Chapter 5

Analysis and designing of the automated mobile money transfer system.

5.1 Introduction

Previous chapter has been discussed approaches, methods of implementing this project and technologies used.

This chapter will explain the analysis and designing part of the system.

Following are the main 4 tasks conducted to analyze and design the system.

1. Project planning using MS-Project
2. System Requirements analysis and completed the System Requirements Specification.
3. System design and architecture- Drawn the necessary design diagrams.
4. Created a test plan and completed the evaluation.

First of all it was identified “to do” list and reserved time lines for all tasks within defined period using Gantt chart. (See the Appendix A for Gantt chart).

Waterfall method selected to implement the system. Reasons to choose this approach the goals are very clear from the beginning. Also each and every phase created output as a document. So it is very understandable and clear to go to the next phase. Also it had limited time frame to implement the system so in this method can’t be move to the

backwards. Then it was easy to make deadlines and it was able to work within the deadlines.

Following diagram (Figure 5.1) show the stages in the waterfall method according to the author's system.

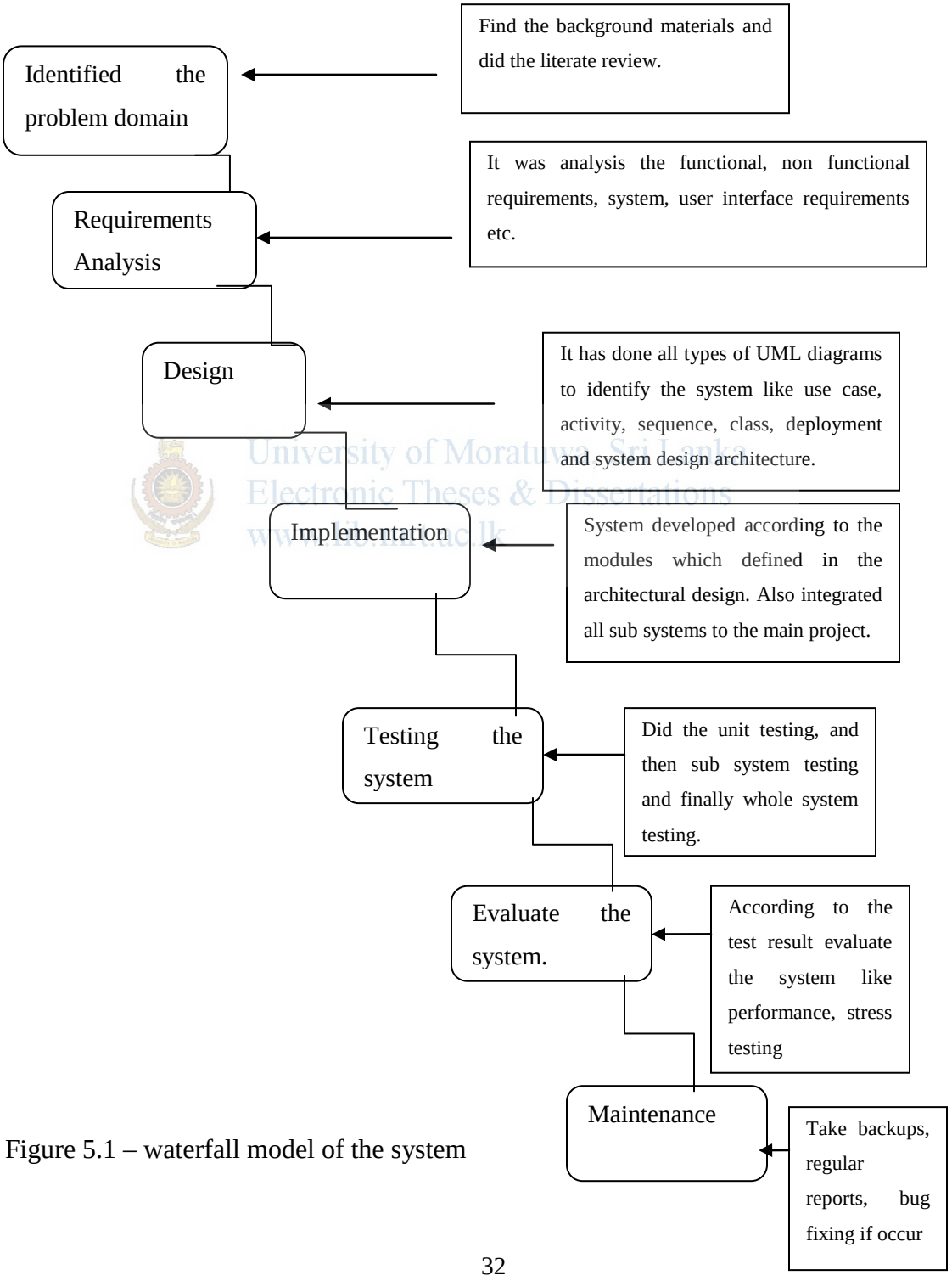


Figure 5.1 – waterfall model of the system

5.2 Requirement specification

This section will illustrate functional and non functional requirements and other system features provided by the system. This section mainly introduces the use case diagrams, class diagrams, system hierarchy, etc.

