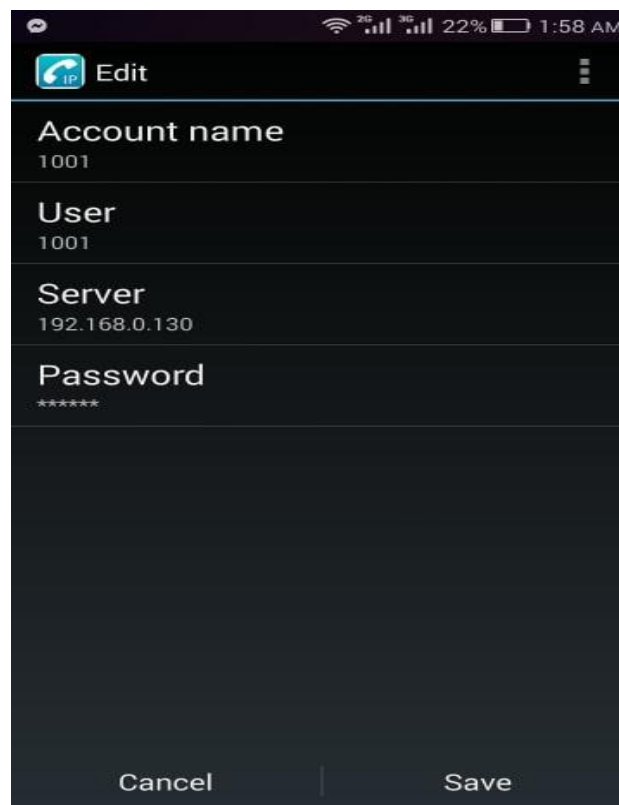
Figure-4.1: Soft phone Registration

4.2 Back-end design

Major step to build in our IVR system

4.2.1 Centos install in virtual box

Community Enterprise Operating system (CENTOS) is an open source software that based on Linux. On the other hand Virtual Box is an important software that it can handle multiple operating system without restart the computer such as Windows, Linux or Mac etc. It has easier software installation and infrastructure consolidation. To install centos in virtual box takes time to load the packages. There are some step to install centos in virtual box. They are,

- At first install the virtual box and open it. After that set name, and version of it.
- After that allocate the memory size
- After that click on the setting-storage-empty-browse the ISO image
- After that it can downloaded the required packages using internet, then start the virtual machine
- Then select the option to install centos Linux 6.5 and hit enter.
- It will be take time to load the packages
- Then set up the server to desire option. After selection the softer and GUI ,setting the network and host name setting
- Finally it can be installed

4.2.2 Asterisk setup

Asterisk is a free and open source framework for building communications applications. Asterisk can be used to build IVR. By using it we can connect any internal external database or API connectivity, routing and number of flexibility. Asterisk powers IP PBX systems, VoIP gateways, conference servers and other custom solutions.

Step 1 : Downloading Asterisk Source Code

    # cd /usr/src/

    #   wget   https://downloads.asterisk.org/pub/telephony/asterisk/old-releases/asterisk-11.0.0.tar.gz

Step 2 : Extraction of Downloaded Files

    # tar zxvf asterisk*

 Step 3 : Changing Asterisk Directory

    #cd /usr/src/asterisk*

Step 4 : Running Configure Script for Asterisk

    # ./configure

    # make config

Step 5 : Start Asterisk

    # service asterisk restart

    #rm -rf sip.conf

    #rm -rf extensions.conf

4.2.3 SSH setup

 To securely access a computer over an unsecured network SSH or secure shell network protocol is a best way. It is a cryptographic network protocol and it can be used to managing the application remotely into another computer. SSH provide strong encrypted data communication between two computer connecting over an open network. To work long distance server it can be used. To work in CENTOS in LINUX platform we used secure shell protocol. Shell environment provides far greater capabilities, flexibility to work in CENTOS. The shell environment also provides a means for interacting with the operating system when a desktop environment not available

4.2.4 Dial plan Work

We use two main files Sip.conf and extensions.conf on asterisk server. Sip.conf is a special file on centos operating system. Basically sip.conf used for necessary number and extensions.conf used for dial plan. In the sip file we registered the number and used coding in extensions.conf file to ready dial plan. In dialer plan, we can increase the no. of extensions as the no. of user increases. These are all about our IPPBX server. To get this IPPBX server in working we required the Wi-Fi router. Here we showing simple command to create sip and extensions file.

