



SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

**COLLEGE OF COMPUTER SCIENCE AND INFORMATION
TECHNOLOGY**

COMPUTER SYSTEMS AND NETWORKS

CARDLESS ATM

**A Thesis Submitted in Partial Fulfillment of the
requirements for the degree of B.S.C(Honors) in computer
systems and networks**

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October 2016

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

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الآية

أَمَّنْ هُوَ قَانَتْ آنَاءَ اللَّيْلِ سَاجِدًا وَقَائِمًا يَحْذَرُ الْآخِرَةَ وَيَرْجُو رَحْمَةَ رَبِّهِ قُلْ هَلْ يَسْتَوِي
الَّذِينَ يَعْلَمُونَ وَالَّذِينَ لَا يَعْلَمُونَ إِنَّمَا يَتَذَكَّرُ أُولُوا الْأَلْبَابِ (9)

صدق الله العظيم

سورة الزمر الآية (9)

الحمد لله

الحمد لله رب العالمين , الحمد لله الذي خلق السموات والأرض وجعل الظلمات والنور , الحمد لله الذي أنزل على عبده الكتاب ولم يجعل له عوجاً , الحمد لله حمداً كثيراً طيباً مباركاً , ملء السموات وملء الأرض وملء ما بينهما وملء ما شاء ربنا من شيء بعد , له الحمد حتى يرضى وله الحمد إذا رضي وله الحمد بعد الرضا , له الحمد بكل نعمة أنعم بها علينا في قديم أو حديث أو عامة أو خاصة , وأصلي وأسلم على النبي المرتضى والرسول المجتبي محمد بن عبد الله , أعيد الناس وأخشاهم وأتقى , وأكثرهم ذكراً وشكراً وحمداً , صلى الله عليه وعلى آله وأصحابه ومن تمسك بسنته وسنتهم إلى يوم الدين وسلم تسليماً .

Dedication

This research is dedicated to Allah first for inspiring us to believe that we can do this research, complete it and make it to the top and above. Then to our parents and families for inspiring us to take the Networks and Information Systems major, for providing the huge and unconditional support and for taking care of us. Thanks for the friends who have been there for us like the sun is for the earth and we don't think that we can thank them enough;
.thanks to you we are where we are now

And we also thank my friends Shiraz and Razan for not only the support and cheering but we may also say that it is because of you we am here now. we can never forget what you did to me a year
.before

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.the good in people

Thanks for everyone that was the reason for our existence right
.here in this moment and has been missed by mistake

Gratitude

We would like to express our gratitude to Allah first, then this country for providing this huge education opportunity. Four years ago, each one of us was wondering, "What am I going to do four years from now?", well , there comes the moment, but do we know that yet?. Four years are a life time, and thank god it has not been wasted, as we are thankful for this country, our gratitude will be coming in the form of contributing in the awareness of this nation about the importance of computer science, promoting this country and raising it up. We were born to do this and we are going to do it because we are part of it. we remember how did we complain every time we were given a project, homework or assignment, and we say, why can't we have some rest, but then we realized the fact that we are different from any other student who studies in other universities. Those assignments, work and projects are what made us unique and better. So we are thankful for this college as well or shall we say, we are thankful for this technical institute.
.Watch us, we are the future of this country

Abstract

The advancement in banking systems and services and computer technologies has resulted in a growing user demand for fast and .secure bank services

The cardless ATM allows account-holders to withdraw cash from the ATM without a card. Instead a set of verification codes are used to identify the customer. It also allows non account-holders to .perform the withdrawal using a verification code

The cardless ATM provides services following one of two scenarios. The first one is account-holders, where it allows them to specify the required amount of money and generates a verification code which will be entered to the ATM instead of the credit card. This is most useful when the credit card is not present or lost. The other scenario serves the customer or the non account holder, where it also provides two verification codes, one sent by the account-holder and the other sent by the Bank server. The Cardless ATM also allows the transfer of cash between bank accounts. A website .is created for the administrator to manage accounts

المستخلص

أدى التطور في مجال المعاملات البنكية والمالية وتكنولوجيا الحاسوب إلى زيادة حاجة المستخدم للحصول على المال بأسرع وقتٍ ممكنٍ وبصورة آمنة. ولذلك قمنا بتطوير نظام صراف آلي افتراضي وهو صراف آلي يقوم بأداء العمليات بدون الحاجة لإستخدام بطاقة الصراف الآلي.

يوفر الصراف الآلي الافتراضي الخدمة على نطاقين، الأول يختص بأصحاب الحسابات في البنوك حيث يوفر لهم إمكانية سحب نقودهم من الصراف الآلي دون الحاجة إلى البطاقة المصرفية. يتم ذلك بإستخدام كود يتم توليده مسبقاً بواسطة موقع ويب. إضافة إلى إمكانية تحويل مبلغ من حساب صاحب الحساب إلى شخص آخر لا يملك حساب بنكي وهذا ما يخص السيناريو الثاني، حيث يمنح الصراف الأشخاص غير مالكي الحسابات البنكية إمكانية سحب نقود من الصراف الآلي وذلك بإستخدام كود يتم إستقباله من مرسل النقود (صاحب الحساب). ويستخدم كود آخر يتم إرساله بواسطة الصراف لمستلم النقود للتأكد من هويته ولضمان وصول النقود للشخص المطلوب.

يقدم النظام خدمات إضافية أخرى مثل (كشف حساب، الإستعلام عن رصيد وتحويل المبالغ المالية من حساب إلى اخر).

List of terms

Terminology	Abbreviation
Automated Teller Machine	ATM
Code division Multiple Access	CDMA
Database Management System	DBMS
Electronic Check Clearing	ECC
Hyper Text Markup language	HTML
Integrated Development Environment	IDE
Near Field Communication	NFC
Hypertext Preprocessor	PHP
Personal Identification Number	PIN
Random Access Memory	RAM
Relational Database Management System	RDBMS
Relational Data Stream Management System	RDSMS
Structured Query Language	SQL
Unified Modeling Language	UML
Virtual Automated Teller Machine	VATM
Visual Basic.NET	VB.NET
Visual Studio	VS

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CHAPTER ONE

INTRODUCTION

:Introduction 1.1

Banking plays an important role in the financial life of a business, and the importance of banks can be seen from the fact that they are considered to be the life-blood of modern economy. They provide vital everyday services through bank branches and Automated Teller Machines (ATM). These services should therefore .be fast and available all the time

:Problem Statement 1.2

Under current ATM services, number of issues arise that prevent :users from fully enjoying these services

When a bank account holder loses his bank card he will not be .able to withdraw cash

If someone wants to receive transferred cash but does not have a bank account, he can only get the cash from a bank branch and during working hours. Alternatively, the money can be transferred .using mobile credit

Some people have no bank account, therefore are unable to use .ATMs

:Objectives 1.3

The cardless ATM provides solutions to the above mentioned :issues, so the goals of this project are to

:Provide Cardless Services •

In case the customer loses the card or forget to carry it, the services will be available through the application. This .happens if the customer lost his card

Reduce time and effort taken to perform a traditional •
.transaction

Expand banking services to the people who have no •
.bank account

:Scope 1.4

The cardless ATM adds the cardless services to the ATM using the a website. It allows the account holder to cash out money for either himself or a customer (non account holder) using a PIN and .a verification code

:Methodology 1.5

The account holder obtains the verification code from his account in the website. And an ATM simulator is used to simulate the ATM. In case of the withdrawal for non account holders, an Android .application is used to send them the second verification code

:Thesis structure 1.6

This thesis is organized as follows: Previous studies, background and history are explained in Chapter two. In Chapter three we show the tools and techniques used in the project. Chapter four describes the system and Chapter five illustrates the system implementation. Chapter six states conclusions and .recommendations

CHAPTER TWO

**BACKGROUND AND PREVIOUS
STUDIES**

:Introduction 2.1

This chapter explains background information about ATMs. It also presents previous studies related to the area of this project

:ATM Background 2.2

:History 2.2.1

Origins of the Automated Teller Machine was in the period from 1950s and 1960s

First Automated Teller Machine was invented by Luther Simjian, in 1939, a machine that takes cash or deposit at anytime. City Bank in USA has been convinced by the inventor to use the machine, but it was removed after 6 months because of the lack of customers acceptance

years later, Barclays Bank in Enfield Town, North London, 25 United Kingdom, installed its first cash machine, the dispenser, and the inventor was Shepherd-Barron. The machine did not use plastic cards but instead used paper vouchers printed with radioactive ink so the machine could read them Barclays' machine required the customers to enter a PIN to identify themselves, but the security was always an issue, where there was no guarantee that the user that entered the PIN was actually the holder or the owner of the account Before ATMs people were limited to bank working hours. Therefore, [ATMs were a revolution in the banking systems. [1

:Authentication 2.2.2

Nowadays, ATMs use a two-factor authentication, password or PIN and smartcard or ATM card. However simple passwords can be guessed easily and the difficult ones can be snooped using sophisticated techniques and therefore this method is not secure.

Therefore suggestions are made to use three-factor [authentication. [2

:ATM services 2.2.3

The ATM has a network that connects it with the local and external banks and it allows the customer to use the services that it provides in exchange for a tax or a charge according to the cooperation convention between the banks

:The services include

:Cash withdrawal .1

A provision enables the account holder to withdraw part or all of his money from his account

:Cash deposit .2

A provision enables the account holder to inject or add money to his account

:Balance transfer .3

A service enables the account holder to pay off the balances on existing account by transferring it to another account

:Bills payments .4

A service receives bills from a biller into the account-holder pay account

:Some advantages of ATM 2.2.4

.Service Availability 24/7 .1

.Cash deposit with no need to reach the bank .2

.Bills payment .3

.Purchasing goods .4

.Providing faster banking services .5

:ATM network 2.2.5

All ATMs and point-of-sales need to be connected with an
.electronic payment network which is Sudapan in Sudan

Sudapan is an electronic network that contains all the ATMs and
point-of-sales that are related to the national switch which allows
all customers with ATM cards to use the ATMs and point-of-sales
.that are inside the network

:National switch services 2.2.6

:The National Switch provides the following services

Connection and identification of banks' ATMs with the .1
.national services

Allowing the customers with ATM cards to utilize the various .2
.banking services

.Allow using various banking cards with various point-of-sales .3

.Generating national switch report .4

Management of techniques that are essential for the ECC and .5
the settlement of reports by introducing reports by the end of
.each period

:Previous studies 2.3

Shabnam Shahreen Sifat and Ali Shihab Sabbir 2.3.1

:(2015) introduced a Virtual ATM

Provides the same services as the traditional ATM but using a different procedure; The withdraw includes several steps

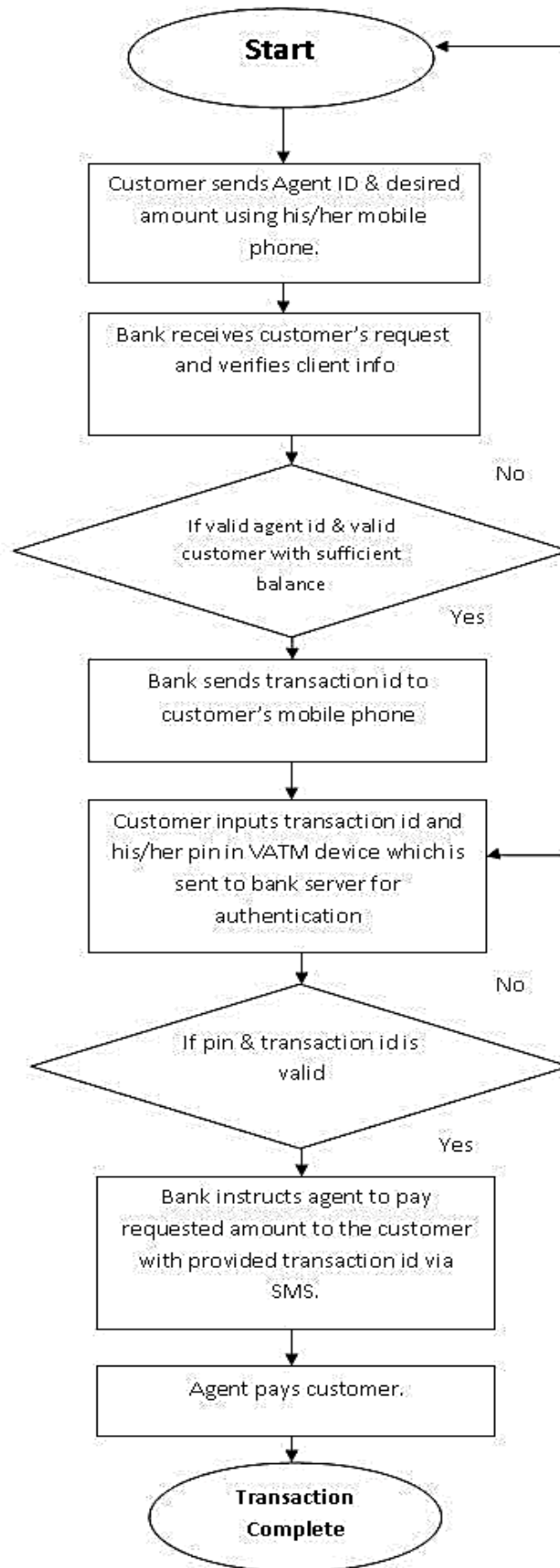
The customer gets to the closest trusted bank agent, each agent has a unique ID. The customer sends the ID of the closest bank agent and the amount of needed money to the bank's server. The bank recognizes the customer and the agent by the phone number .from which the message has been sent from