5.2.1 User classes and characteristics.

The system mainly consists of following users.

Money Sender

- Initiate the transaction by sending the SMS with the receivers NIC number, PIN number, Mobile number and amount has to be transferred. User is suppose to be use a mobile phone to do this transaction.
- User is able to send SMS message and view the reply SMS message.

Money Receiver

- Receive an SMS message with authorization key transaction id, amount, sender mobile Number.
- Show this message to the bank and collect money.

Bank executive

- Check the validity of the customer and the amount.
- Issue money to the consumer.

Mobile operator technical staff

- This group behaves as a gateway between bank or retailer and the customer.

Customer care executives

- View the customer status.

Retailer

- Check the customer validity
- View status of the transaction
- Receive the transaction details via SMS.

Customer at retailer shop

- Request purchase using the cashless purchasing system providing his/her mobile number, NIC number and amount.

Bank technical group

- Bank user can see the customer transactions and should be able to send reply to each and every customer transactions.
- Bank will generate reports to the transactions.

Bank non technical group

- View the customer transactions status reports.

Mobile operator non technical group

- View the customer transactions reports.

5.2.2 System Requirements

1. Interaction between Mobile application and the mobile device.

SMSC receives the customer transaction as a SMS and it will deliver to the java application that binds with the 3G Modem.

2. Send message to the mobile device through the modem application.

Send reply message receive from the bank or originate from the mobile operator, send to the mobile device.

3. Connectivity between the bank and the mobile operator.

Applications between bank and the mobile operator connect through the lease line or the VPN line.

5.2.3 Software Interfaces

5.2.3.1 Mobile application and the Modem.

This is a java application and it is always running as a separate process like a thread and this application bind with the Modem via COM Port of the computer. When a request is received to the SMSC it will be delivered to the mobile application via the modem.

Databases

Development and deployment environment: - MYSQL server version 5.0

Tools

MYSQL GUI (control center) used for connect to the mysql database via GUI. It is possible to create databases and tables via this interface.

Development tool and language

Programming language is Java JDK1.5 version and development tool is NetBeans version 6.5. IReport tool used to design reports. Rational Rose and Microsoft Visio have been used to draw the UML diagrams of the system during the system design stage.

Libraries

Drivers

- mysql-connector-java-3.1.11-bin.jar

To connect to the Modem

- JSMEngine.jar
- Comm.jar
- Win32comm.dll
- javax.comm.properties

Logging purpose

- log4j-1.2.8.jar

Jasper Software jar files

- To generate repots.

Protocols used

- TCP/IP
- This protocol is used to communicate with the mobile provider and the bank

HTTP 1.1

- This protocol is used to communicate with the retailer web application.

5.3 Functional Requirements

This section will discuss about the software capabilities that must be present in order to the user to carry out the services provided by the feature, or to execute the use case. Include how the product should respond to anticipated error conditions or invalid inputs.

Following requirements are from the mobile provider end.

1. The mobile phone interface of the system shall provide a facility to entering customer PIN number, customer national ID number and amount.
2. System should validate customer entering data and if error condition occurs shall be able to give proper error message.
3. System shall be able to store customer transaction.
4. System shall be able to send customer transaction to the bank immediately after receiving.
5. System shall be able to give proper error message to the customer when bank is not respond within predefined (3 minutes) times.

6. System shall be able to send reply message to the customer when receive from the bank.
7. System shall be able to generate reports date wise and mobile number wise etc.
8. System shall be able to send the SMS to the retailer when receive transaction from the bank.
9. System should be able to validate customer entering amount in the mobile phone interface.
10. System shall be able to track if system failure occurs.
11. System shall be able to generate the unique transaction id for each request.

Following requirements are from the bank end.

1. System shall be able to get the transaction from the mobile provider.
2. System shall be able to validate the transaction (customer).
3. System shall be able to debit amount from the particular customer and credit money to the relevant customer or retailer.
4. System shall be able to send the user friendly reply message to the customer.
5. System shall be able to view the customer validity by retailer.
6. System shall be able to send proper messages to the customer as well as retailer.
7. System shall be able to generate one time password to the relevant customer.
8. System shall be able to generate reports mobile number, account number, date wise etc.

9. System shall be able enter 6 alpha numeric characters in the PIN number field, and user type the pin number it should be appears actual character at once and then it should be converted to the stars.
10. System shall be able to provide NIC filed as alpha numeric characters. Length should be 10 digits.
11. System shall be able to allow enter amount field numeric only. It doesn't allow entering text and it should be allow entering decimal places.
12. System shall be able to show help screen relevant to the particular screen.

5.4 Non Functional Requirements

1. The system should be developed using java, Sun application server mysql database

2. The system should be worked with intranet/internet environment.
3. The system should be able to handle more than 500 customer information at once.
4. The system should be able to keep backups of all information.
5. The system should be able to retrieve customer data for at least 2 years.
6. The system should have the parallel recoverable server for an emergency.
7. The system should be supported by the existing HW platform.
8. The system should function properly through wide area
9. The system should be recoverable from backup immediately if the main DB got fail.