creating new sip and extensions file

#touch sip.conf

#touch extensions.connf

vi extensions.conf

[default]

exten => _1001,1,Dial(SIP/1001)

exten => _1001,2,Hangup

exten => _1002,1,Dial(SIP/1002)

exten => _1002,2,Hangup

exten => _1003,1,Dial(SIP/1003)

exten => _1003,2,Hangup

exten => _1004,1,Playback

exten => _1004,2,Hangup

Figure-4.2: Number added in sip file

Figure-4.3: Extension file dial plan

4.2.5 Database

To work in the database we use MySQL .We use Adminer.php tool. We know PhpMyAdmin is a famous tool for managing MySQL database. But we think Adminer is better than PhpMyAdmin because Adminer has many benefits. It has more security and better performance and it also support MySQL feature. PhpMyAdmin usually need configuration but Adminer need zero configuration. To connect our MYSQL database we create two php file. One is addclient.php and another is DBhandeler.php. Client.php give input to the user and then crosscheck this input to the database and DBhandeler.php can connect database to the web.

4.2.6 Voice recording

In our IVR system when user press keypad it can play audio so that we can record all of the menu option in our own voice with Bangla and English languages. We can record all the value 1 to 100 both Bangla and English. We store all the value at single array so that when database check it can play it with a string. As our recording file is mp3 so that we convert it waveform audio (wav). Because in our extensions file cannot support mp3 form. It can be support WAV, GSM and PCM form audio. Wav format audio can support full frequency audio that human hear can support. Wav sound is better than mp3 sound.

4.2.7 Audacity software:

Audacity is an open source audio software. It works both windows and Linus for edit record or sounds. We use it by edit our recorded audio.

4.2.8 Codec

A Codec is a device or computer program for encoding or decoding a digital data or signal. It handles analog signal to digital form. In VOIP codec are widely used. Codec help to packetized audio data. Codec fulfil the transformation by sampling the audio signal several thousand time per second. VOIP minimum speed dependent on codec. The famous codec that is usually used in VOIP is G711. It uses 64 kilobits per seconds. It uses no compression. In our project we use G711 codec. Without codec voice cannot be hear. Using codec our analog voice go to the destination point by translate digital form via a phone.   Now given some example of VOIP codec comparison.

Table-1: VOIP codec comparison

Codec	Data rate	Bandwidth	Packetization delay
G711u	64.0 kbps	87.2 kbps	1.0 msec
G711a	64.0 kbps	187.2 kbps	1.0 msec
G.726	32.0 kbps	55.2 kbps	1.0 msec
G729	8.0 kbps	31.2 kbps	25.0 msec