The server checks the customer's credit, if it is enough for the requested transaction it will generate a transaction ID for the request and send it to the customer. When the customer enters the transaction ID and the PIN, the agent sends it to the bank's server to authenticate the customer. In case of an authenticated customer the transaction will be performed, and in case of a wrong PIN the customer will be informed by a text message from the .bank's server

The customer's mobile is only used to send the withdraw request, and the VATM is responsible for sending the PIN. This prevents the customer's secret PIN from being sniffed, and the VATM uses the .CDMA network to send the PIN

.Cardless ATM and VATM both use the ATM card

But in the cardless ATM, an application is used to request the [services and a verification code is generated for the service. [3



[Figure(2.1) VATM Flow Chart. [3

Paczkowski et al. introduced Point-of -sale and 2.3.2 automated teller machine transactions using trusted :mobile access device

:The authors of this study availed several proposals

Service users may use NFC or any other similar technique for .1
[the transmission of data between the entities. [1

They also introduced a method to manage the financial .2
transaction in unattended devices such as ATM. This method
:contains several steps

transmitting information to the nearest remote location ATM
indicating the establishment of a transaction procedure. The ATM
responds with another piece of information indicating that this
ATM itself is authorized to be engaged in this transaction. The
mobile returns information which can be a PIN or similar
information to ensure the ATM that this mobile device is authorized
to perform the transaction. Specifically, the user enters a PIN into
the mobile device and gets closer to the ATM to allow the mobile
to contact the NFC associated with the ATM which will transmit the
.PIN from the mobile device to the ATM

Following the process, a data record will be generated based on
the entered PIN which will also be transmitted to the ATM. To
prevent the unauthorized use of PIN, the time of the availability of
.the PIN has been limited

In this method, the transactions using ATM is improved by using
the NFC for transmitting the confidential information between the
.mobile device and the ATM

Other embodiment introduces this transaction via secure .3
wireless telecommunication. A secure wireless telecommunication

link is established between the mobile device and the institution .that the ATM is associated with

The user establishes a communication with the bank or the institution by providing information that is almost typical to the information provided by the traditional transaction. The user then uses the mobile device to send a transaction identifier to the ATM, [which will be transmitted via NFC as well. [4

The Cardless ATM does not need a credit card in order to cashout as well as this study. The difference is that this study requires the .account holder to enter the PIN using a mobile phone

Hitchcock introduced A portable automated 2.3.3 :teller machine

This portable ATM provides exchange of information with bank computer over public telephone network. It allows its users to securely access bank accounts, security assured by assigning a personal identification number (PIN) to each user, identification number for each machine and by providing encrypted data .communication

Security includes the confidentiality and integrity of the processed and/or stored information which needs to be protected, and the .risk of malicious manipulation and/or theft or misuse of products

The bank computer system allows only the authorized machine to .(be accessed by using Machine Identification Number (MIN

Users enter their cards to the machine and then enter PIN; if the PIN is matched the users are free to access their accounts. That means the only authorized user and authorized machine can [access the bank computer.[5

The Cardless ATM need a PIN in order to cashout as well as this study, the difference is that the portable ATM is portable , but the . cardless ATM is fixed like traditional ATM

:Summary 2.4

This chapter addressed a background information about ATMs. It .has also discussed a number of related studies in the area

CHAPTER THREE

TOOLS AND TECHNIQUES

:Introduction 3.1

This chapter addresses the tools and techniques used to
.implement the Cardless ATM application

:VB.NET 3.2

Is an object-oriented computer programming language developed
[by Microsoft specially for windows application programming. [6

The vb.net is employed to develop the ATM simulator. In this
.project, we used vb.net to develop the Cardless ATM application

:Visual studio 3.3

Is a comprehensive collection of developer tools and services to
help the programmer create apps for the Microsoft platform and
.beyond

Microsoft's integrated development environment (IDE) for
[developing in Visual Basic.NET language is Visual Studio.[7

Hyper Text Markup 3.4

:(Language (HTML

A format that tells a computer how to display a web page. The
documents themselves are plain text files with a special tags or
codes that a web browser uses to interpret information on the
computer. HTML was used in this project to design the static part
[of our website. [8

: Hypertext Processor PHP 3.5

Is a free open source project of Apache foundation. It is a general

purpose scripting language and interpreter that is specially used to
[create dynamic web page. We use PHP to create database [9

:Wampserver 3.6

Is a Windows web development environment. It allows the
programmer to create web applications with Apache, PHP and the
MySQL database. It also comes with PHPMyAdmin to easily
[manage your databases. [10

Unified Modelling Language 3.7

:((UML

Is an international industry standard graphical notation for
[describing software analysis and designs. [11

:UML Diagrams

:Use Case Diagram -1

A use case diagram is a type of behavioral diagram, used for
.describing a set of system users scenarios

:Sequence Diagram -2

The Sequence Diagram is used to describe data flow, objects,
.and messages between system's components

The horizontal component describes the common objects in the
system and the vertical components describe the exchanged
.messages order based on the system

:Activity Diagram -3

Activity diagrams are a type of flowchart used to describe a
business process or workflow of a system; that is, they show the
flow of control from activity to activity in the system, what

activities can be done in parallel, and any alternate paths
.through the flow

:Class Diagram -4

.Used for describing structure and behavior in the use cases

:State Diagram -5

State Diagrams show the sequences of states an object goes
.through during its life cycle

:Component Diagram -6

Component diagrams illustrate the pieces of software that will
.make up a system

:Deployment Diagram -7

A deployment diagram models the run-time architecture of a
.system

In this project, we used use case and sequence diagrams to
explain the design of the Cardless ATM

:Android 3.8

Android is an open source and Linux-based Operating System for
mobile devices such as smartphones and tablet computers. The
[Android used to simulate the customer mobile phone.[12

:Summary 3.9

This chapter addressed the main tools and techniques that have
.been used to achieve the goals of this project

CHAPTER FOUR
PROPOSED SERVICES AND
SYSTEM ANALYSIS

:Introduction 4.1

This chapter addresses the general description of the system, its functions and the hardware/software components of the system. In addition, it also explains the detailed analysis of the processes of .the system

:System Description 4.2

The system provides services for the customer through a website allowing the account holder to perform several transactions. These services include withdrawal for both the account holder or non account holder, where it generates a verification code to be used in the ATM. The system also provides a transfer service, where the account holder can transfer money from his account to another account by entering the account number and the PIN. Finally a check balance service is provided where the website asks for the owner's account number and PIN to display his current amount of money on his account. The website also has an Administrator part, where the administrator can login and perform some actions including, creating a bank account for a customer, and editing the .PIN for and existing account

A database and an ATM simulator are created using VB.NET to .perform the same functions as the ATM

The ATM simulator is connected to the database as well as the :website. The simulation of the ATM has two types of users

A non account holder: which is a customer that can only use the .1 withdrawal service by entering the verification code he receives by the account holder or the owner of the account. Then the ATM checks the verification code on the database and sends another code to the customer on his mobile to check that this is the same person who should withdraw the money. Once the customer

receives the second verification code and enters it, the withdrawal operation is performed

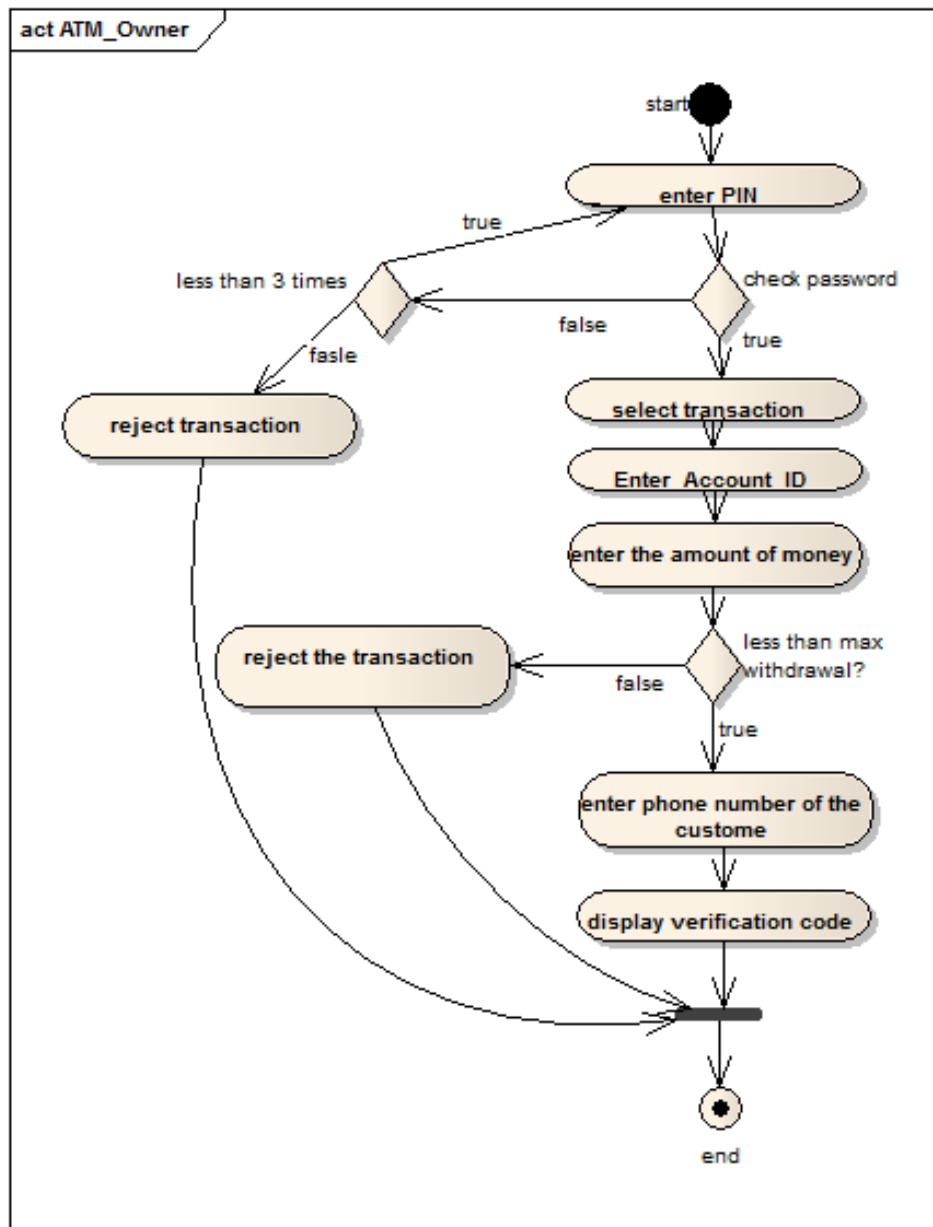
A valid account holder: for the account holder or the owner of the account, several services are available including withdrawal, transfer, check balance and check last transaction

:Service scenario 4.3

:Cash withdrawal by bank account owner 4.3.1

The system requires the account holder to enter his account ID and the needed amount through the web site. The website then generates a verification code to the account holder. Then from the nearest ATM the account holder can perform the cash withdrawal. The flowchart in Figure [4.1] shows the steps for this scenario

This service is useful when the bank account owner does not have his ATM card present, due to the card being lost or left at home for example



