Chapter 3

METHODOLOGY

This chapter contains the project design, project development, operation and testing procedure, and evaluation procedure.

Project Design

The project is designed to make a queuing system using QR code. The queuing system includes allowing companies to post configurable initial setup of transactions, generating QR code for customer's queue, providing a real-time transaction, and providing notifications for customers. The customer will choose what type of transaction he/she would like to make in a particular company. The customer will be able to see the estimated time per transaction as well as the counter or window managing the transaction. Then, he/she will be given a QR code for their queue. Next, the customer will be notified five times, 1 hour before, 30 minutes before, 10 minutes before, 2 minutes before and when it is already his/her turn.
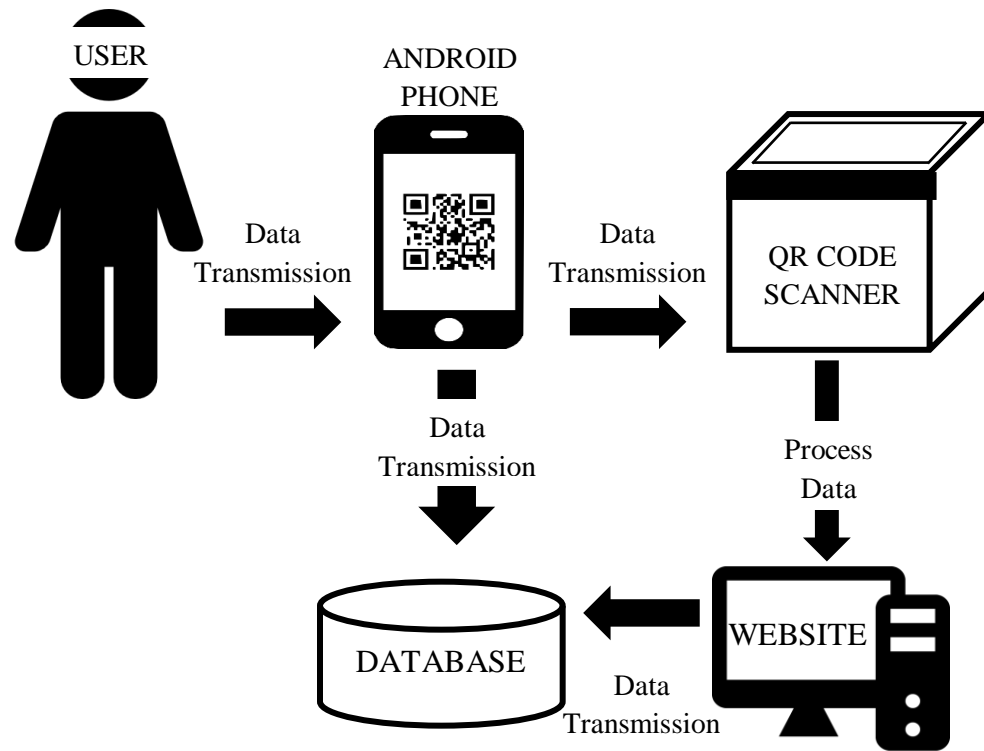
USER   ANDROID
                          PHONE

Data   Data   QR CODE
Transmission   Transmission   SCANNER

          Data   Process
          Transmission   Data

                         DATABASE   WEBSITE
                                   Data
                                   Transmission

Figure 2. Block Diagram

Figure 2 represents the Block Diagram of the system. The user will register to the

Android application to schedule a transaction. The information that the user will give will

be stored in the database. A QR code will be generated for the user's queue. The user will

go to the establishment at the specific time he/she scheduled then the user will get to

his/her designated window and he/she will be asked to scan the QR code. After scanning

the QR code, the person in charge on that window will see the customer's information.

The customer will be notified 1 hour before, 30 minutes before, 10 minutes before, 2

minutes before and when it is already his/her turn. The person in charge on the window

will also be able to notify the customer. The company uses the website to register. The