4.3 Interaction Design and UX

In the first figure we show the network interaction in our system. And in the second figure we show the user interaction of the system.
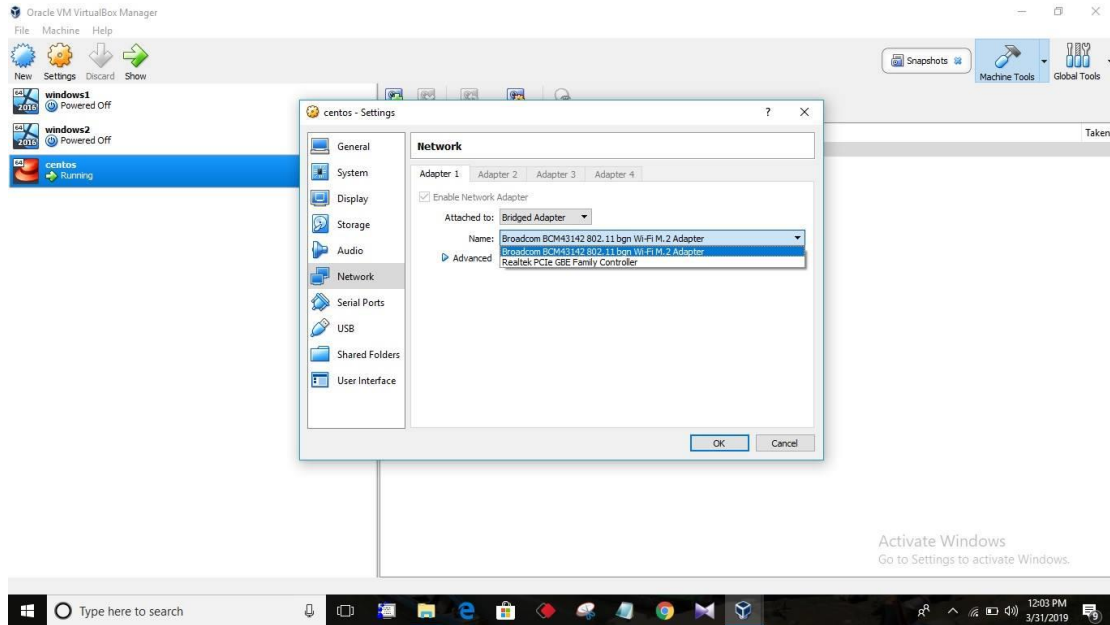
Figure-4.4: network interaction of system
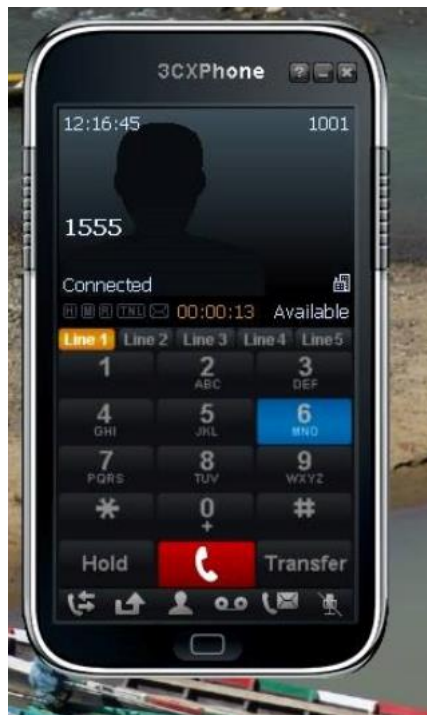
Figure-4.5: User interaction of the system

4.4 Implementation Requirement

Basically our server configuration depend on our server call volume .Now we showing the hardware and software requirement to develop this project.

Client side: (ZOIPER, 3CX, CSIPSIMPLE softphone)

Hardware Requirement:

Server side:

Processor: 4 GB

Hard disk: 50 GB

RAM   : 2 GB

Software Requirement:

Server side:

Networking device: WI-FI Router

Operating system: CENTOS 6.5(LINUS distributor)

Tool: SSH

Back-End: ASTERISK, PHP, MySQL

Audio editor: Audacity software

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation of database

We work MySQL database. We use adminer.php tool. To connect our database in asterisk server we command

#cd /var/www/html/

#ls

>addclient.php=DBhandeler.php

After using this ls command we see 2 php file addclient.php and dbhandeler.php.

- ➢ client.php give input to the user and then crosscheck this input to the database
- ➢ DBhandeler.php can connect database to the web.