5.5 Priority of the system.

Requirement	Priority(Most important is 1)
System should be able to send SMS	1
System should be able to see the status of the transaction	1
System should be able to get the reports	3
System should be able to connect with the banking system.	1
System should give proper messages to the users	1

Table 5.1- priority of some system features.

5.6 Stimulus/Response Sequences

This will discuss about user action and response of the system to the particular user action.

Action	Response from the system/user
User login to the system via mobile phone interface	If user enter details correct send the SMS
When receive the transaction, then mobile provider send the transaction to the bank	Bank socket application will receive the transaction and do the needful.
When transaction complete send the SMS to the user	View the SMS by user.
Retailer check the customer validity	Retailer can see whether customer is valid or not.
Banking application originate transactions and send to the customer	SMS receive both retailer and customer

System user give the particular date range or mobile number to the system	User can view the reports according to the mobile number wise or date wise

Table 5.2 – simulate response sequence.

5.7 External Interface Requirements

User Interfaces

Describe the logical characteristics of each interface between the software product and the users. This include sample screen images, any GUI standards that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, error message display standards, and so on. Define the software components for which a user interface is needed. *(See Appendix B to user interfaces)*

5.8 Communication Interfaces

Communication between bank and the mobile operator through the TCP/IP socket connection. Server and client socket should have both bank and the mobile operator.
Network connectivity should be VPN, lease line or internet.

Retailer use a web based interface to check customer validity. Http protocol and sun application server is used.

COM port is used to communicate mobile application and modem. All the transaction should be done through the transaction id and this number should be unique.

5.9 Performance Requirements

Performance should be very important to this system.

When a message receives from the customer the reply from the bank should be happened within maximum of 3 minutes times. Otherwise transaction invalid (timeout) message should send to the customer.

More than 500 transactions should be able to handle for a given period of time.

Retailer should be able to view the customer validity within 2-3 seconds.

Total time spend for the transaction is not greater than 4 minutes. Table 5.3 describes the performance requirements.

Req. #	Performance Requirement	Description	Affected Req #
1	The system shall perform simple queries (e.g. no more than 2 tables) in less than 10 seconds	This speed is required to ensure speed of the transaction happen in satisfactory level.	2 & 3
2	Getting backups should not effect to performance of the system	Daily backups are performed every day at 6:00 p.m.; if this process takes too long, it will affect the operations of system.	4

3	Transaction should complete within 4 minutes	This speed is required to ensure transaction is successfully completed. Otherwise transaction will abort.	5

Table 5.3 – Table description for performance requirements.

5.10 Safety requirements

It should be checked whether message is having proper format. Otherwise message should be discarded. In between mobile operator and the bank should have the proper message format, Otherwise proper error message should give to the relevant party.

Web application is provided to the retailer should used HTTPS for security purpose. After completing the transaction, mobile operator should delete sensitive information from their database. If the transaction is fail in some point like SMS delay or transaction may not updated properly. In that case it should be able to manually recover the transaction.

5.11 Security Requirements

Proper agreements should be declared between bank and the retailer shops. HTTPS technology and other encoding mechanisms should be used.

5.12 Qualification Requirements

This section will enumerate the Qualification requirements.

Req. #	Qualification Requirement	Description	Affected Req #
1	The system shall be user friendly	The system shall be used by non-technical users, thus must be simple and easy to use. Especially mobile interface should be user friendly.	1,7,2
2	The system requires little training	Help menus shall be available for all on-line and mobile user screens.	12

Table 5.4 – describe the qualification requirements.

5.13 System Design Artifacts.

Above sections defined the requirements of the system and this section will describe the designing of the system from many views.

5.13.1 Use Case View

The system identified 10 actors mainly like money sender, money receiver, bank executive, retailer and etc.

Following diagrams exhibit some actors and their use cases.

Money Sender:-

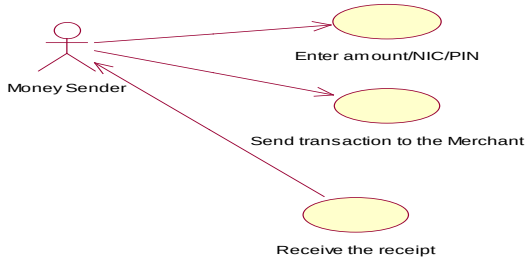


Figure 5.2 – Money sender use case diagram.

Money sender enters transaction details in the mobile phone interface and send SMS.

Money Receiver:-

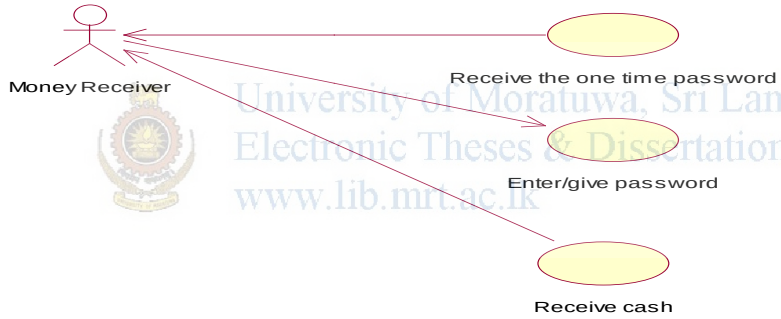


Figure 5.3 – Money receiver use case diagram.