company will add transaction accounts that will be used by the window. All the

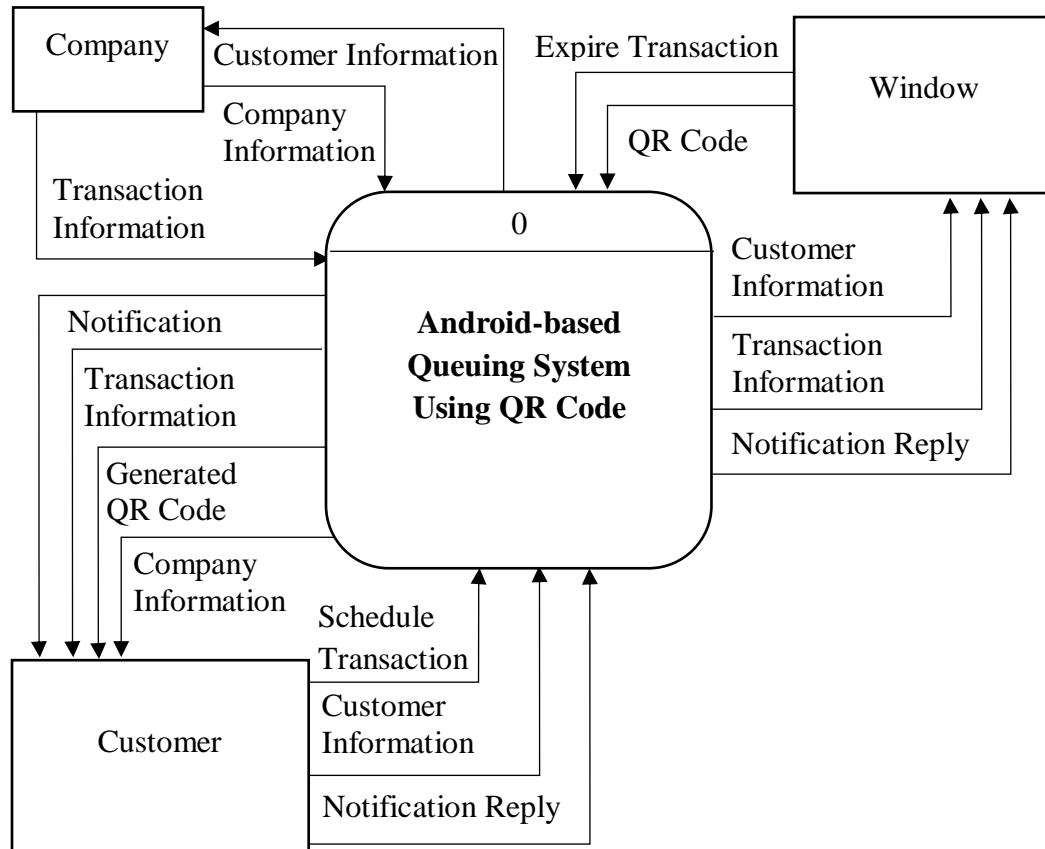information that the company will give will also be stored on the database.

Figure 3. Context Diagram of the System

Figure 3 shows Context Diagram of the system. The customer will input his/her

information to register. The customer will be able to see the list of all the companies and

as well as their information. After choosing what company he/she would like to have a

transaction with, the customer will be able to see the list of all available transactions in

that company and he/she will be able to schedule the time of his/her transaction. After

scheduling a transaction, the customer will be able to see the generated QR code which

will be used for his/her queue. The customer will be notified 1 hour before, 30 minutes

before, 10 minutes before, 2 minutes before and when it is his/her turn where the

customer will be given a choice if he/she can go or not and which will be sent to the

window. The person in charge on the window can expire the transaction of the customer.