Figure(4.1) Cash withdrawal by bank account owner

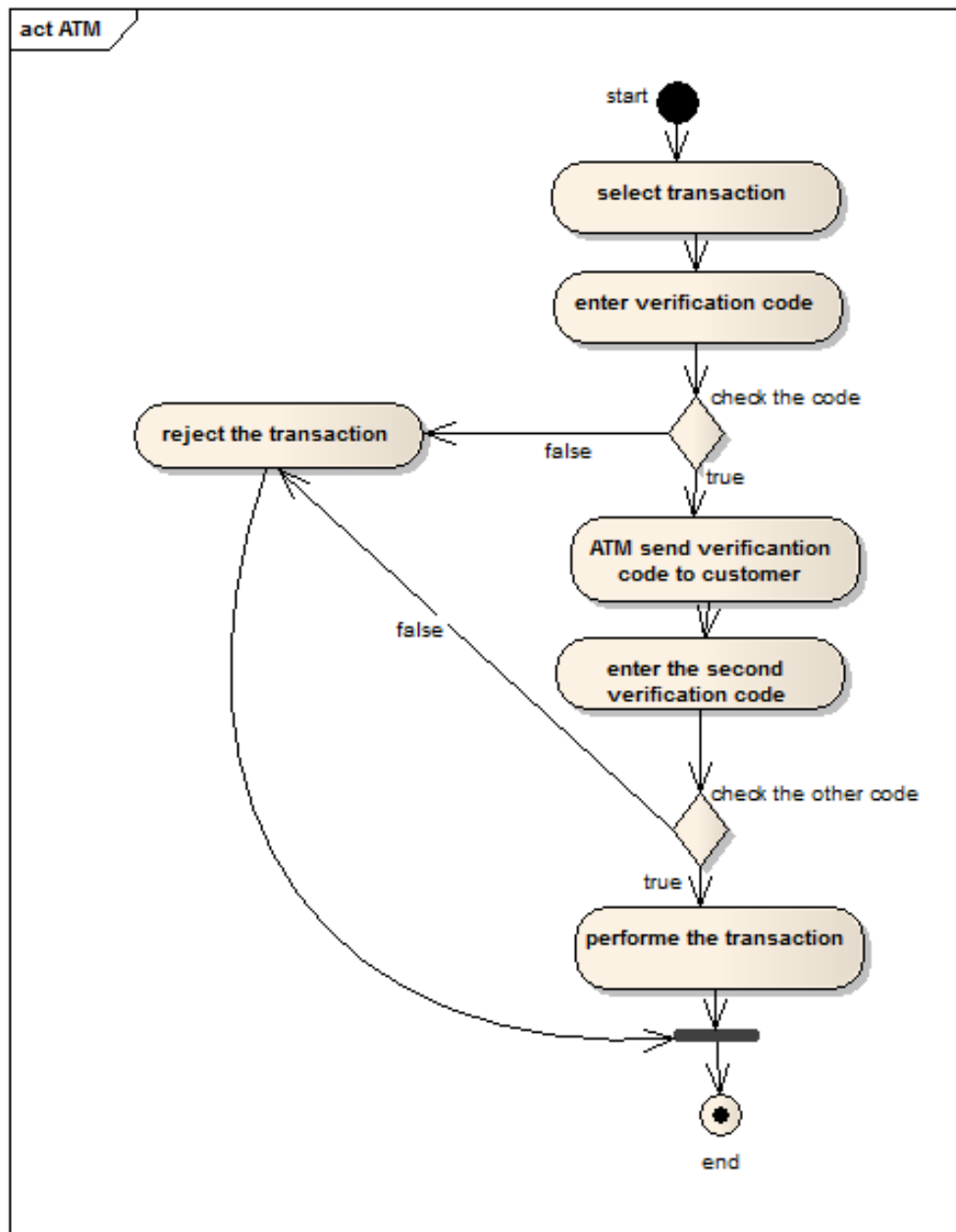
:Cash withdrawal by non bank account holder 4.3.2

The system requires the owner of the account to enter the receiver's phone number and the needed amount and then it .will send the verification code to the customer

.The customer will then send this code to the user

The user withdraws this from an ATM. When the user enters the code into the ATM the system will send him another

verification code to double check. Figure [4.2] shows the .flowchart of this service



Figure(4.2) Cash withdrawal by non bank account holder

:System database 4.4

To store the application data, a database is created using PHP. It is connected to the website and the ATM simulator

The website allows the administrator to create bank accounts for the customer where he enters the customer's information which

goes right to the customer table in the database, the table includes information including customer personal information plus the account number and the account PIN. But in order for a customer to use the Cardless ATM services through the website, he has to create an account in the website; he enters the information needed which is stored in the sign up table in the database. The sign up table includes username, password, account number and account PIN. Whenever the account holder uses the services or performs any transaction, it will be recorded in the transaction table in the database. The table includes: the transaction ID, account number, phone number and verification codes generated for the transaction. The account holder can also see the last transaction he made which is recorded in the report table by date, .time and type of transaction

The administrator also has a username and password by which he .is authenticated in the admin is checked with when login

Verification code 4.5

:generation

The algorithm used for verification code generation is the Random number generator, which generates a 4 digit number. The number is validated by checking other verification codes stored in the .transaction table to ensure its uniqueness

:System functions 4.6

The system functions are divided into two categories based on the .type of user, either a customer or an administrator

:Administrator functions 4.6.1

The system allows the administrator to add a bank account by inserting the name of the customer and the related information about the customer

:Customer functions 4.6.2

The systems provides the following functions to the customer through the website

:Transfer 4.6.2.1

Allows the owner of the account to transfer money from his account to a non-account holder

:Cashout 4.6.2.2

This function is provided for two types of users; customer or account holder which allows him to cashout for himself in case of a card loss using a verification code that the website generates. And the non account holder, which allows the customer to cashout money using a verification code that was sent by the account holder

:Check Balance 4.6.2.3

.Allows the account holder to check his balance

:System components 4.7

:System components are divided into

:Hardware components 4.7.1

A device acts as a server and it is a PC with high specifications for the (Random Memory Access (RAM), Hardisk, ...). Another part is a phone simulator that supports Internet access

:Software components 4.7.2

:The software components are

:Website 4.7.2.1

The website can be accessed through a phone that supports Internet access. It allows the customer to access his account and perform transactions. In addition, it allows the administrator to add .accounts

:ATM Simulator 4.7.2.2

The ATM simulator is a desktop application that is connected to .phpMyAdmin and is managed by VB.NET Language

:System analysis using UML 4.8

The Unified Modelling Language (UML) has been used to analyze the systems. Two Diagrams are used: Use case diagrams and sequence diagrams

:Use case diagram 4.8.1

This Diagram is used to describe the way the system works by the customers, owners and administer. Figure[4.3] describes the .system's use case

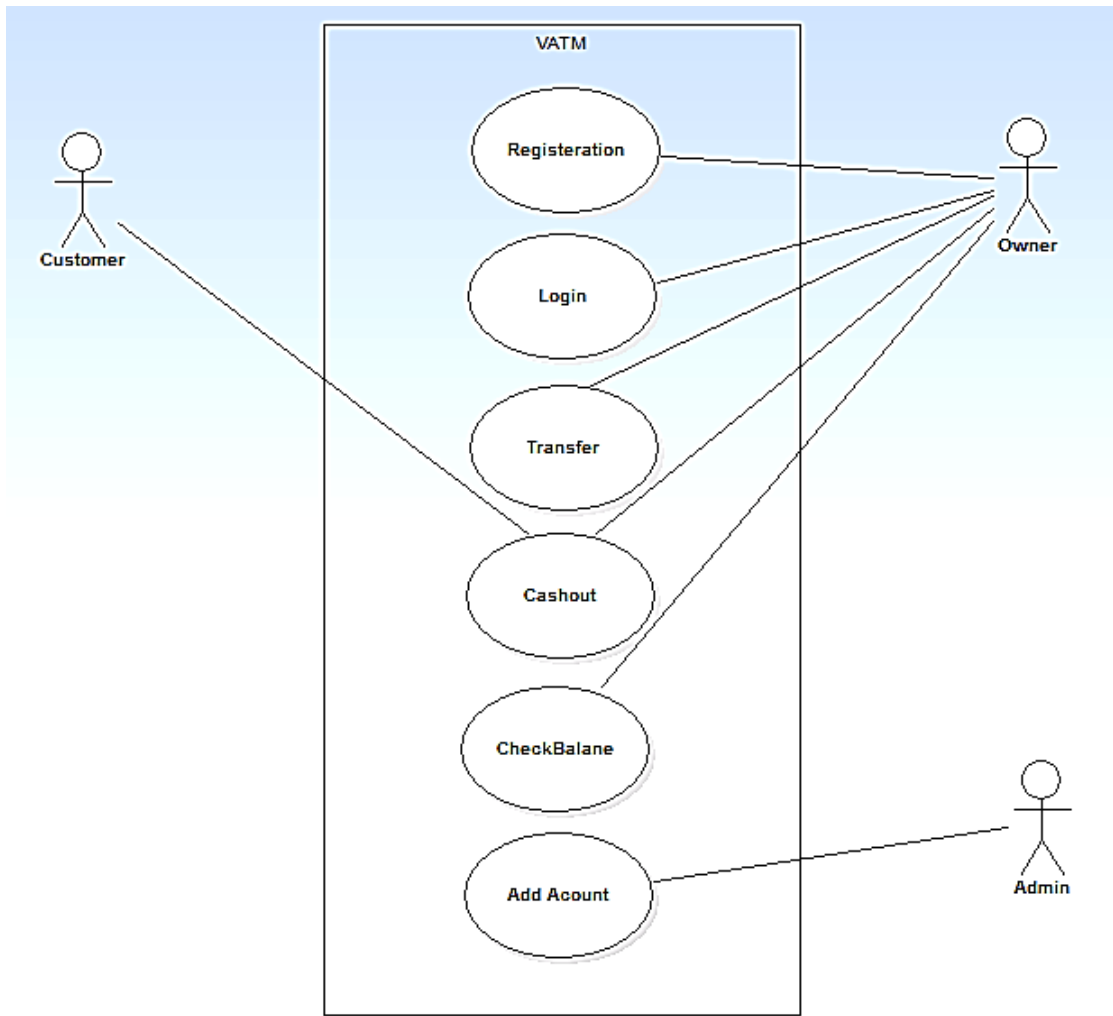


Figure (4.3) System Use Case

:Sequence diagram 4.8.2

Seven sequence diagrams are used to describe system's functions. .Following is an explanation of these diagrams

:Registration .1

The customer is asked to enter the registration information to be stored in the database as shown in Figure[4.4]. An .acknowledgment message is displayed on the screen