Money receiver receives one time generated password and gives the password to the bank executive and receives money.

Bank Executive:-

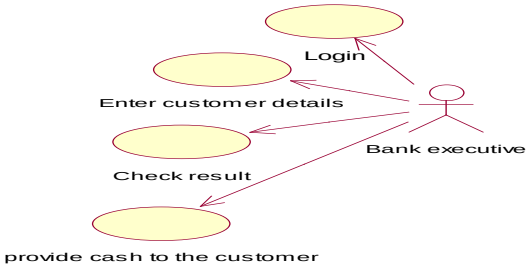


Figure 5.4 – Bank executive use case diagram.

Bank executive is login to the system, verify customer and issue money.

Following diagram is for mobile operator. Mobile operator actor is behaving as a gateway between customer and the bank.

Mobile Operator:-

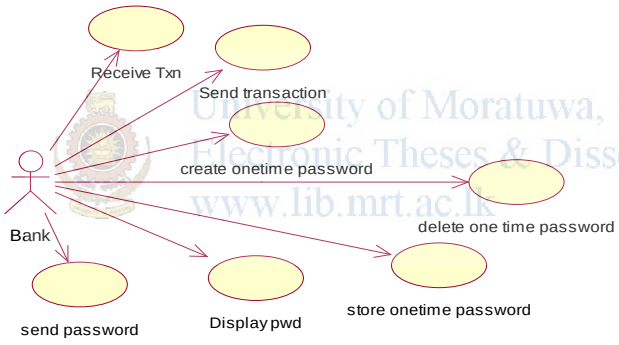
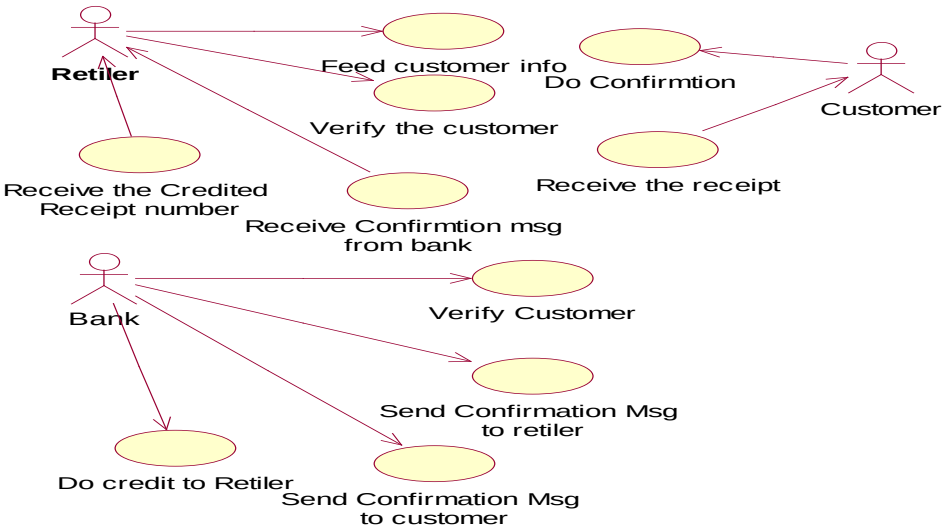


Figure 5.5 –Mobile operator use case diagram.

Mobile operator receive the customer transaction and generate one time password, send transaction to the bank and get reply message from the bank then send the reply with the on time generated password to the customer.

Below diagram describes about the use cases of the retailer, customer and bank. These diagrams for the cashless purchasing sub system.



UseCase Diagram 2- Cashless purchasing at super market

Figure 5.6 –Cashless purchasing at super market.

Retailer is verifying the customer using ID number, amount, name and etc. Then customer receives SMS to confirm transaction. If customer confirms the transaction, the bank does the debit - credit the money from the customer and to the retailer account. Both parties will receive the SMS. *(See Appendix A for other user case diagrams).*

5.13.2 Activity Diagrams

Send Transaction to the merchant.

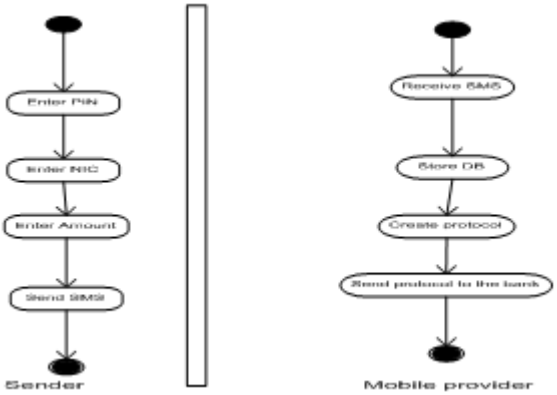


Figure 5.7 –Activity diagram for send protocol. - Peer to peer money transfer

According to the Figure 5.7 money sender send the SMS and mobile operator create predefined protocol using it and send to the bank. *(See Appendix A to other activity diagrams)* Figure 5.8 explain the process of the retailer validating customer.

