SMART SHOPPING CART

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Submitted for the partial fulfillment of BS Software Engineering degree to the Faculty of Engineering and CS

NATIONAL UNIVERSITY OF MODERN LANGUAGES

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ABSTRACT

The economy of Pakistan is growing every day; life is becoming busier so time is of the essence. Everyone is in a hustle to save time. People are moving towards online shopping but a lot of people still prefer going to the store for shopping because of the limitations faced in online shopping such as reliability issues and quality assurance. The major problem that is faced in shopping from a store is that it is very time consuming as one needs to go to cashier for payments. The cashier generates the bill using bar code scanner that takes a lot of time in scanning individual products.

Smart Shopping Cart is a new way of shopping and avoiding long queues. The item would be tagged with a unique RFID tag, which will be identified by the RFID reader attached to the cart as the object is added in it. As the automatic scanning is done the cost of the product will automatically be displayed on the LCD screen attached to the trolley. Customer shall know the total amount to be paid via Android app and on the LCD screen before going to the bill counter and the customer can plan accordingly only buying the essential items, and then customer will choose the channel of payment either through online payment or by hand. The bill value changes dynamically as the objects are added and subtracted. It will also reduce the possibility of human errors substantially. The customer will also be able to maintain a record of previous shopping lists in the Android App.

The test proves that the application's features are producing the intended results in a context where the system is given with the necessary hardware and software elements for creating the desired results. For the purpose of testing the built application, an Android phone running Android is used along with the hardware components that are required to complete the system.

CERTIFICATE

Dated: ________________

Final Approval

It is certified that project report titled '**Smart Shopping Cart'** submitted by **Sohaib Aftab, Muhammad Ahmed** and **Ghazala Zainab** for the partial fulfillment of the requirement of "Bachelor's Degree in Software Engineering" is approved.

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Head Project Committee Signature: ______________________

Mr. Talal bin Afzal

Supervisor Signature: ______________________

DECLARATION

We hereby declare that our dissertation is entirely our work and genuine / original. We understand that in case of discovery of any PLAGIARISM at any stage, our group will be assigned an F (FAIL) grade and it may result in withdrawal of our Bachelor’s degree.

Group Members **Signature**

1. Sohaib Aftab ____________________

2. Muhammad Ahmed ____________________

3. Ghazala Zainab ___________________

PLAGIARISM CERTIFICATE

This is to certify that the project entitled “**Smart Shopping Cart**”, which is being submitted here with for the award of the “**Degree of Bachelors**” in “**Software Engineering**”. This is the result of the original work by **Sohaib Aftab**, **Muhammad Ahmed**, and **Ghazala Zainab** under my supervision and guidance. The work embodied in this project has not been done earlier for the basis of award of any degree or compatible certificate or similar title of this for any other diploma/examining body or university to the best of my knowledge and belief.

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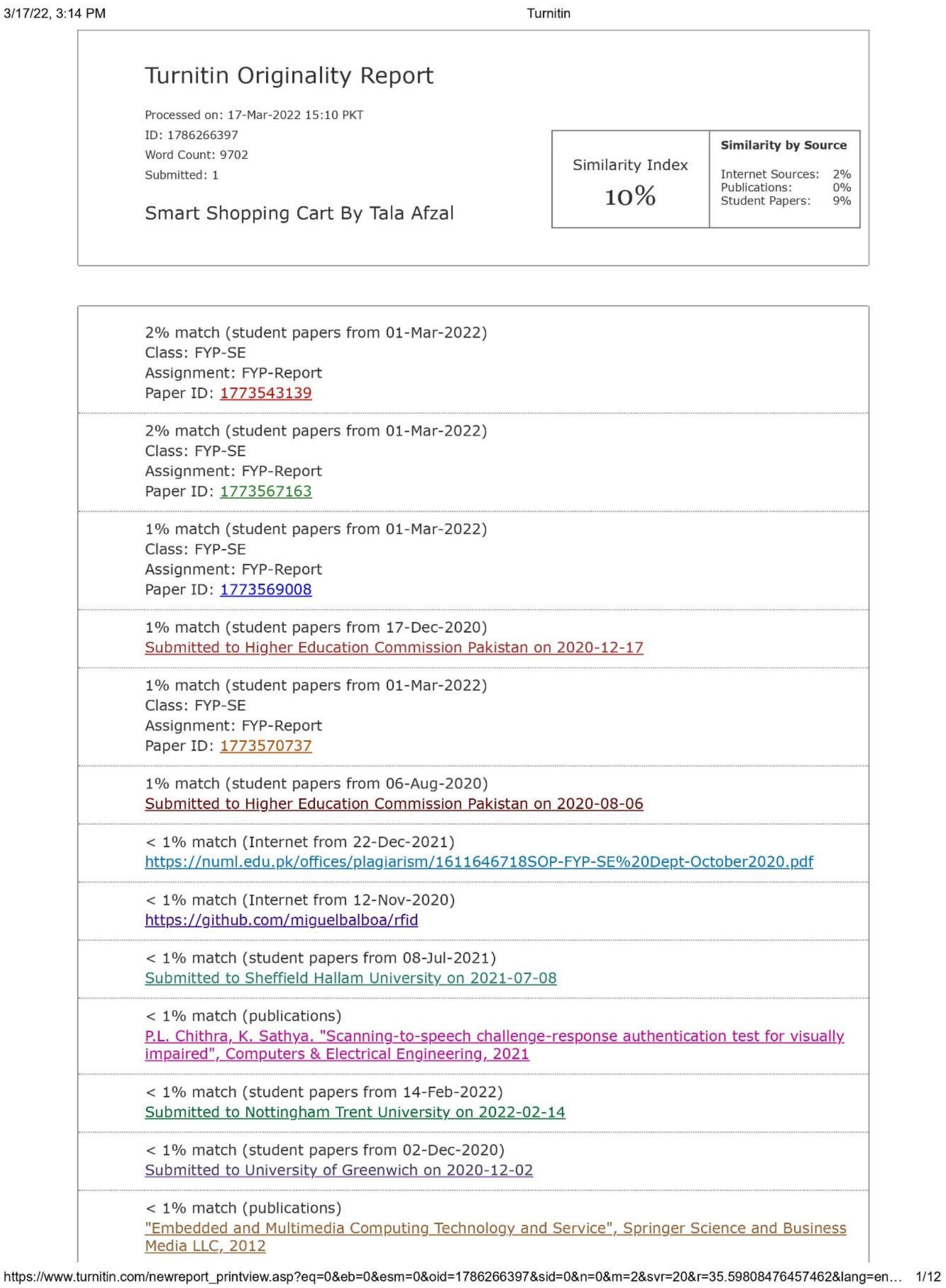