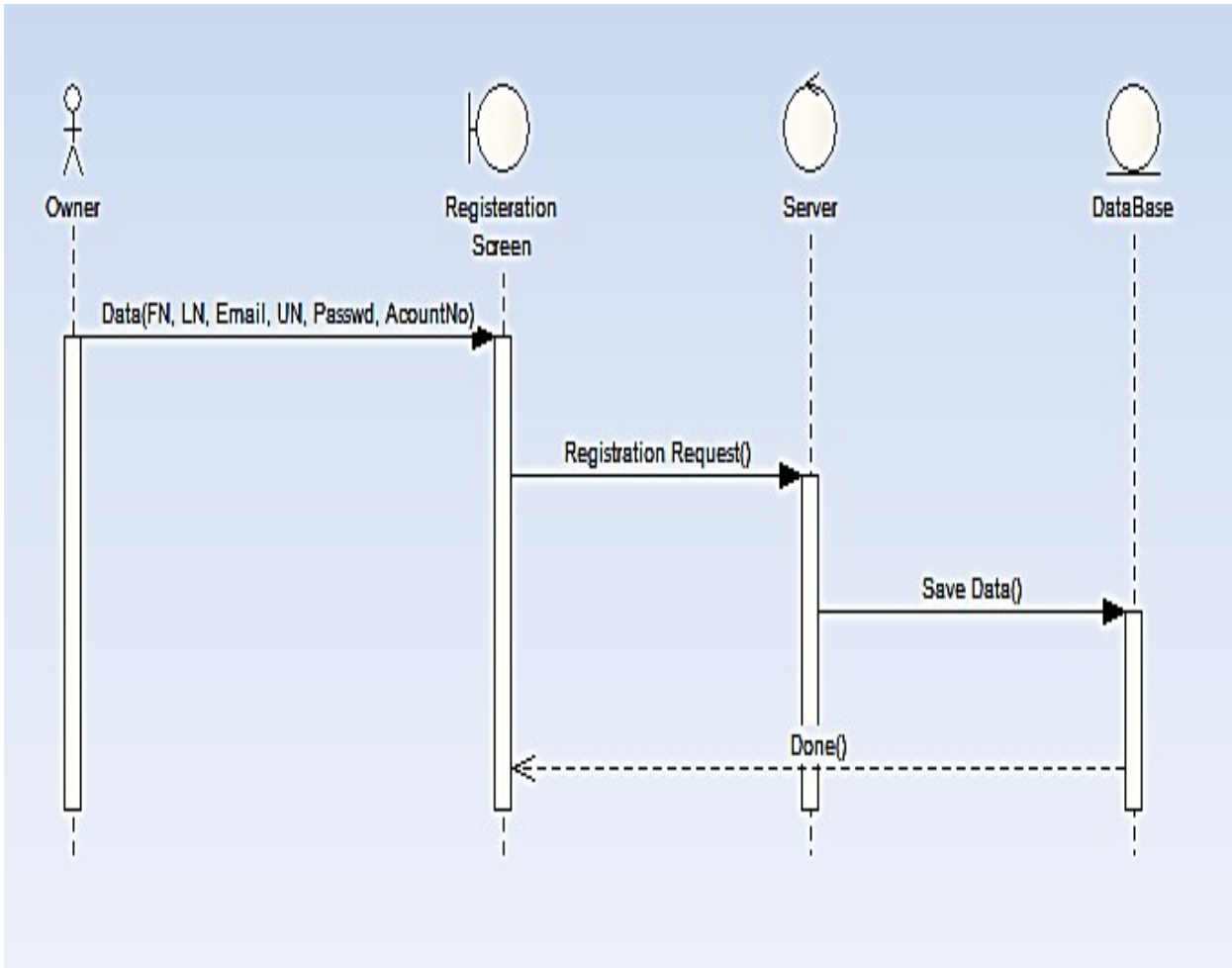


Figure (4.4) Registration Sequence Diagram

- :Login .2

The customer is asked to enter the login information to access his account as shown in Figure[4.5].The customer's login information is checked for verification, and the result are displayed

.accordingly

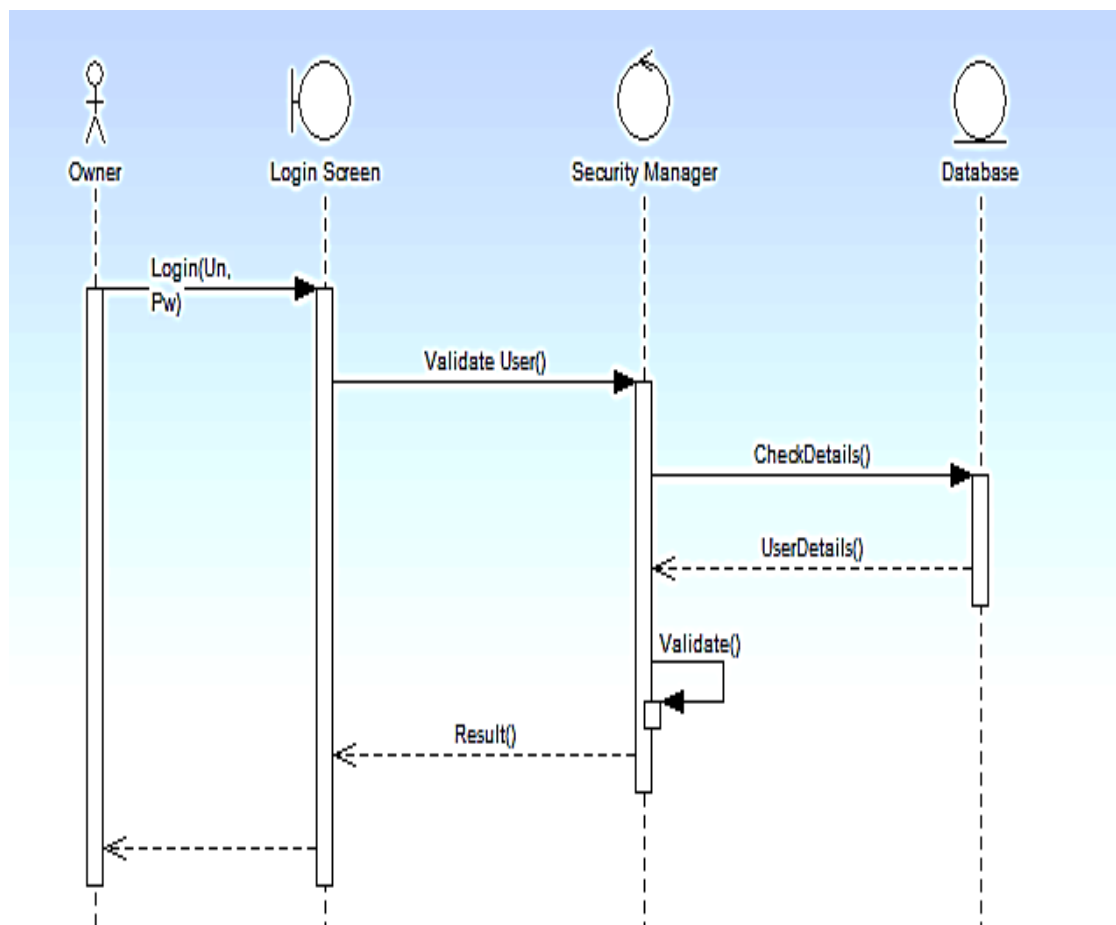
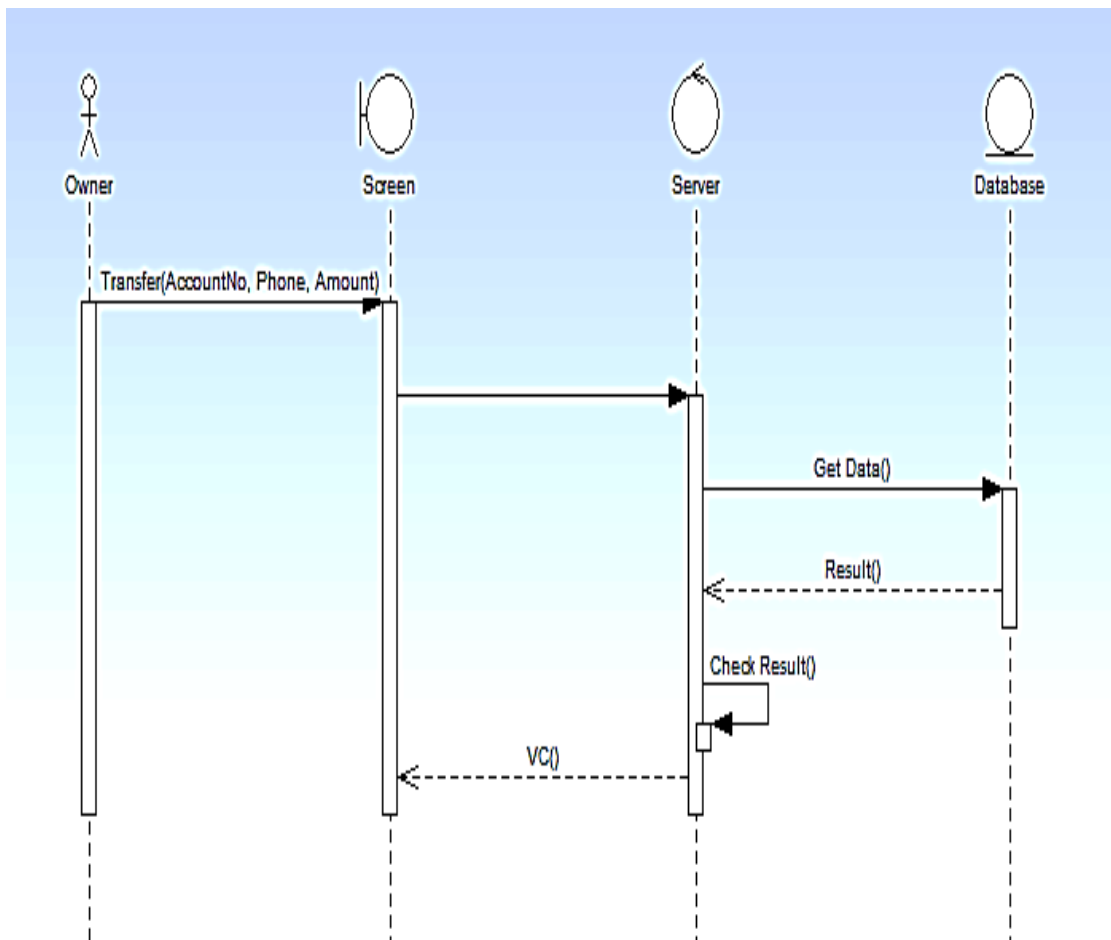


Figure (4.5) Login Sequence Diagram

- :Transfer .3

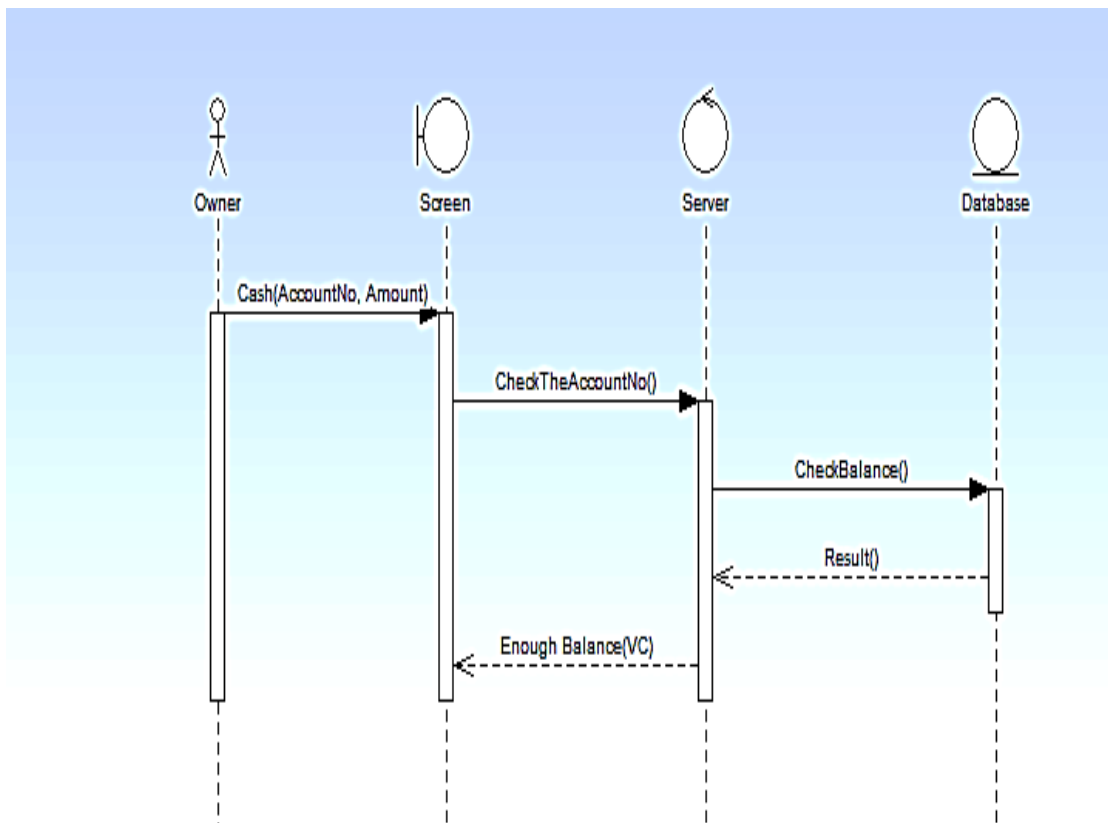
The user is asked to enter the transfer information which is the amount, phone number and the account number. After the inputs are validated, the process returns a verification code that is used .[to complete the service. This process is shown in Figure[4.6