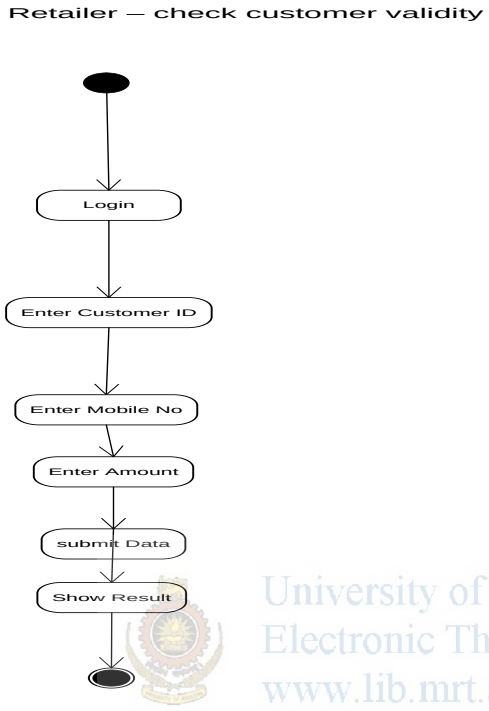


Figure 5.8- Retailer check customer validity.

5.13.3 Sequence Diagrams.

Following sequence diagram describes the processing and sends the message to the customer.

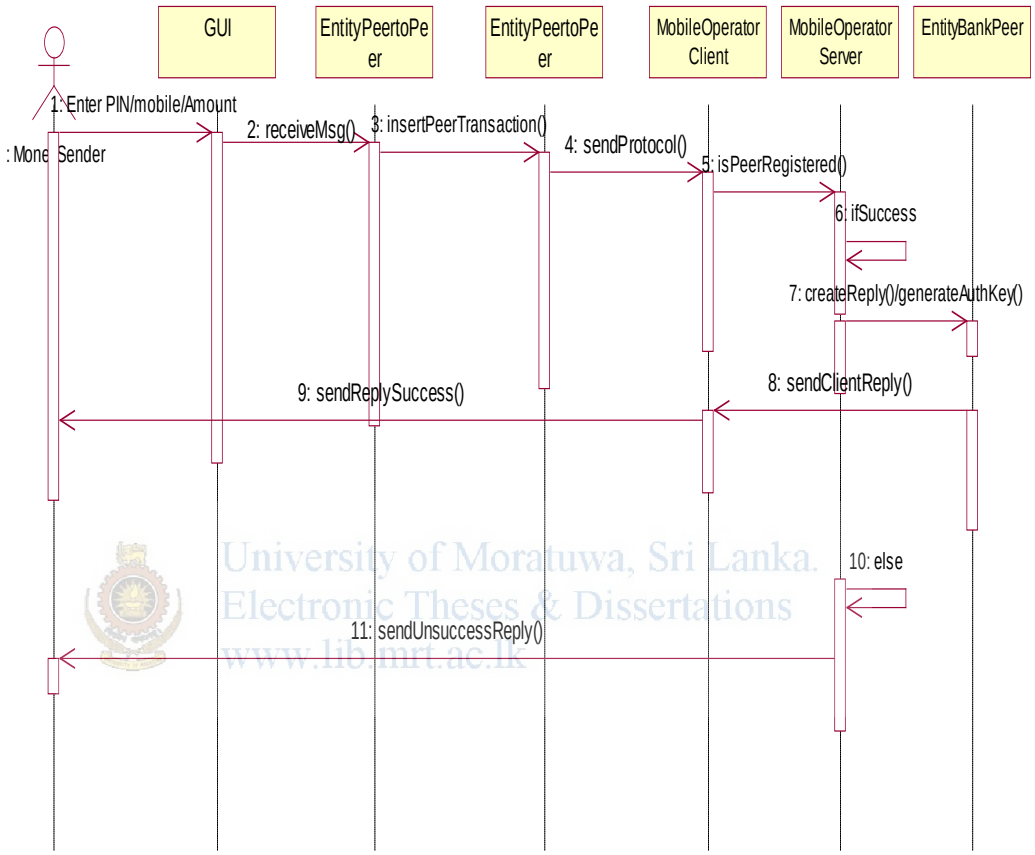


Figure 5.9 – Sequence diagram – Peer to peer money transfer. Money Sender *(See Appendix A for other sequence diagrams).*

5.13.4 Class Diagram:-

Figure 5.10 defined the classes involved to implement the system and their interactions.