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The following chapter gives introduction to the project and the report. It addresses the problem statement, overall view, objectives and targets of the projects. This section contains information related to the project's goal. In this section, alongside the developed system features, the hardware and software are likewise discussed.

1.2 Motivation

People visit the shopping malls to get their daily necessities; this has become an important part of our lives. After the cumbersome task of finding your desired products, all the products need to be scanned by a barcode reader for billing, so there's a long queue for checkouts and payments at the exit counter. Customers' basic desire is to eliminate numerous problems like long queues, waste of time, going through the whole process even if the customer buys one or two items; Smart Shopping Cart satisfies these demands.

1.3 Problem Statement

Due to our growing economy and rapidness in every domain of life, standing in a long queue to get your grocery items scanned is stressing and very time consuming. Sometimes the user just needs to buy one or two items but still has to stand in the line to get their items scanned and billed. Another major problem with traditional shopping is that a customer only gets to know the total amount at the time of paying, this way if a customer has exceeded the budget he/she planned for the grocery he/she will have to put some items back.. Above all traditional shopping has a chance of human error.

1.4 Goals and Objectives

To overcome the current situation and to ease the purchasing process, a new RFID (Radio Frequency Identification) technology is being introduced. By using RFID technology, tags are assigned to items and generally an RFID scanner is used for identification of objects using radio waves. It has a significant advantage over barcode scanning system technology since there is no designated line of sight in RFID, whereas in barcode scanners, the object is scanned only if it is put inside a line of sight. The goal is to save the customer’s time, maximize productivity and increase customer satisfaction.

1.5 Scope of the Study

This system will remove the difficulty of waiting in line for hours to pay the bills in mart or shopping centers. Users will be able to know at the same time what they are buying and how much it costs. This system is very easy to use so anyone can use it; just have to drop the item in the cart and in your phone, software is keeping the record of the previous bills.

1.6 Process Model

Waterfall model approach divides the process of software development in to individual phases. In this, the outcome of previous phase goes about as the contribution for the following stage successively.

- Better Project Control
- Greater Customer Satisfaction
- Higher Quality Project
- Predictable Delivery Dates
- User-Focused Testing