Figure(4.6) Transfer Sequence Diagram

:Cashout for owners .4

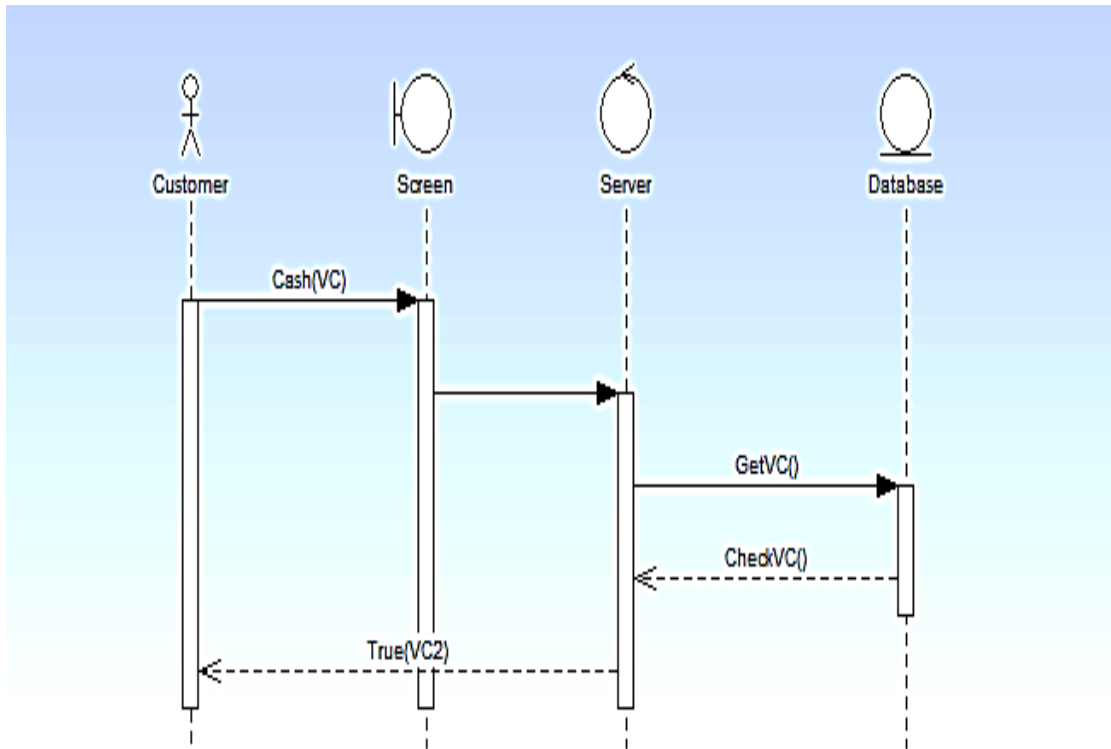
The account holder enters the account number and the amount as shown in Figure[4.7]. The process carries out a number of checks on the account number and the balance and returns a verification .code that is later used to complete the service



Figure(4.7) Cashout for owners sequence diagram

:Cashout for customers .5

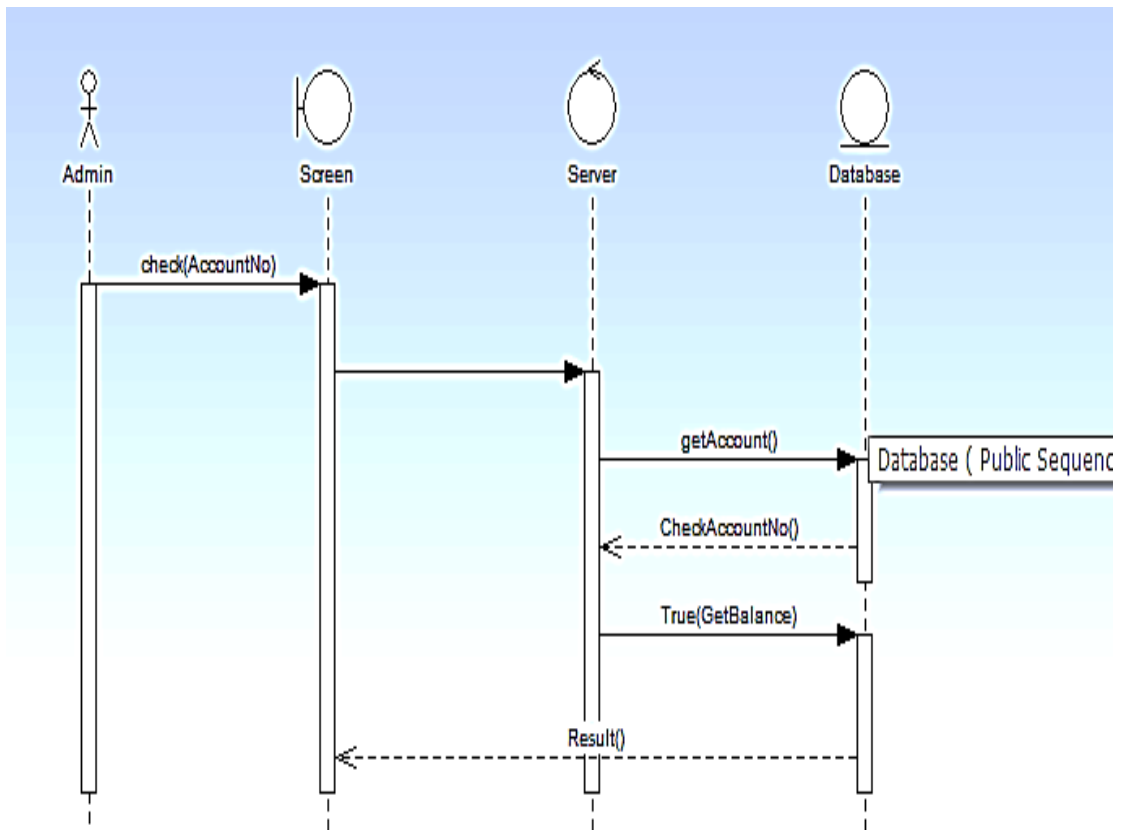
The customer with no bank account enters the verification code as shown in Figure[4.8]. If the code is valid, he receives a second .verification code



Figure(4.8) Cashout for customers sequence diagram

:Check balance .6

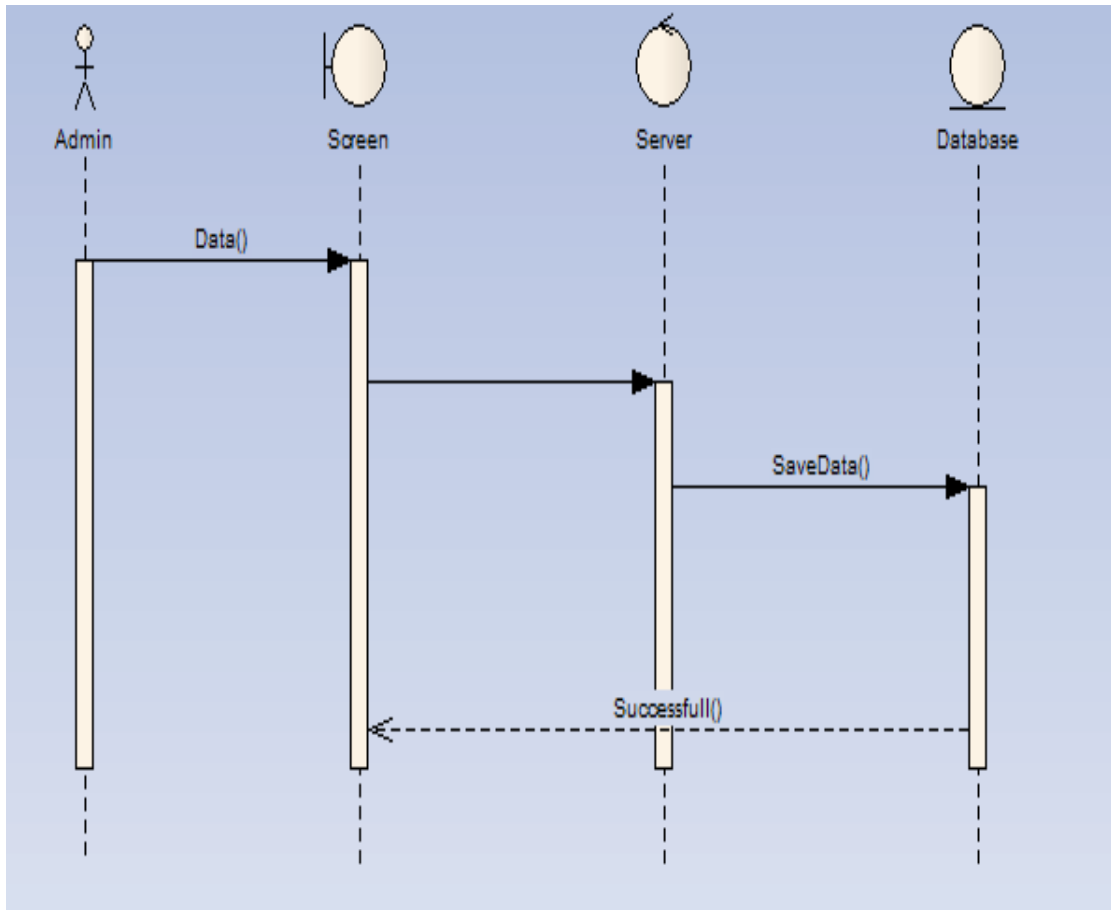
Where the balance for a specific account is displayed as shown in .[Figure[4.9



Figure(4.9) Check balance sequence diagram

:Add account .7

The administrator enters the information needed to create an account as shown in Figure[4.10]. An acknowledgement message .is displayed



Figure(4.10) Add account sequence diagram

:Summary 4.9

This chapter addressed general system analysis and description where it explained the system services, scenarios and the processes that are provided by the system for the user and .administrator

CHAPTER FIVE

SYSTEM IMPLEMENTATION

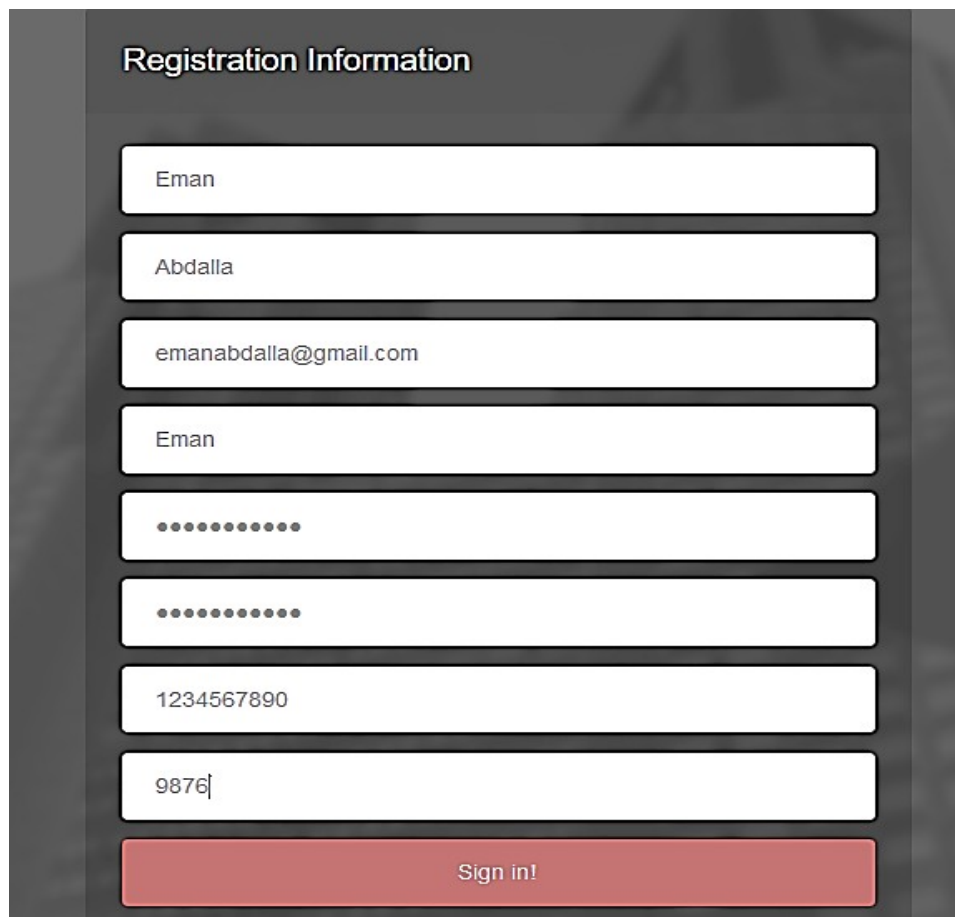
:Introduction 5.1

This chapter addresses the interfaces of the website and the ATM simulator and demonstrates by figures an example of executing .them to explain how they work