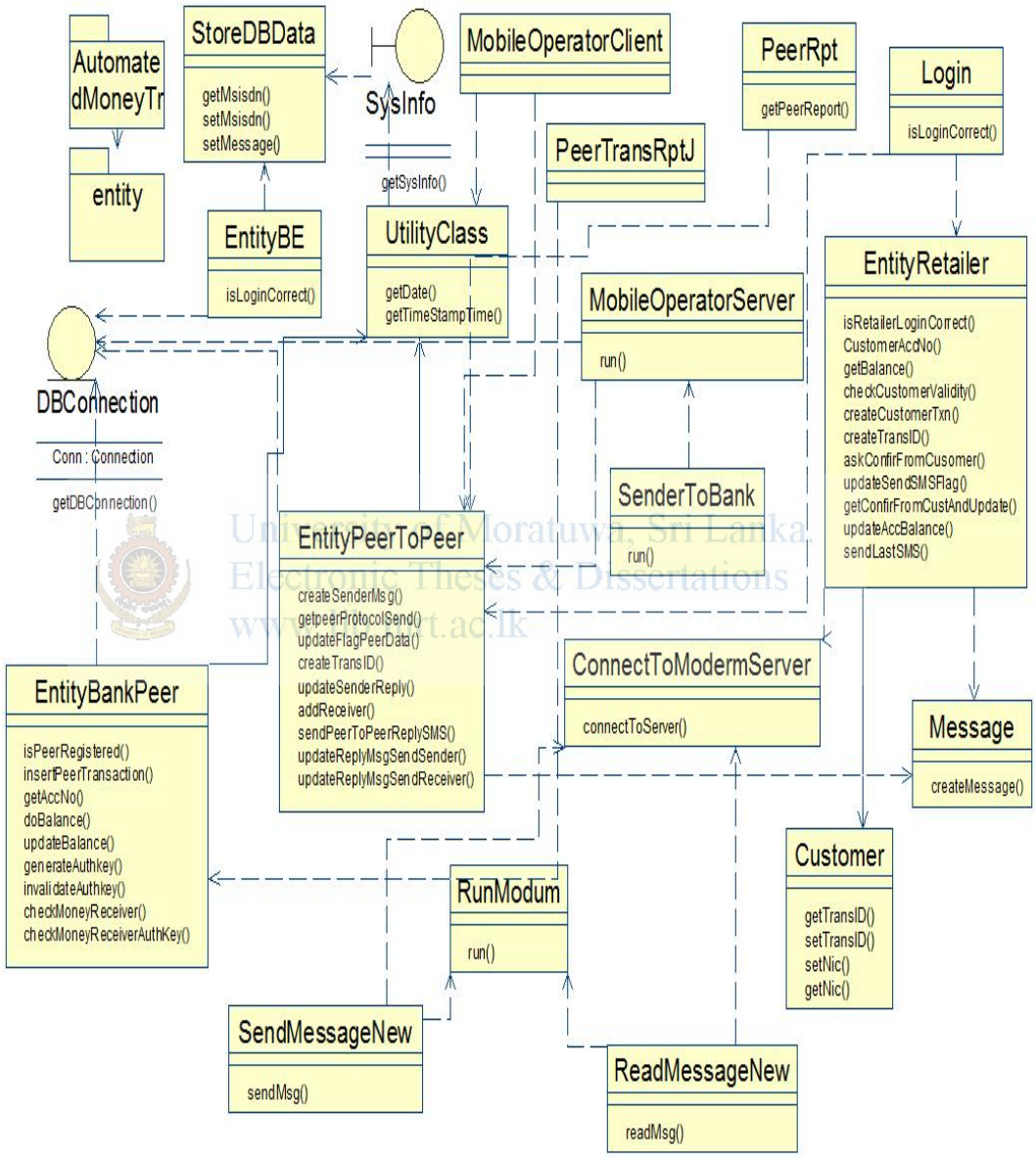


Figure 5.10 – Class Diagram.

5.13.5 Deployment Diagram:-

Figure 5.11 explain the hardware, software and external device components and their interactions.