The company must also input its information to be able to register. The company will be able to add transactions that will be used by the person in charge on that window. The company will be able to see all the customers that made transactions with their company. The person in charge of the window will be able to see the information of the transaction on that window and as well as the information of the all the customer on that day.
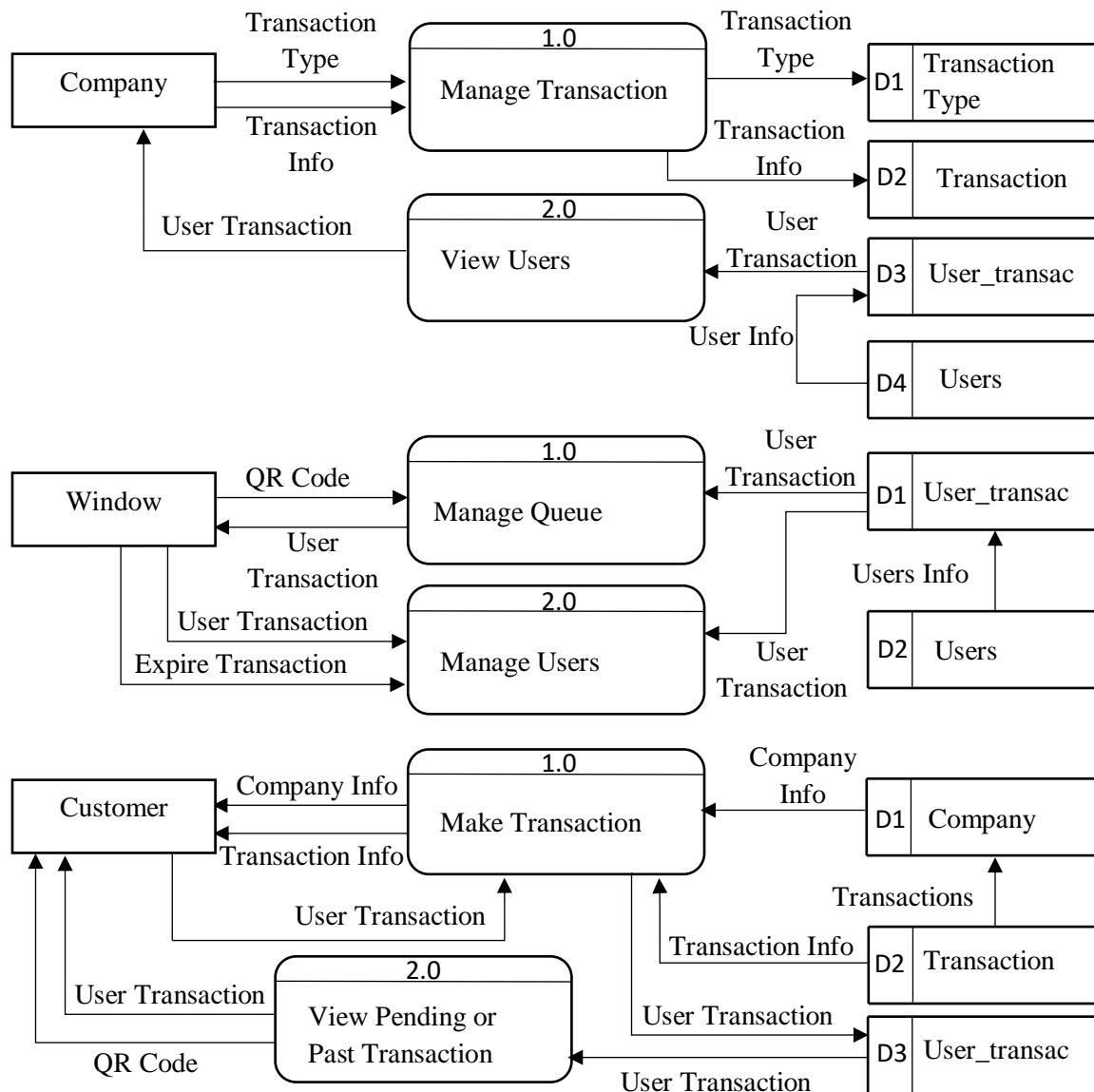

Figure 4. Data Flow Diagram

Figure 4 shows the data flow diagram of the system. To manage the transaction, the company must first add transaction types. After adding different transaction types, the company can now create transaction accounts. The company will input the transaction accounts' information and its transaction type. For the company to be able to see its users, the system will get the information of those users who made transactions on that company. For the window, to manage the queue, the person in charge on the window should scan the QR code of the customer. After scanning the QR code, the system will get the information of that user as well as its transaction's information. The person in charge on the window can view the transactions and information of users that made a transaction on that day and can expire the transaction of the user. For the customer to be able to make a transaction, the system will send the list of all companies as well as their information and list of available transactions. The customer then will choose the transaction he/she wants to make with that company and will select the time of his/her transaction from the list of available schedules. The customer can view his/her pending and past transaction as well as the generated QR code of the transaction.