to connect our database we browse 192.168.0.130/addclient.php .after that we give input in our user and password that we use our server connect. Here we create bankdb database. In the bankdb databse we added customer information and transaction information.
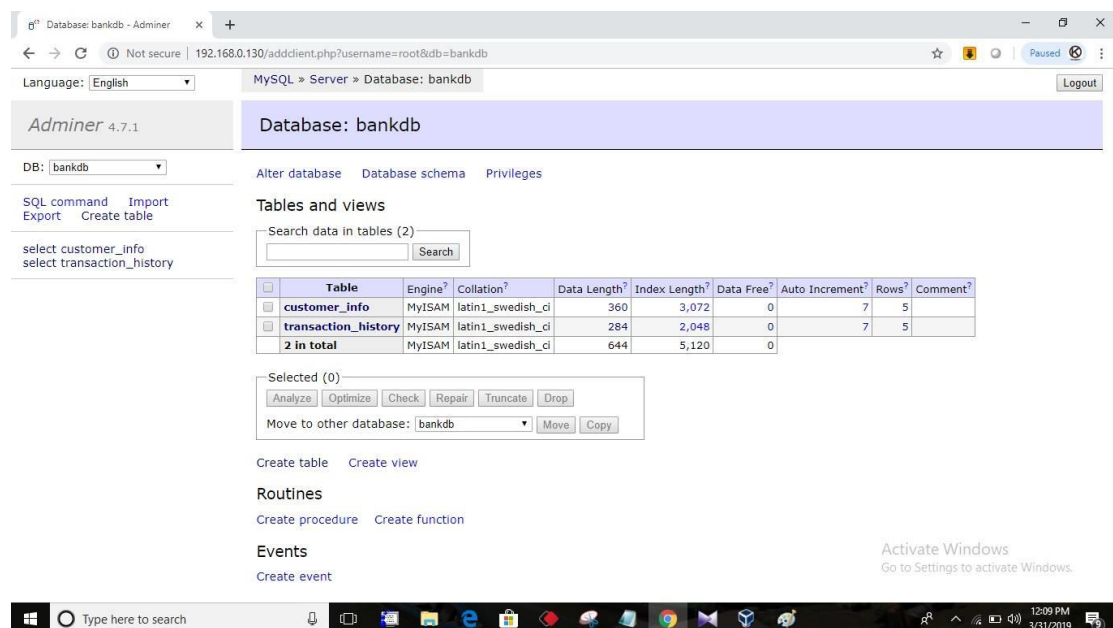
Figure-5.1: Bankdb database

Table-2: Customer information table

Customer id	1
Phone number	1001
First name	Popi
Last name	Popi
Card name	Miss.Popi
Account number	123456
Card number	444444444444444
Expire date	1220
ATM pin	5678
Birth year	1980

In the following table we showing the customer information that we save our customer information table in bankdb database. We added six customer information in database. This information is needed to know the information in the IVR system. When customer correctly input this information then our system give the output.
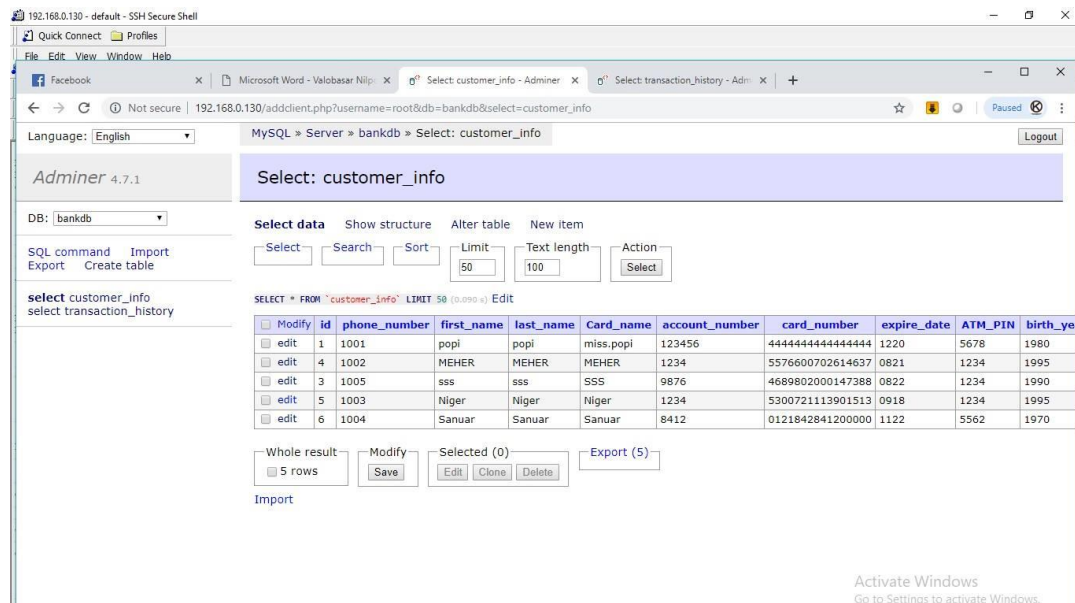
Figure-5.2: Customer information