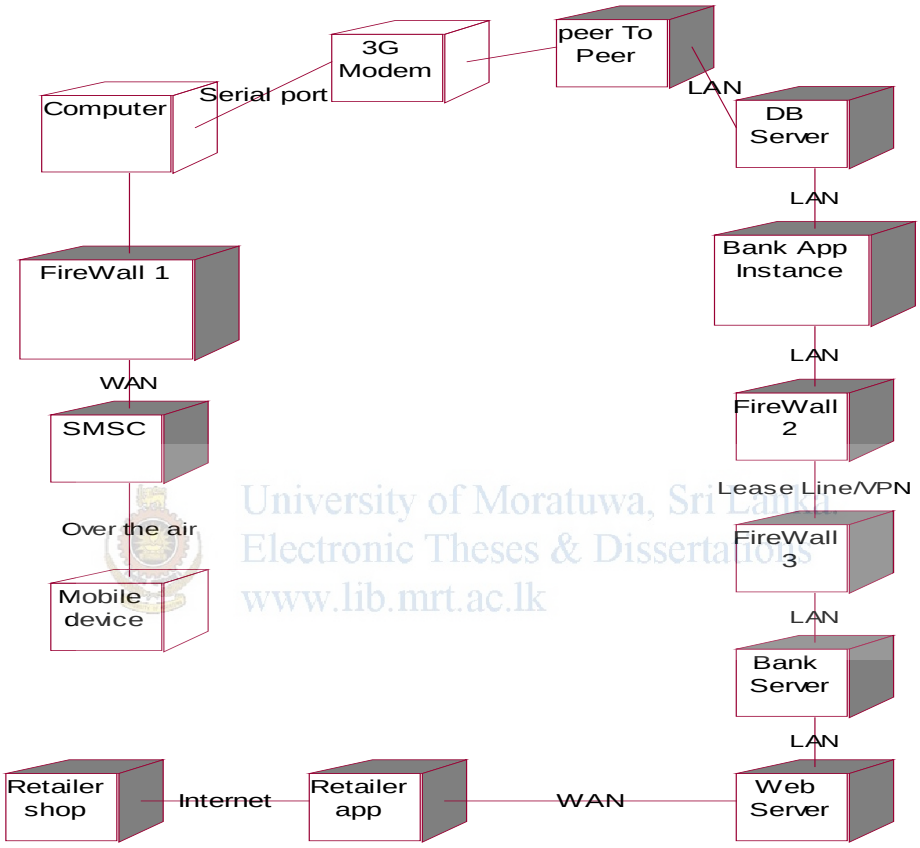


Figure 5.11 – Deployment Diagram.

5.13.6 System Design Architecture.

Figure 5.12 is described the design architecture of the system. System divided to main two modules called Peer to peer module and Cashless purchasing module. Each main module divided into sub modules and each module contains many programs.

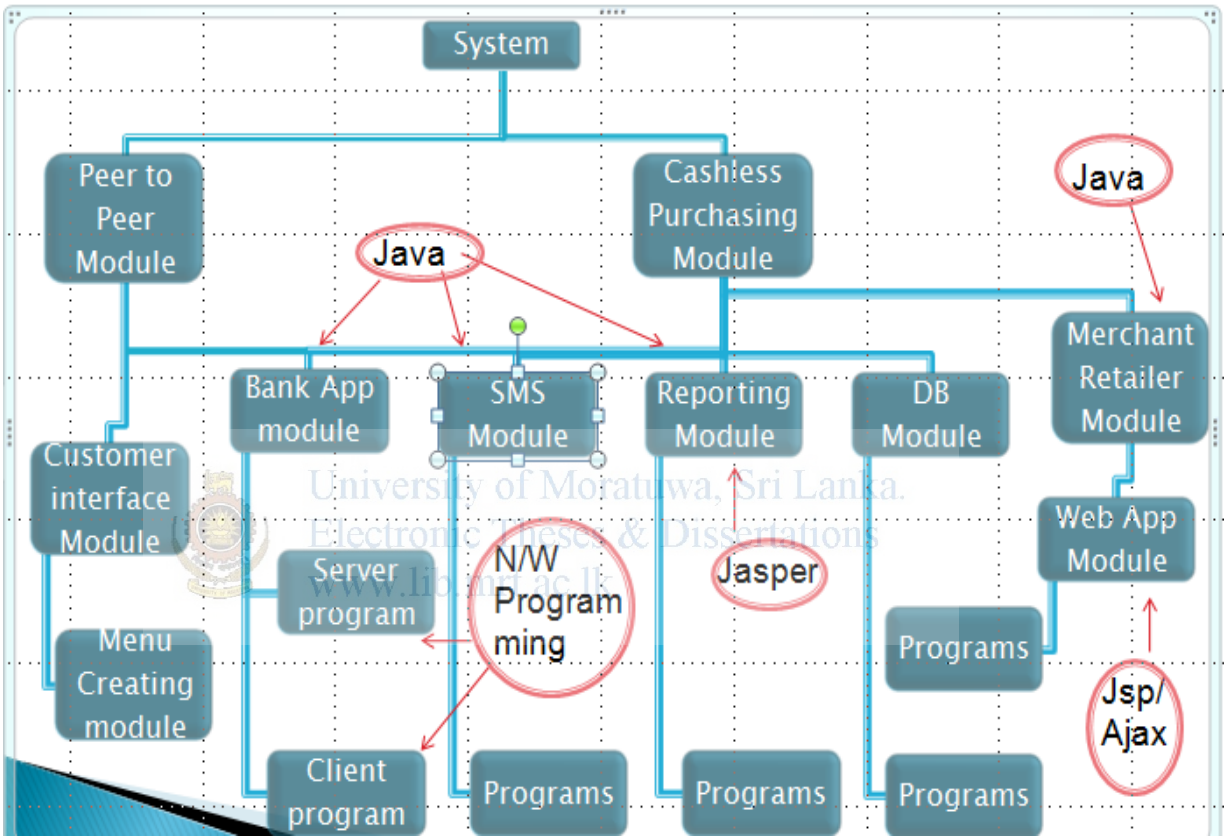


Figure 5.12 – System Design Architecture.

Peer to Peer module contains sub modules like bank application module, SMS module, reporting module and database module. Peer to peer module does is connect bank and the customer and send person to person transaction. Connect bank to the mobile provider via client application of the bank application module. Server program within the bank application module get the response from the bank. This application is run on the mobile provider side. This module is used java TCP/IP socket programming.