Use Case Diagram

The use case shows the roles of each user in the system. There are four actors in the developed system, the administrator, company, window, and the customer.
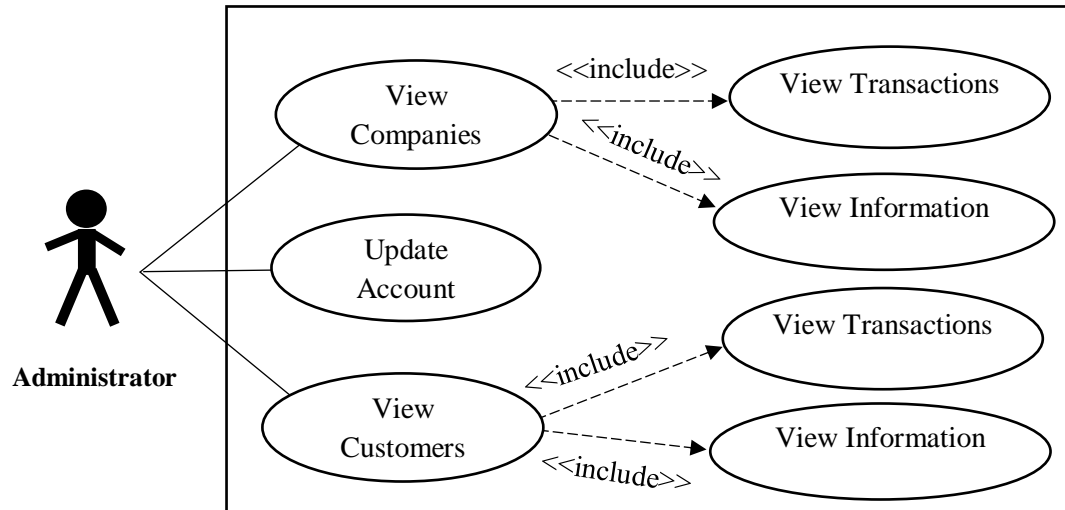

Figure 5. Administrator Use Case Diagram

Figure 5 shows the Administrator Use Case Diagram of the system. It consists of the main processes that the admin handles. These are:

- View Companies

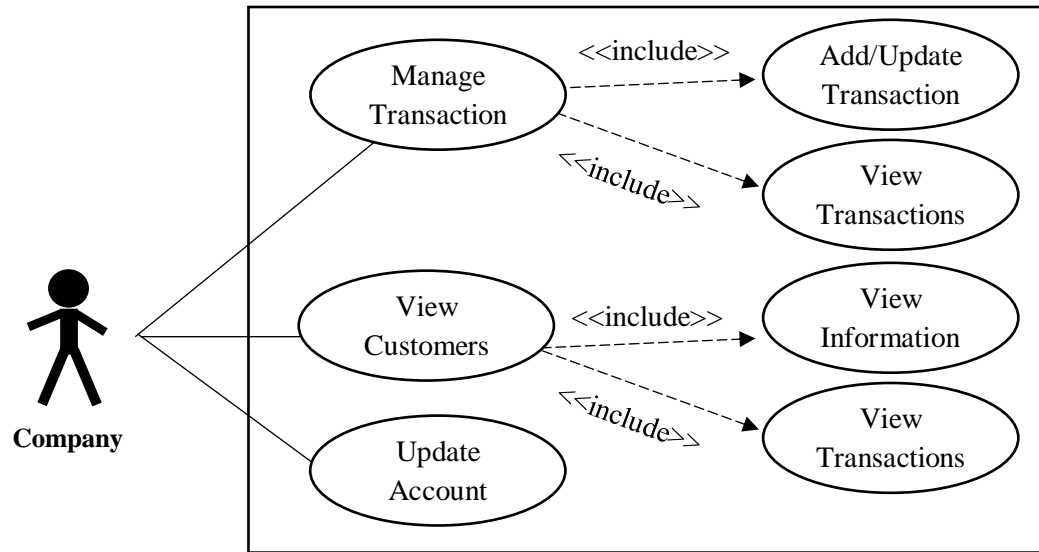- View Customers

- Update Account

Figure 6. Company Use Case Diagram

Figure 6 shows the Company Use Case Diagram of the system. It consists of the main

processes that the company handles. These are:
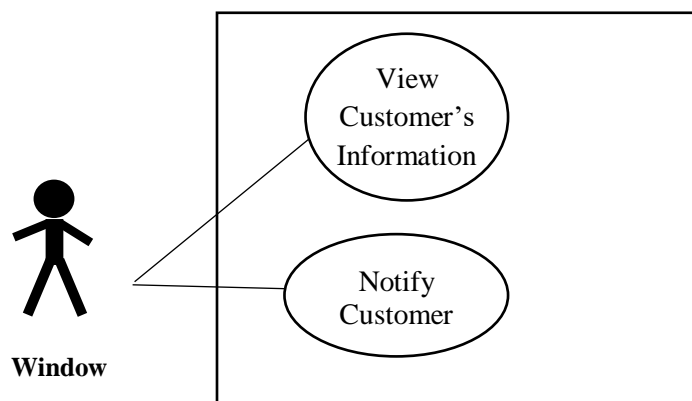
- Manage Transaction