:System interfaces 5.2

:Sign up 5.2.1

Figure[5.1] shows the sign up form. This form allows users to create accounts in the website and access their bank accounts, .perform transactions, and use services

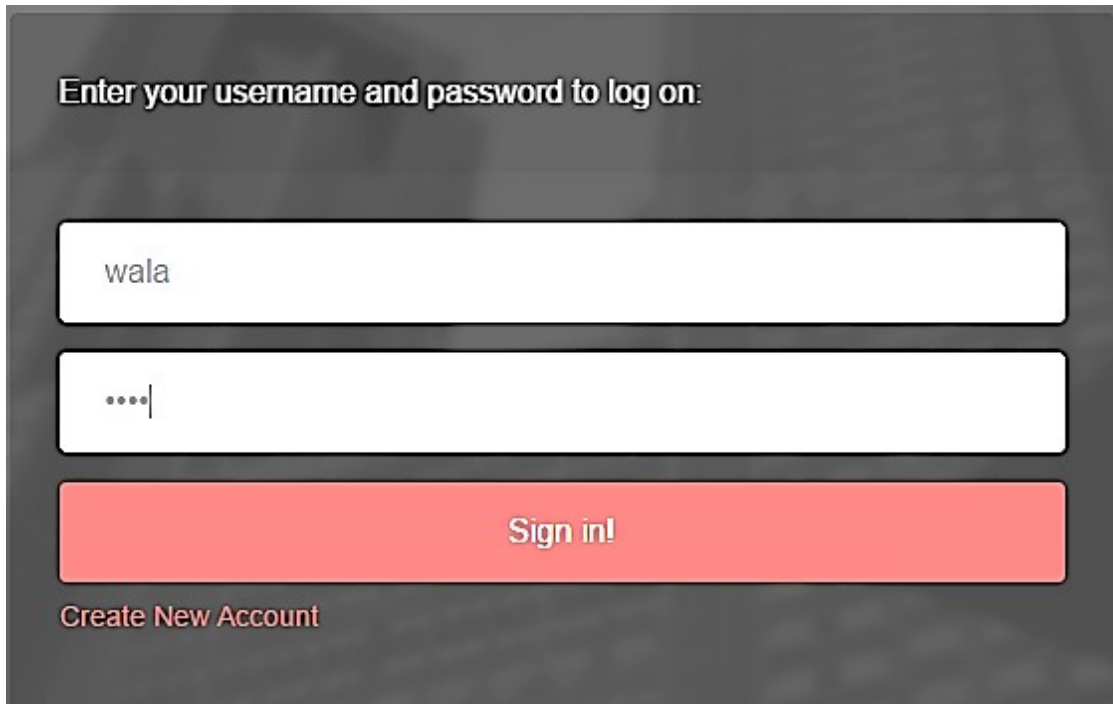


The image shows a registration form titled "Registration Information" on a dark background. The form consists of several white input fields stacked vertically. The first field contains the name "Eman". The second field contains the surname "Abdalla". The third field contains the email address "emanabdalla@gmail.com". The fourth field contains the name "Eman". The fifth and sixth fields contain masked passwords represented by ten dots each. The seventh field contains the phone number "1234567890". The eighth field contains the verification code "9876". At the bottom of the form is a red button with the text "Sign in!" in white.

Figure(5.1) Sign up form

:Sign in .5.2.2

All registered users with valid accounts are required to sign in before being able to use services. Figure[5.2] shows the user sign .in by entering the username and password



Enter your username and password to log on:

wala

....|

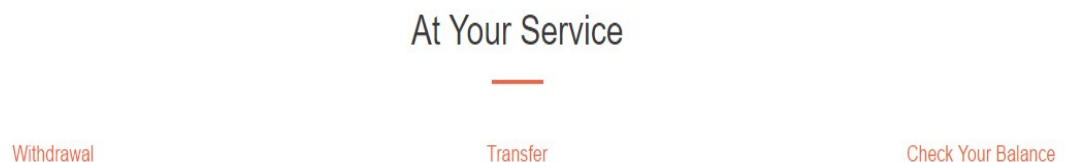
Sign in!

Create New Account

Figure(5.2) Login Form

:Services .5.2.3

.Figure [5.3] displays the services that are available at the website



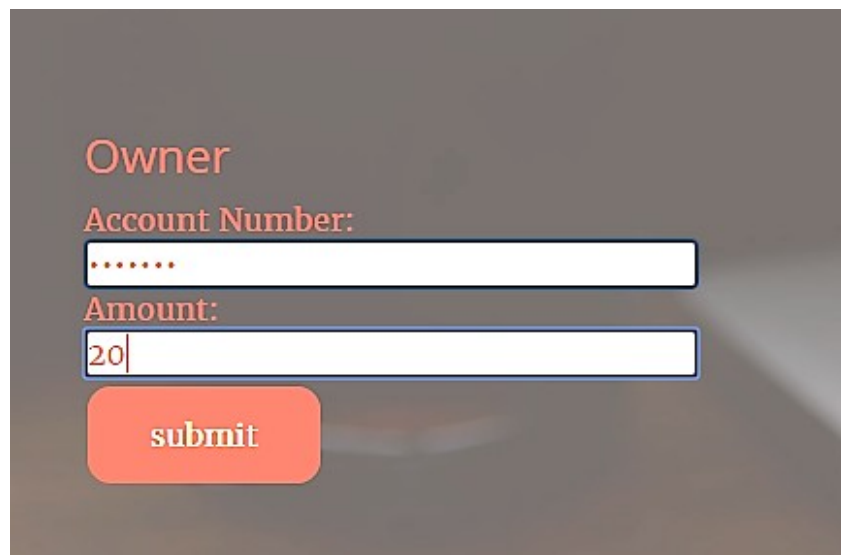
Figure(5.3) Available services

:Withdrawal 5.2.4

Allows the account holder to choose the type of transaction, either .for himself, or for a customer, or non account holder

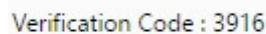
:Owner 5.2.4.1

Figure[5.4] asks the owner or the account holder to enter his .account number and the needed amount of money

A screenshot of a web form titled "Owner" in orange text. Below the title, there are two input fields. The first is labeled "Account Number:" in orange and contains six red dots. The second is labeled "Amount:" in orange and contains the number "20". Below the input fields is a red rounded rectangular button with the word "submit" in white text.

Figure(5.4) Owner form

Then it generates a verification code that can be used at the ATM :[to perform the transaction as shown in Figure[5.5

A small white rectangular box with a thin border containing the text "Verification Code : 3916" in a light blue font.

Figure(5.5) Owner's verification code

:Customer 5.2.4.2

Figure[5.6] requires the owner to enter the account number, amount of needed money and the phone number of the customer and then it generates a verification code to be sent to the .customer



Verification Code : 7660

OK

Customer

Account Number:
.....

Amount:
10

Phone Number:
0966208561

submit

Figure(5.6) Customer form

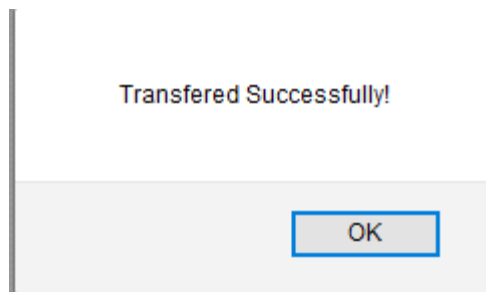
:Transfer 5.2.5

The transfer service allows the account holder to transfer money from his account to another account holder's account. This process .[is shown in Figure[5.7

The image shows a mobile application interface for a transfer form. At the top, the word "Transfer" is displayed in a large, orange font. Below it, there are four input fields, each with a label above it: "From_id:" with the value "1234567890", "PIN:" with four red dots, "Amount:" with the value "20", and "To_id:" with the value "2548127". At the bottom of the form is an orange button with the text "Transfer".

Figure(5.7) Transfer form

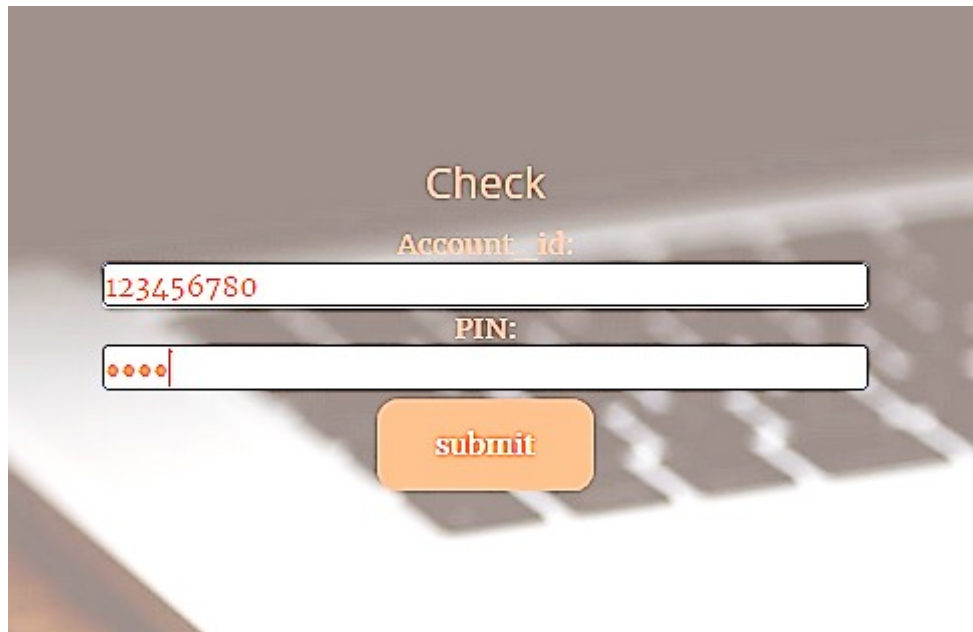
As soon as the transfer operation is complete, it displays a confirmation message as shown in Figure[5.8



Figure(5.8) Transfer confirmation message

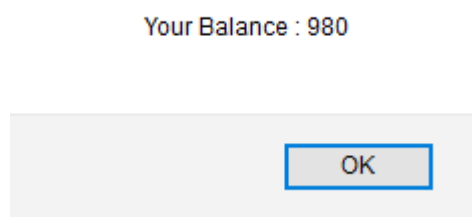
:Check balance 5.2.6

Figure[5.9] shows the check balance service, which allows the .account holder to see his balance



Figure(5.9) Check balance form

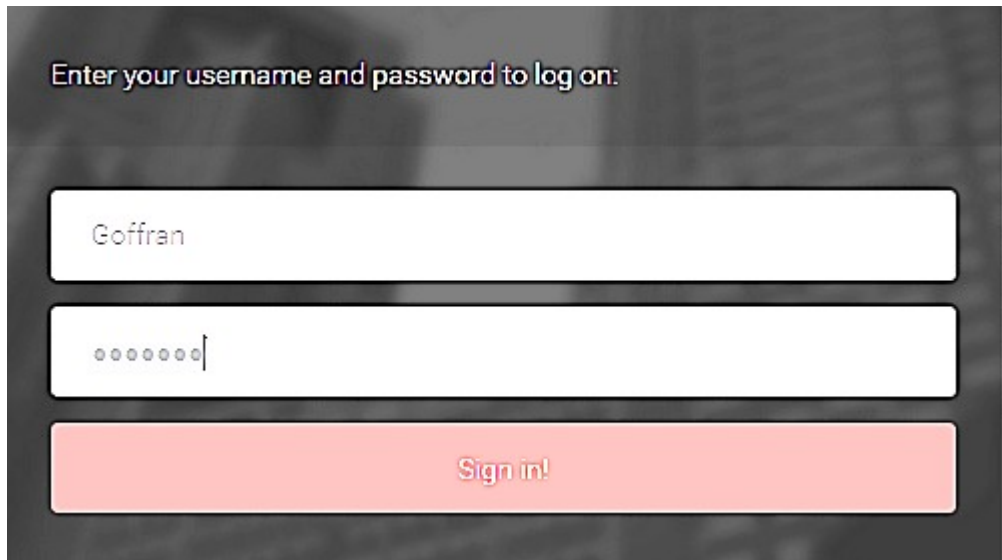
When the button is pressed the following message appears as in .[Figure[5.10



Figure(5.10) Check balance result

:Admin login 5.2.7

Figure[5.11] shows a form that allows the administrator to sign in .to the administrative account

A login form with a dark background. At the top, it says "Enter your username and password to log on:". Below this are two white input fields. The first field contains the text "Goffran". The second field contains a series of dots followed by a cursor. Below the input fields is a red button with the text "Sign in!" in white.