Here we see our bankdb database all customer information. Each customer has registered phone number. Here added six registered number as 1001, 1002, 1003, 1004, 1005. To their customer information we add first name, last name, card name, account number, card number, expire date, ATM pin and birth year. All have a specific customer id. We use this customer id in the transaction history. To check current balance, transaction history and change ATM card password customer must need to give input this information.
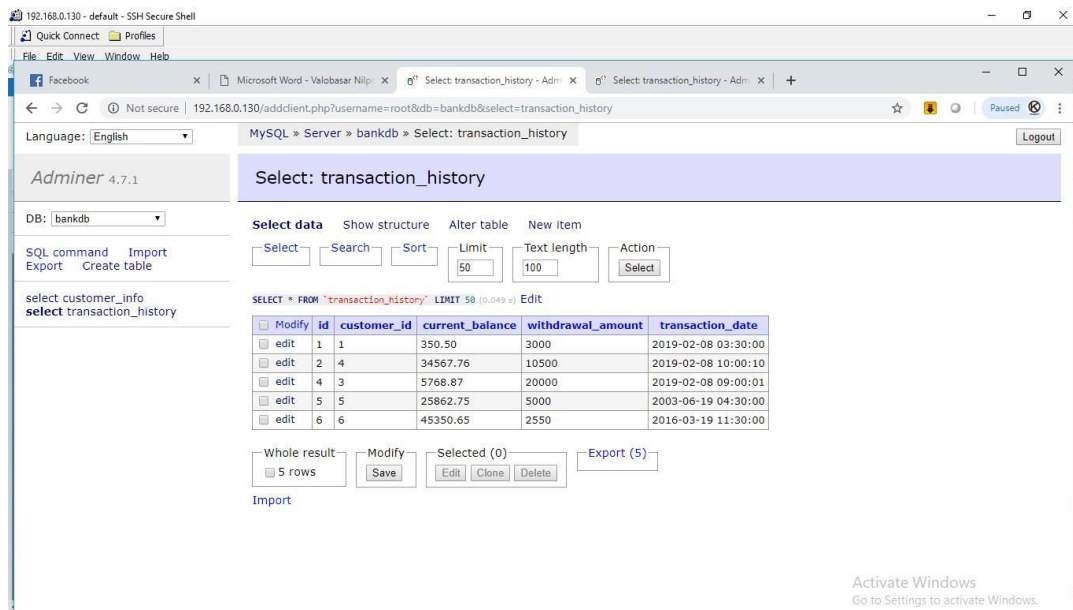
Figure-5.3: Transaction history information

In the following database we added all the customer transaction history. Here we added current balance, withdraw amount and transaction date. To check transaction history a customer must need to give input 16 digit card number, expire date, ATM pin and birth year. When user press this input then addclient.php connect this bankdb database and cross check the information.

5.2 Implementation of front-end design

We used various kind of softphone to call the IVR system. Softphone is an application program that enables VOIP telephone calls from computing devices. We used ZOIPER, 3CX and CSIP SIMPLE softphone. We registered the softphone phone in our system sever IP. We registered six specific number in our softphone. This phone number can be registered in our asterisk sip files. If an unregistered number call our system than the call is hang up and it cannot be done. In the figure we showing our ZOIPER softphone registration.
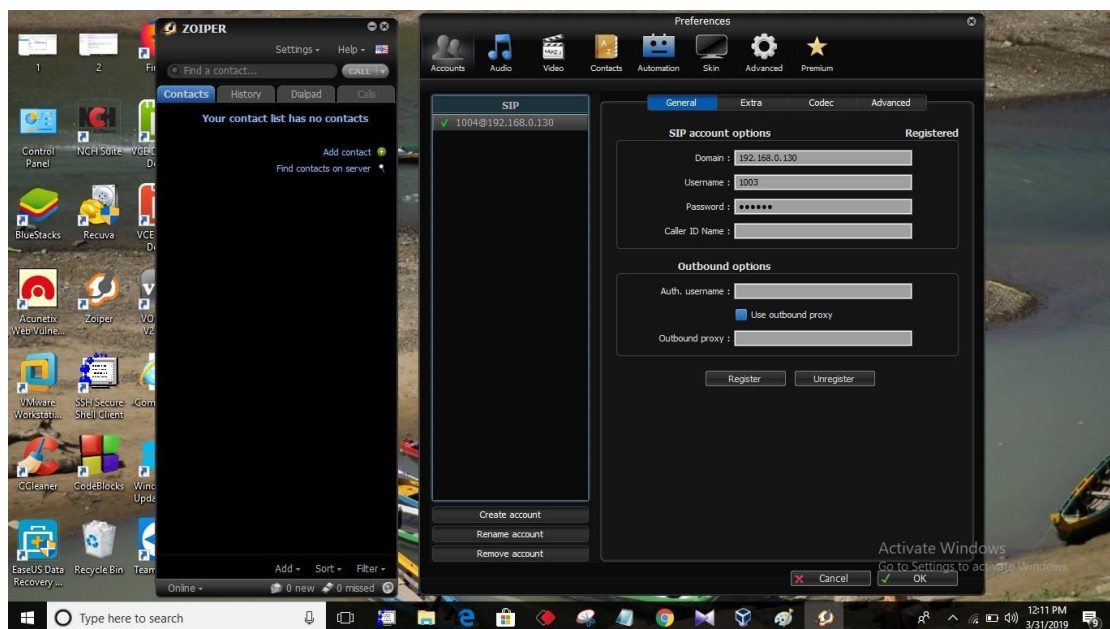
Figure-5.4: ZOIPER Soft phone registration