- View Customers

- Update Account

Figure 7. Window Use Case Diagram

Figure 7 shows the Window Use Case Diagram of the system. It consists of the main

processes that the company handles. These are:

- View Customer's Information

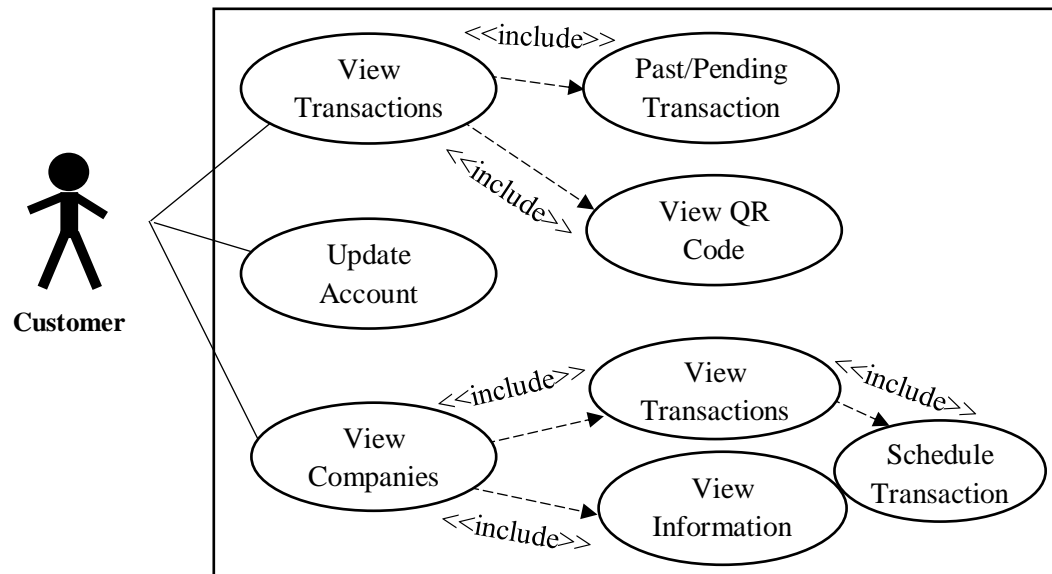- Notify Customer

Figure 8. Customer Use Case Diagram

Figure 8 shows the Customer Use Case Diagram of the system. It consists of the main

processes that the customer handles. These are:

- View Transaction

- Update Account

- View Companies

Entity Relationship Diagram (ERD)

The Entity Relationship Diagram shows the graphical presentations of entities of the database and their relationships. It shows how the data are shared between entities.
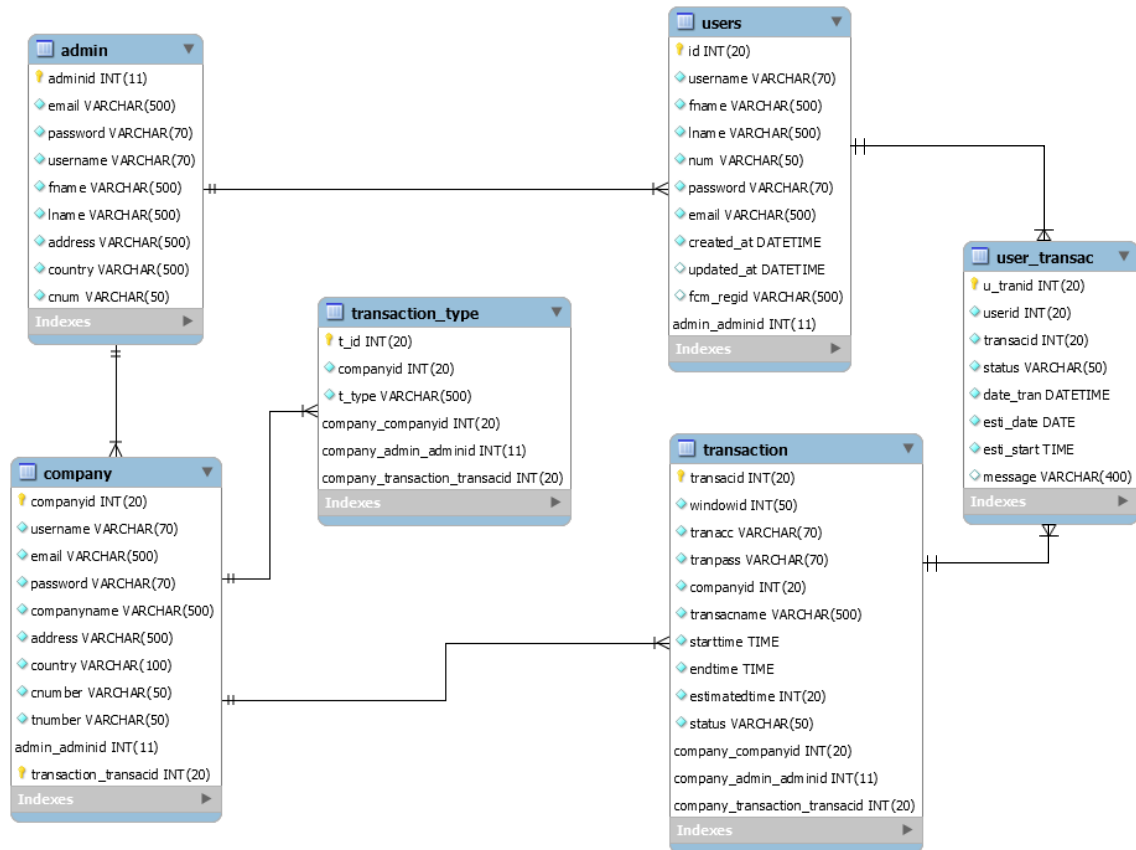