Figure(5.11) Admin's login form

:Admin's services 5.2.8

Figure[5.12] displays the available services for the admin in the .website



Figure(5.12) Admin's services

:Add account 5.2.9

This service allows the admin to create a bank account for a .[customer. The form is displayed in Figure[5.13

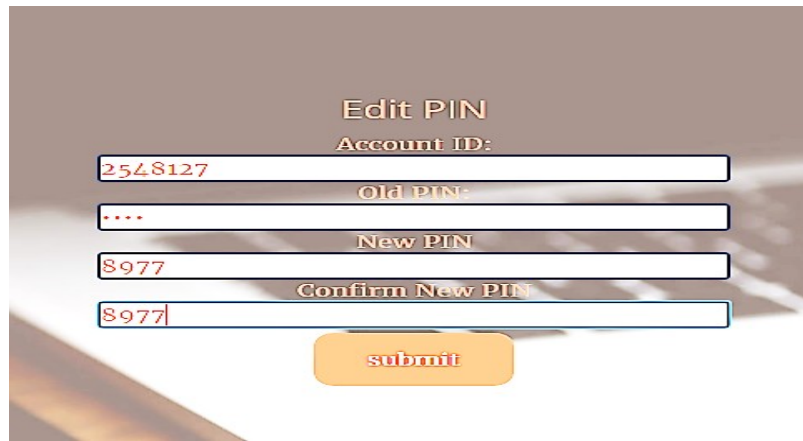
The image shows a registration form titled "Admin" on a dark grey background. The form consists of several input fields, each with a label above it. The labels and their corresponding values are: "First name:" with "Amna", "Last name:" with "Hashim", "Address:" with "Khartoum", "Phone number:" with "0966208561", "Email:" with "eman@gmail.com", and "Account id:" with a series of ten red dots. Below the fields is an orange rounded rectangular button labeled "submit".

Field Label	Value
First name:	Amna
Last name:	Hashim
Address:	Khartoum
Phone number:	0966208561
Email:	eman@gmail.com
Account id:	••••••••••

Figure(5.13) Add account form

:Edit PIN 5.2.10

Which allows the user to change their PIN number after correctly (entering the information shown in Figure(5.14



Figure(5.14) Edit PIN

:Application interfaces 5.3

:Main screen 5.3.1

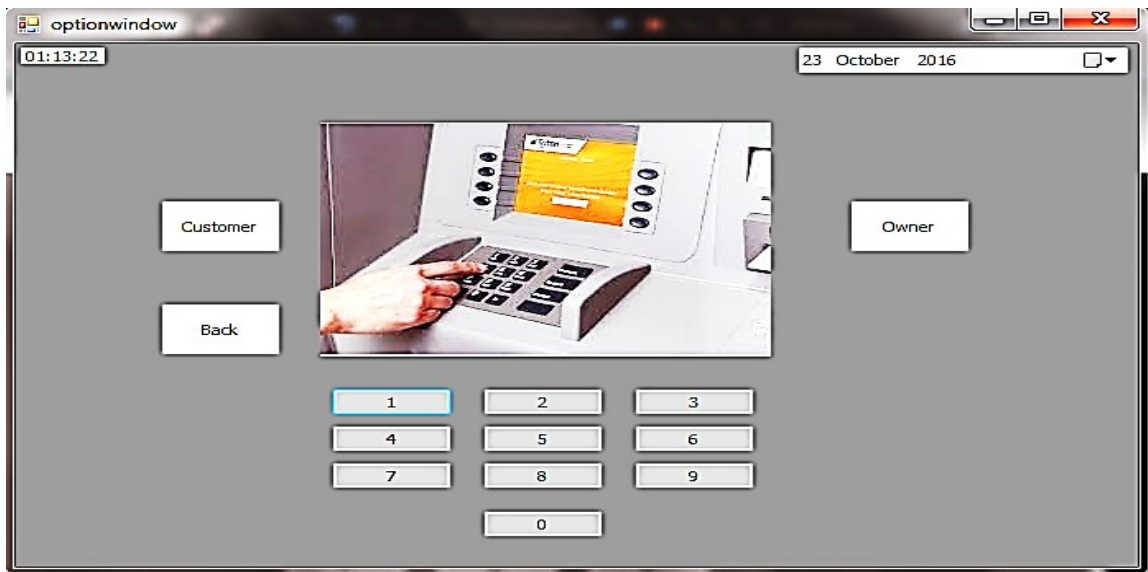
Figure[5.15] shows the main screen of the Cardless ATM. The user .is required to choose the language of preference



Figure(5.15) Application main screen

:Type of user 5.3.2

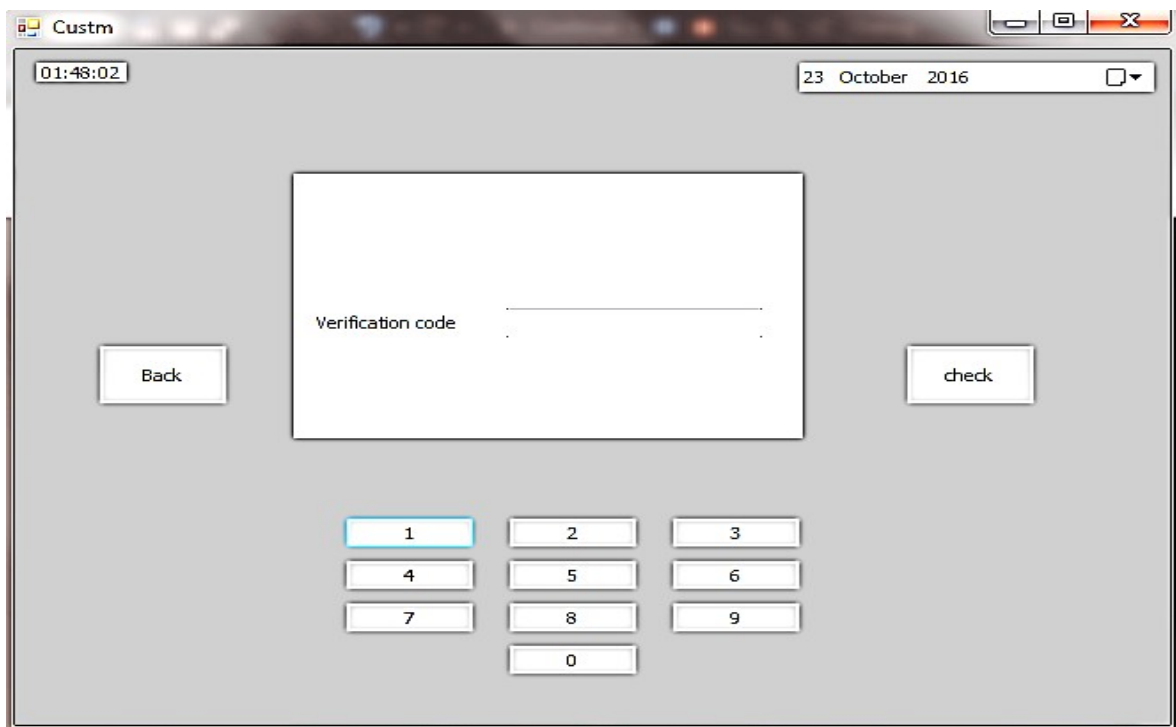
.Figure[5.16] shows a screen with two options or types of user



Figure(5.16) Type of user screen

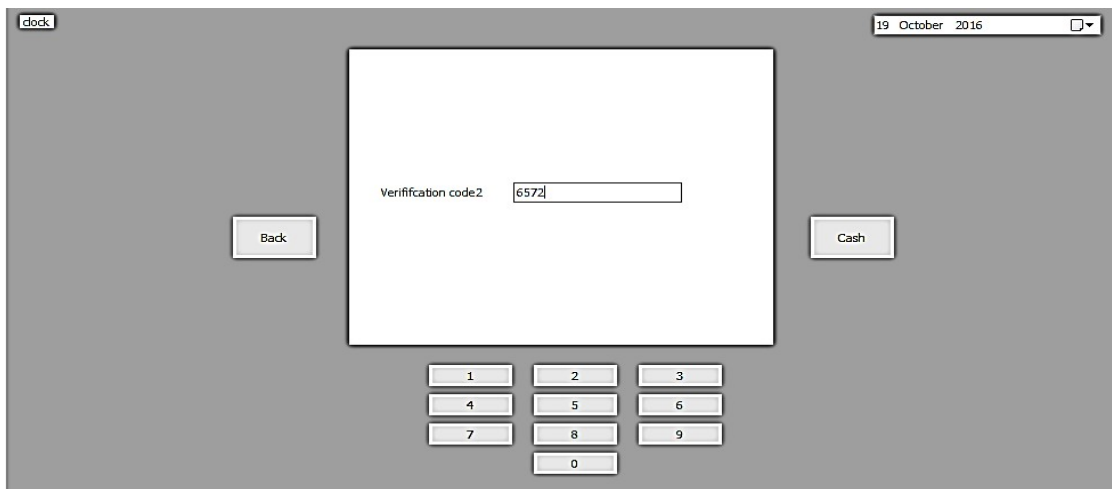
:Customer 5.3.3

Figure[5.17] displays a screen that offers the only service for the .customer which is withdrawal by entering the verification code



Figure(5.17) Customer screen

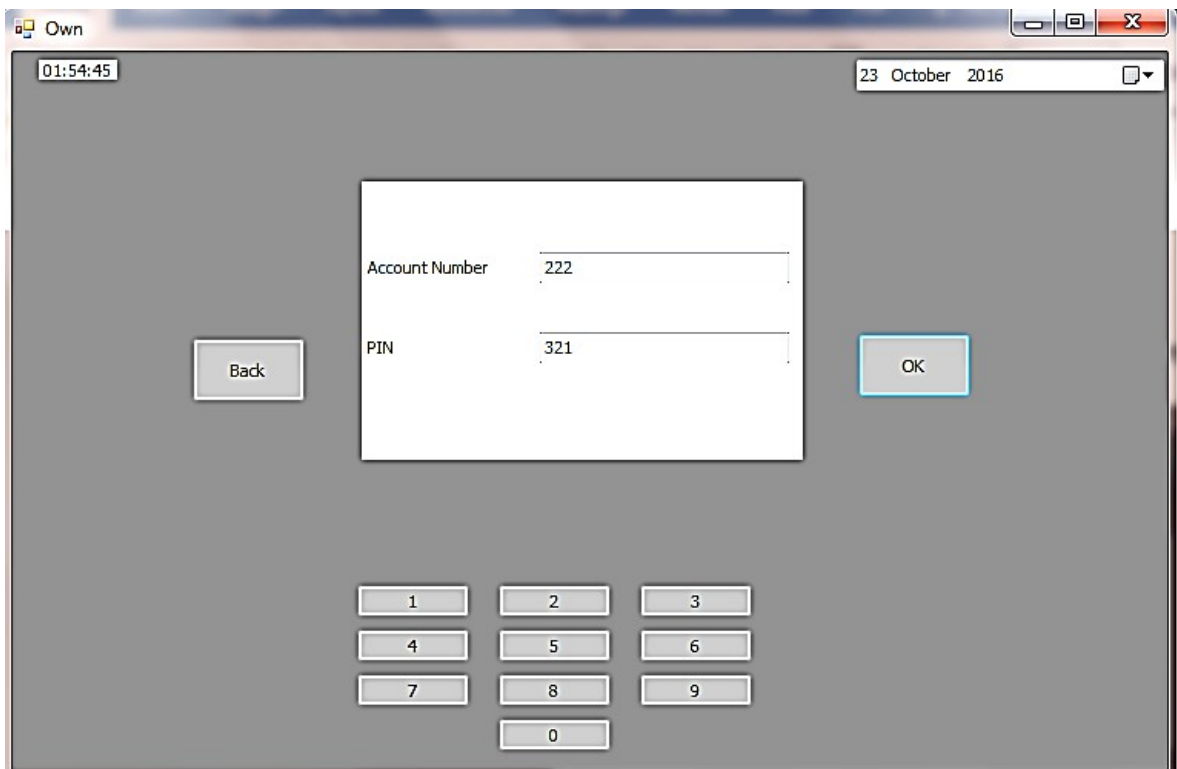
If the verification code is correct, another verification code is sent to the customer in his phone, and he will be asked to .[enter it again as shown in Figure[5.18