5.3 Implementation of interaction

In the following figure we showing how user interact our system. Here 3cx softphone with registered number 1001 calling our IVR system 1555.By given six services it can choose 6 .That the call is going to the customer care officer. We set customer care officer number in ZOIPER. So that the call is transfer in ZOIPER by our IVR system.
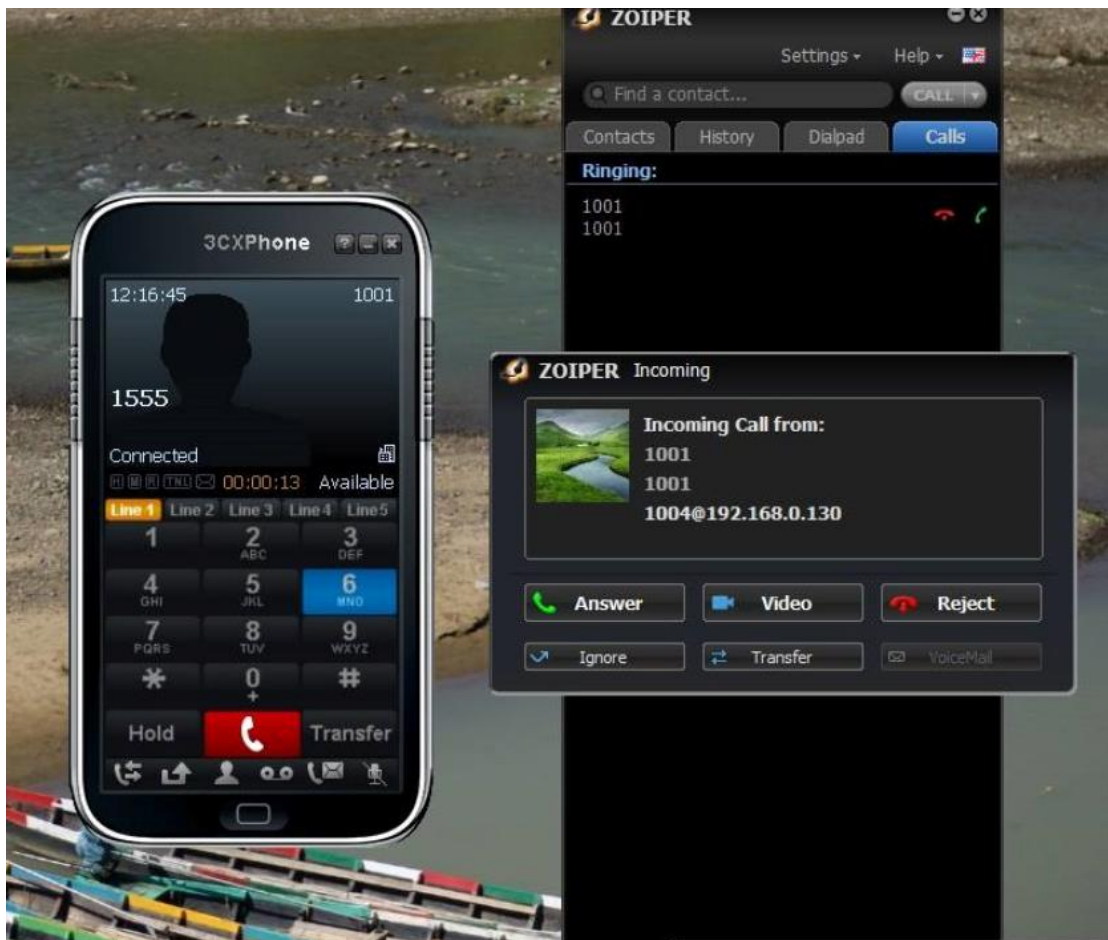
Figure-5.5: User and system interaction