Figure 9. Entity Relationship Diagram of the System

Figure 9 shows the relationship of the following entities from the database. The diagram shows that there are 4 modules in the system. Every company and user can only have one account. The admin manages the accounts of the company and the users while the company manages the transactions and transaction types. The user may choose to perform any transaction many times.

Project Development
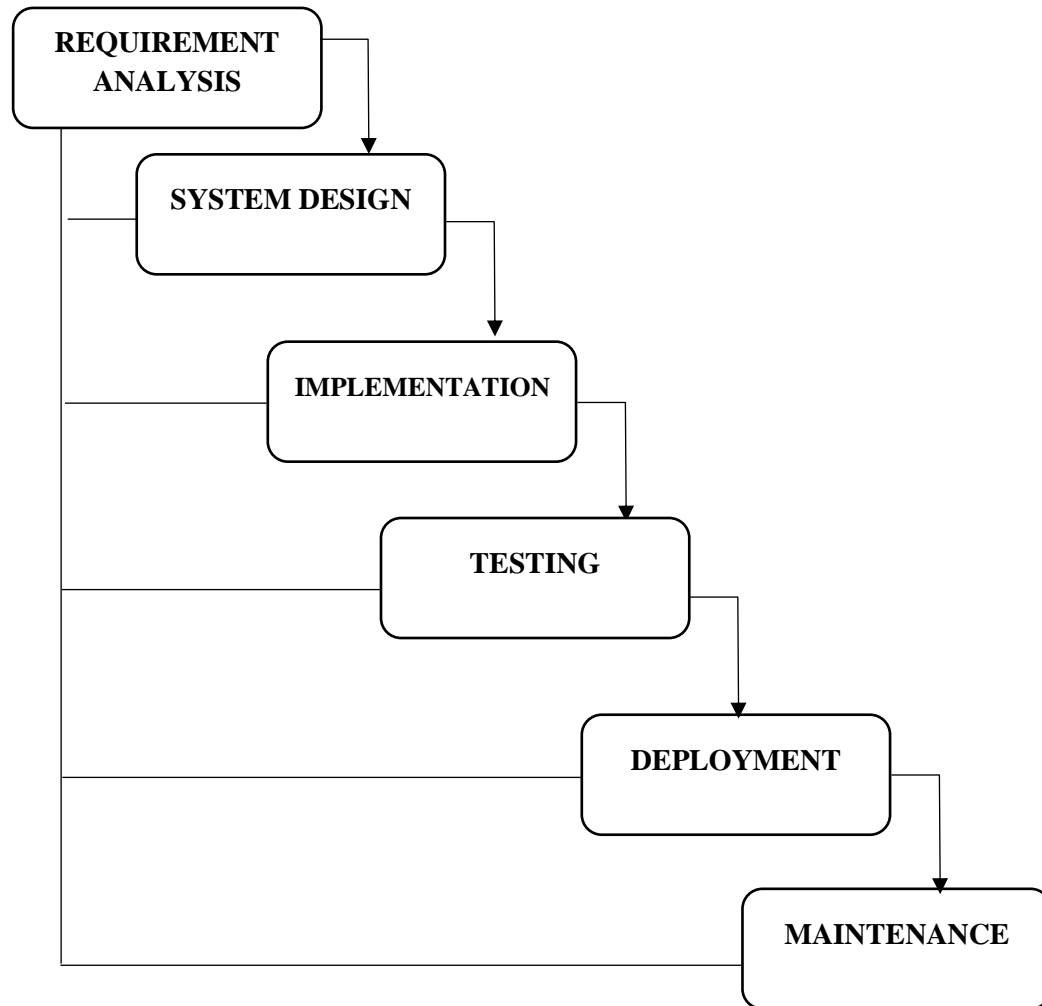
Figure 10. Waterfall Diagram