Figure(5.18) Cashout for customer screen

:Owner 5.3.4

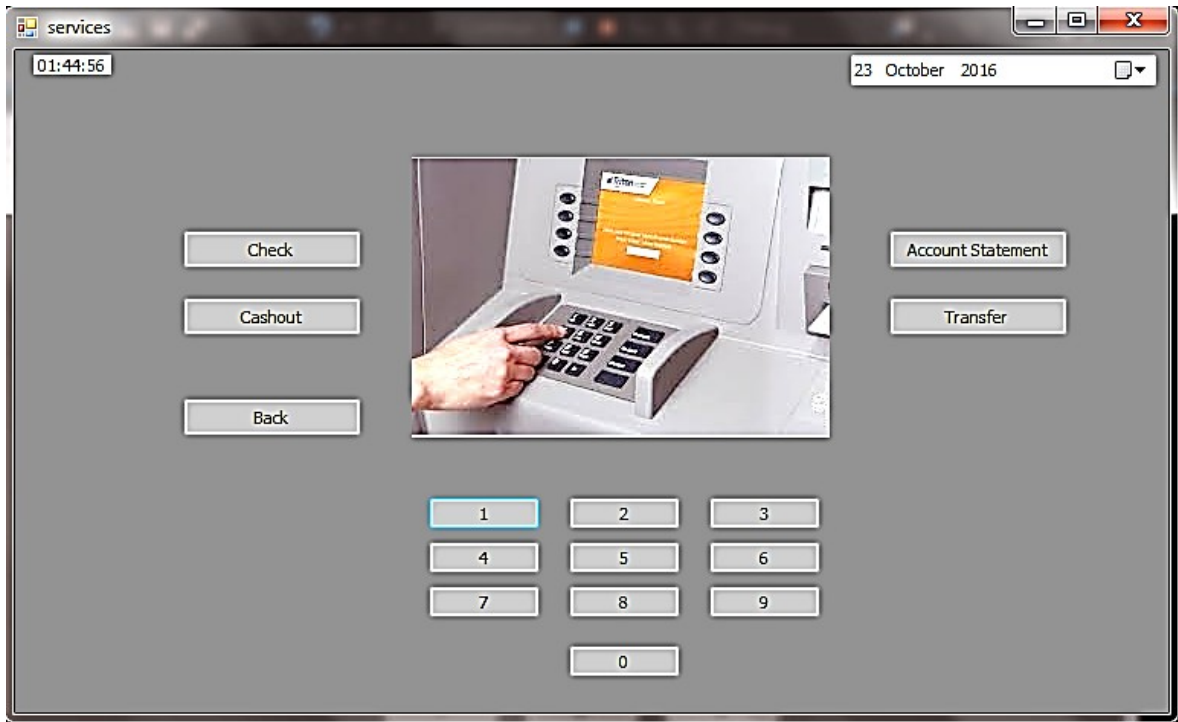
Figure[5.19] asks the owner for his account number and PIN to .avail the services



Figure(5.19) Owner screen

:Services 5.3.5

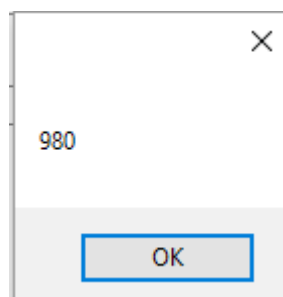
Figure[5.20] shows a screen that displays the services provided by .the ATM



Figure(5.20) Owner's services screen

:Check balance 5.3.5.1

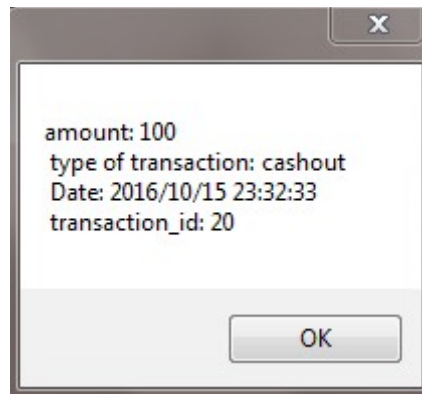
The form in Figure[5.19] requires the user to enter the account number and the PIN and returns the amount of money the user has in his account. Figure[5.21] is an example of displaying the .balance after entering required data



Figure(5.21) Check balance

:Last transaction 5.3.5.2

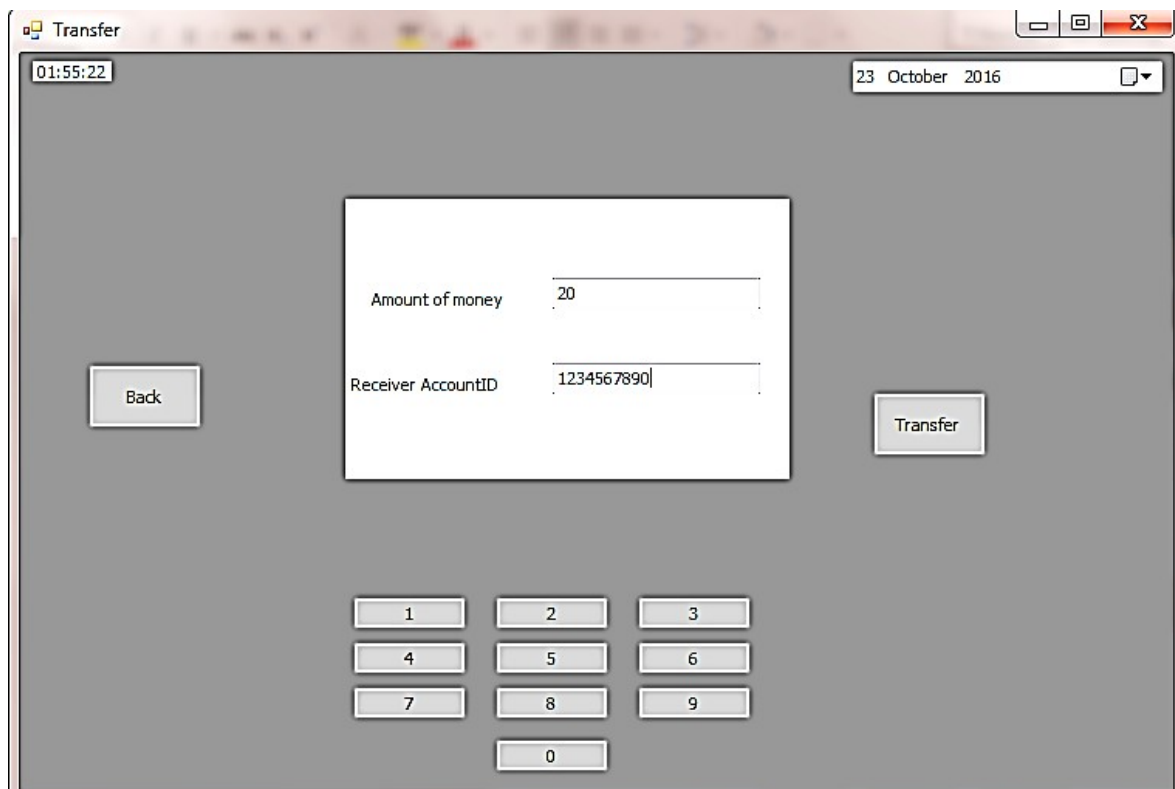
.Figure[5.22] displays the last transaction the user has made



Figure(5.22) Last transaction

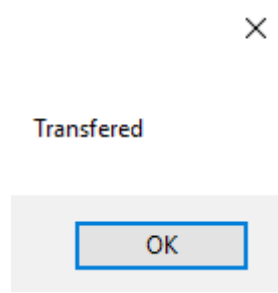
:Transfer 5.3.5.3

Figure[5.23] shows the transfer service which allows the user to .transfer money from his account to another account



Figure(5.23) Transfer screen

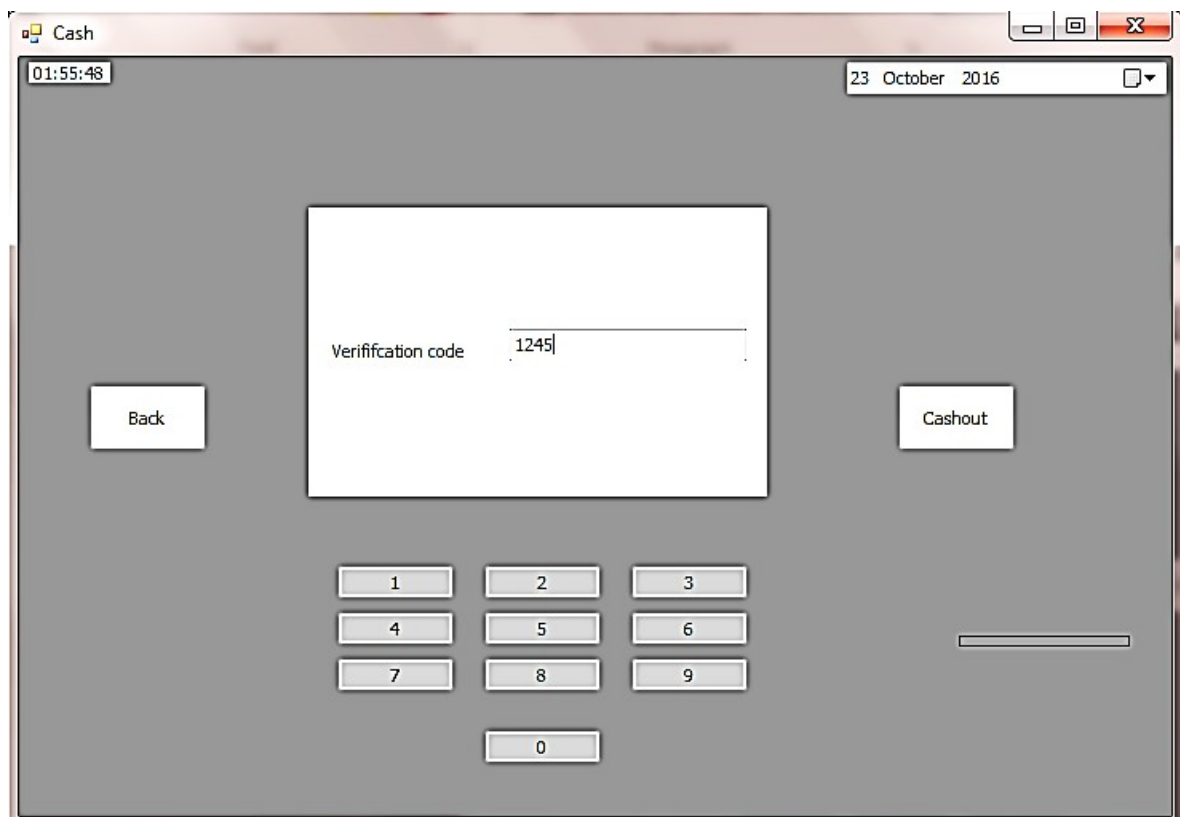
If the transaction is successfully completed, the following :[confirmation message is displayed and is shown in Figure[5.24



Figure(5.24) Transfer confirmation message

:Cashout 5.3.5.4

Requires the owner to enter the verification code generated for the
. [transaction as shown in Figure[5.25



Figure(5.25) Owner's cashout

:Summary 5.4

This chapter shows the system implementation that includes the website interfaces and the ATM simulator interfaces and explains them.

CHAPTER SIX

CONCLUSIONS AND

RECOMMENDATIONS

:Introduction 6.1

This chapter contains the final results of our project and recommended additions and future work that can be included to .improve the system

:Results 6.2

We have developed the Cardless ATM , which is a software that enables users to access important bank services. These services include cash withdrawal, transfer and balance check. The system allows the account holder to withdraw cash without a credit card, which is most useful when the card is not present or lost. It also enables the user to transfer money from one account to another using the website or ATM. For verification, the system generates codes that are used in these transactions. An administrator .webpage is also developed to manage accounts

:Recommendations 6.3

To improve the Cardless ATM system, we recommend the :following

.Applying the simulated ATM to real ATMs .1

Applying the services provided by the website in an Android .2 application, so that the application can be accessed using mobile .phone

Adding the basic ATM services to the Cardless ATM application .3 .to explain its functionalities

Adding other services like water, electricity and other bills to the .4 .Application to make the most use of the system

:Conclusion 6.4

This chapter addresses the results of this project and the
.recommendations needed to improve it

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