5.4 Testing implementation

Figure-5.6: Call log in server

Here we showing the call log implementation in our server. Here 1003 registered user calling our IVR system. We choose a specific number of our system that is 1555. When the call is going first of all IVR check the number that it can be registered or not. Then it can show if it range in server or not. So that we see 1002 and 1003 number is specified and other 4 number is unspecified. Because other 4 number is not in range. If the number is not be registered then the call is hang-up. If the number is registered then it can be playback audio in good-morning or good afternoon or good evening that set in the time and welcome the bank both Bangla and English language. 1003 number is registered and it call 12:00 am so that IVR execute Good Evening playback both Bangla and English language. After that give option to choose language. Here our registered number can choose Bangla. Then the system go to Bangla menu. Then it can play six option. That is, to know your current balance press 1, to know your transaction history press 2, ATM card password change 3, to talk customer care office to know bank account press 4, to talk customer care office to know card service press 5 and last to customer care officer press 6. If the user press out of this six option then it play you

have entered wrong number and hang up. To choosing the option and give the true information in input customer easily get this service.

5.5 Test Result and Report

Figure-5.7: Calling customer care

To testing our IVR system that we show in testing implementation we can finally reach to test result and report. Our whole system result can be described in below:

When a user call in our IVR banking system then firstly it can be check the number. If the number is registered then the call is going otherwise it can be hang up. Receiving the call in welcome greeting Both Bangla and English languages. Then give option to choose language. There are two language Bangla and English. If user press out of this two option than IVR play you have entered wrong number and give opportunity to again press the right option. After choosing language we have provide six services that customer choose to their needs.

- To press 1, a customer can know his current balance by giving input 16 digit card number, 4 digit of card expire date, 4 digit of ATM pin, 4 digit of his birth year. To give input in 16 digit card number a customer get 10 second. If customer cannot press input in this time than the call is hang up. To provide better security we set this limited time. After giving this true information a customer can know his current balance in our IVR system.

- To press 2, a customer can know his transaction history giving input 16 digit card number, 4 digit of card expire date, 4 digit of ATM pin, 4 digit of his birth year. After giving this true information a customer can know withdraw and date

- To press 3, a customer change his ATM card password change by giving input similarly giving input press 1 and also his current password and new password after that he know his new password

- To press 4, a customer know his bank account information by calling customer care center. This time call is transfer to live agent and customer can solve his all type of account information by live agent. For the further inquiry this time call can be recorded.

- To press 5, a customer know his card service by calling customer care. This time call is transfer to two live agent in same time. When one live agent receive the call then other hang up automatically. If a customer card is stolen or any problem in his card than he can solve it by live agent. For the further inquiry this time call can be also recorded.

- To press 6, a customer calling customer care officer and this time call is transfer 3 customer care officer one by one. At first it go one phone and when the number is busy and it decline the phone then it transfer to another customer care number. This time call can be also recorded.in the above figure we show that customer call IVR system and choose service 6, so that the call is transferred customer care officer that we set in ZOIPER.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

In our project IVR application on banking system will be provide customer care service very easily and user get this without any difficulties. Traditional telephony system is complex because it complex wiring. It can increase cost. But the output of our IVR system helps to better productivity and customer services. This system is very cost efficient. Both the bank and user benefited the system. Not only bank this system can be use any company or organization whose have not enough manpower or member to deal with customer inquiries.

6.2 Scope for Further Developments

In the future we want to develop a Payment gateway integration system through IVR application and banking promotional voice broadcasting through IVR application. We also trying to add new services in our system that people will more benefited to it.

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