In Figure 10 using waterfall model is the best way to deliver the phases to be done in the study. The first phase in the process is gathering requirements and analysis. All the possible requirements of the system are elicited by the researchers by accumulating data supports to the project. So, all the requirements are analyzed and documented in this phase that it is supposed to be in the system and to make sure that the requirements are unambiguous. Following the first phase is the system design, wherein the researchers

compiled and interpreted all the gathered information such as hardware and software

system requirements. With this phase it produces and assists the researchers in the task of

designing the overall system architecture. When the system design is complete,

implementation is started and the objectives are based on it. The developers looked at the

system specification and created the software including the implementation of interfaces.

The Android-Based Queuing System using QR Code was developed using HTML, CSS,

Java Script as frontend and PHP and MySQL for the back-end of the website. Also the

mobile application for the customer was developed through the Android Studio.

Fulfilling all the objectives in the project resulted to the next phase which is the testing

of the study. The entire system is tested for any faults and failures. Succeeding to the test

of the study is the deployment as it is deployed in the customer environment or released

to the market. Finally, maintenance is made to deliver some changes or further

enhancement in the customer environment and issues may come up, so patches are

released to fix it.

The algorithms of the Android application that will be developed will be coded using

the following steps:

1. Plan and design the desired user interface of system activities.

2. Create the activities and order it based on its function.

3. Create a database using web hosted phpMyAdmin.

4. Application Modules

    4.1 Splash Screen

        4.1.1   Create a Splash Screen activity that would notify the user that the

                application is in the process of loading.

4.2 Login

    4.2.1   Create the function of the Login button that will send data about the username and password of the user and will redirect to Profile.

4.3 Register

    4.3.1   Create the function of Register button that would send data about the information of the user and will redirect to Login.

4.4 Profile

    4.4.1   Create the functions of buttons present such as Make Transaction, Manage Transaction, and will display the information of the user.

4.5 Menu

    4.5.1   Create the functions of buttons present such as Settings, Logout, and Profile.

4.6 Manage Transaction

    4.6.1   Create the function of Past Transaction button that would retrieve data about the past transactions of the user and the Pending Transaction button that would retrieve data about the pending transaction of the user.

4.7 Pending Transaction

    4.7.1   Create the function of a button that would retrieve data about the transaction of the user and will display the generated QR code.

4.8 Past Transaction

    4.8.1   Create the function of a button that would retrieve data about the transaction of the user and will display the generated QR code.

4.9 Make Transaction

    4.9.1   Create the function of list of buttons that has the company's name that would send data about the information of the company.

4.10   Company

    4.10.1 Create the function of list of buttons that has the available transaction of the company that would send data about information of the transaction.

4.11   Confirm Transaction

    4.11.1 Create the function of a spinner that would retrieve data of available schedules and Confirm button that would send data about the chosen transaction and schedule of the user.

4.12   Notification

    4.12.1 Create the function of displaying the notification message 1 hour before, 2 minutes before and if it is now the user's turn.

4.13   Window Notification

    4.13.1 Create the function of displaying the notification message if the window is already available or open as well as creating reply buttons, can't go and can go.

4.14   Logout

    4.14.1 Create the function to logout the customer's account.

4.15   Setting

    4.15.1 Create the function to update the user's information.

Table 1.

Use Case Title and Description

Use Case Number	Use Case Title	Use Case Description
UC01	Internet Connection	This use case will allow the user to use the application.
UC02	Splash Screen	This use case will be displayed when the user start the application.
UC03	Login	This use case will allow the user to input the user's username and password.
UC04	Register	This use case will allow the user to input the user's information needed to make an account.
UC05	Profile	This use case will display the information of the user and will allow the user to view its transactions and to make a transaction.
UC06	Manage Transaction	This use case will allow the user to view its past transactions or pending transactions.
UC07	Past Transaction	This use case will allow the user to view its past transactions and as well as the generated QR code.
UC08	Pending Transaction	This use case will allow the user to view its pending transactions and as well as the generated QR code.
UC09	Make Transaction	This use case will display a list of companies
UC010	Company	This use case will display the information of the company and will show list of all available transactions
UC11	Confirm Transaction	This use case will allow user to see the information of the transaction and the user will be able to choose the schedule for the user's transaction.