SMS module is used to send and receive SMS. Both peer to peer main module and retailer module both used this module. SMS module is used the 3G modem to send, receive SMSs and process them. JSMEngine API is highly used in this module. Reporting module also used in both main modules. Jasper reporting tool is used to generate reports. Both main modules contains database module. Mysql5.0 is used as the database. Merchant retailer module contains sub module called web application module and this module has implemented using AJAX and JSP. Java bean classes are used in backend. Peer to peer module contains menu creation module and this module is used to create the menu based interface to enter transaction information like NIC number, receiver's mobile number and amount. SIMGO software is used to create menu structure.

5.13.7 Database Design Architecture.

Following table structure is used to implementation of the system.

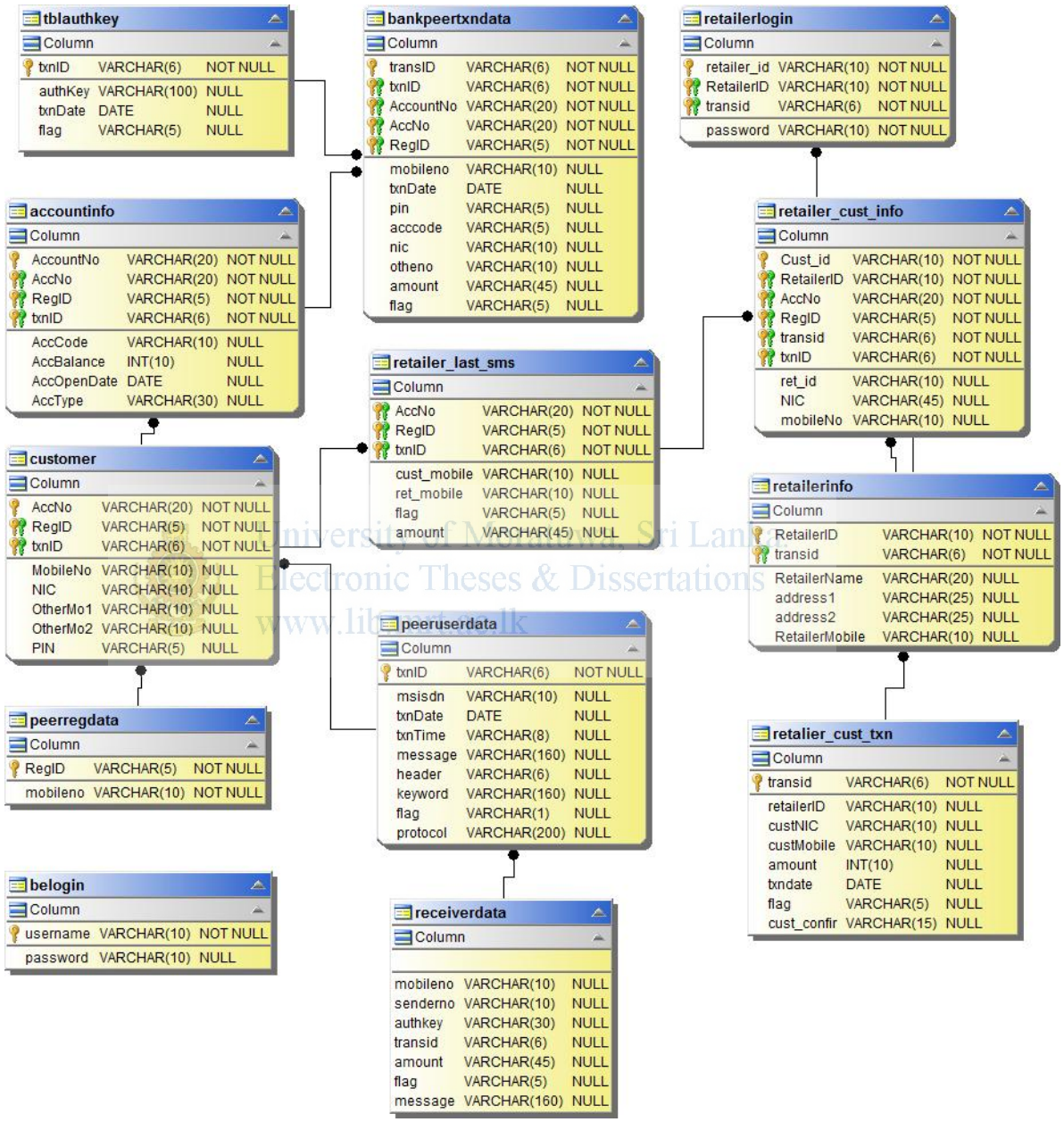


Figure 5.13 – Database Structure.

5.14 Summary

Chapter 5 describes the analysis and design methodologies of the system. It has given design diagrams like use case diagrams, activity diagrams, class diagram, sequence diagram and deployment diagram. Especially system design architecture and it has given a short description about the each module of the system. In the next chapter it will be described about implementation details of each module discussed in the system design architecture.