UC12	Notification	This use case will notify the user 1 hour before, 2 minutes before and if it is now the user's turn.
UC13	Window Notification	This use case will notify the user if the window is already available or open.
UC14	Logout	This use case will allow the user to logout its account.
UC15	Setting	This use case will allow the user to update the user's information

Table 1 shows the Use Case Title and Description which presents all the options and menus that would be seen in the application such as Internet Connection, Splash Screen, Login, Register, Profile, Manage Transaction, Past Transaction, Pending Transaction, Make Transaction, Company, Confirm Transaction, Notification, Window Notification, Logout and Setting. The table also gave the description and the function for each menu and option existing in the application.

Operation and Testing Procedure

Operation Procedure

For the operation procedure of the web application, the following are the steps to follow:

1. Install WAMPServer.

2. Open and run the web servers.

3. Copy the program files of web application.

4. Open and access the web application.

For the operation procedure of the Android application, the following are the steps to follow:

1. Copy the installer of the application.

2. Install the application.

3. Connect to an internet connection.

4. Open and access the android application.

Testing Procedure

Table 2.

Functionality, Portability and Usability: Test of the developed system

Module	Steps Undertaken
Administrator	1. Login using the administrator username and password. 2. View dashboard 3. View list of companies 4. View information of company and its available transactions 5. View list of customers 6. View information of customer and its transactions 7. Update account
Company	1. Login using username and preferred password 2. View dashboard 3. View list of type of transactions 4. Add or delete type of transaction 5. View list of transactions' accounts 6. Add, update or delete transaction's account 7. View list of customers 8. Update account
Window	1. View dashboard 2. Scan a QR code 3. Mark a transaction "Done" 4. View list of customers 5. Notify customer

	6. Close all transaction
Customer	1. Login using username and preferred password 2. View Profile 3. Manage transaction 4. View past transaction and view generated QR code 5. View pending transaction and view generated QR code 6. Make transaction 7. Choose company 8. View company's information and its available transactions 9. Choose transaction 10. View transaction's information and choose schedule 11. Update account

Evaluation Procedure

The system will be evaluated by 50 respondents composed of 10 IT professionals and 40 students of the Technological University of the Philippines-Manila using random sampling.

The evaluation procedure will be conducted as follows:

1. The system will be demonstrated by the researcher.

2. The evaluators will be asked to rate the performance of the system.

3. Each respondent will be given a set of questionnaires.

4. The system will be carefully evaluated by the respondents and they will be allowed to raise questions.

5. The respondents will be requested to rate the system based on the criteria in the evaluation instrument.

6. The results will be tallied to determine the mean of each criterion and the overall mean.

7. The results will be interpreted using Table 3.

Evaluation Instrument

The criteria for evaluation will be focused on the project's functionality, efficiency, compatibility, usability, reliability, security, maintainability, and portability based on ISO 25010 criteria.

The evaluation instrument that will be used is a 4-point Likert Scale that will be shown in Appendix A. Likert Scale is a psychometric scale commonly used in questionnaires and is most widely used in survey research. By using the scale, the researcher can determine the acceptability of the project based on experience and user's opinion of the acceptability of the system.

Statistical Tool

The statistical frequency was computed by getting the number of respondents in the given criteria. The total number of percentage was computed using the formula below and interpreted using the Numerical Rating in table 4.

Formula:

$$\% = \left(\frac{f}{n}\right) \text{ x } 100$$

Where:

% = represents the percentage

f = represents the number of times the scores repeated in a set

n = represents the number of respondents

Table 3.

Rating Scale for the Evaluation Instrument

Numerical Rating	Qualitative Interpretation
4	Highly Acceptable
3	Very Acceptable
2	Acceptable
1	Not Acceptable

Table 3 describes the criteria and indicators of the evaluation instrument to measure

the acceptability of the system.

Table 4.

Scale Range and its Qualitative Interpretation

Range	Qualitative Interpretation
76% - 100%	Highly Acceptable
51% - 75%	Very Acceptable
26% - 50%	Acceptable
0% - 25%	Not Acceptable

Table 4 describes the range scale of criteria and indicators of the evaluation instrument

to measure the acceptability of the system.