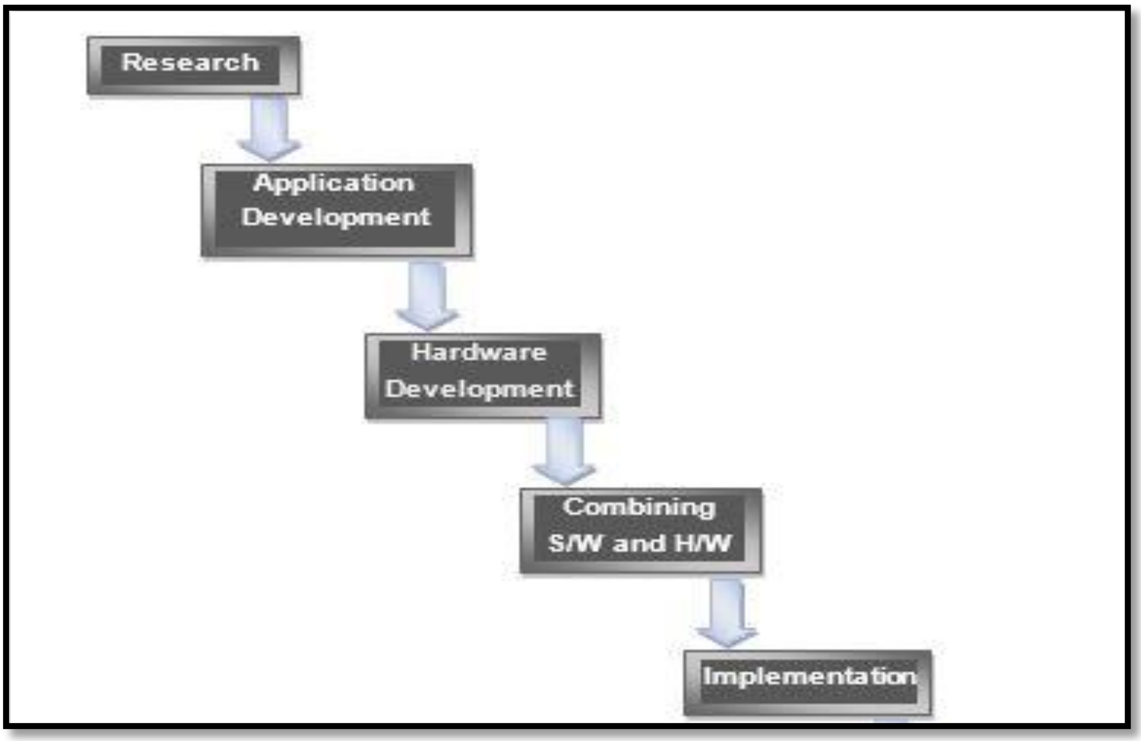


Figure 1.1 Waterfall Process Model

1.7 Nature of the Project

The Project is based on the combination of hardware and software components. RFID technology is the main highlighting feature of the system. QR code is also involved to transfer stored data from OLED screen to the android Application.

1.8 Overview of the Report

A unique RFID tag would be attached to each product and an LCD screen placed on the cart will display the price and name of the product placed in the cart by the help of an RFID scanner. By Using the Smart Shopping Cart android app, people would easily know the bill to be paid and add in the cart. The names of items in the cart and their prices will be displayed on the LCD screen. Billing will be made from the Android App either through online payment or manually by hand. The customers will also have a record of their previous shopping.

CHAPTER 2

BACKGROUND AND EXISITING WORK

2.1 Introduction

In following chapter, an outline of present systems is discussed. The examination of smart shopping cart has been demonstrated with their features and limitations.

2.2 Important Constructs of the Application

The important constructs of this application are as follow:

2.2.1 Application Development

The android Application for the smart shopping cart is developed in this phase. The application is capable of fetching data from the cart using QR code scanning method, storing all the previous grocery lists, calculating the total bills and is equipped with the option to pay the generated bill online as well as in cash to the nearest seller available on the aisle depending on customer's ease.

2.2.1.1 Kotlin

For the development of android application, kotlin is used as it gives an adaptable, secure platform for developing applications. The applications that are created utilizing kotlin are convenient, secure, and can take the advantage of local capacities of the device.

2.2.1.2 Arduino coding

Arduino Uno is used to fetch data from the RFID scanner and direct it to the ESP 8266 microchip for further processing.

2.2.1.3 C Language

C language is used for the programming of Arduino Uno and ESP 8266 microchip as it provides advantage over the Arduino language in terms of some limitations. C is an object- oriented language that is a lot simpler to use than the other low-level language like binary coding so it is best suited for programming Arduino.

2.2.1.4 Assembling Hardware

In this domain all the Hardware components are installed and configured on to the shopping cart which includes a Power source(Battery), an RFID scanner, an Arduino Uno, ESP 8266 microchip, an OLED and LCD screen.

2.3 Existing Systems and Their Limitations

This system is being practically implemented by just one company right now i.e. “Amazon” although many models have been developed for this system. But they have some restrictions which make them less effective. Those systems are discussed below:

2.3.1 Amazon Dash Cart

Amazon dash cart is a grocery store shopping cart that recognizes the prices of the items inside the basket.

2.3.1.1 Features

- Saves time by scanning each item as you put it in the basket.
- Provides you with access to your Amazon account.
- Subtotals the amount as you shop.
- Payment is made online.

2.3.1.2 Limitations of current system

- Uses bar code technology which demands line of sight.
- Uses complex computer vision algorithms.
- Expensive

2.3.2 RFID based models

There are many models of this system based on RFID technology but they all lack some features that do not allow this technology to be utilized with its true potential.

2.3.2.1 Features

- Does not need Line of sight.
- Subtotals the amount as you shop.
- Buzzers a sound upon every successful scan

2.3.2.2 Limitations of current model

- Does not have an App to manage the system
- Does not have online payment option

2.4 Comparison of Existing System and Developed System Features

The table below compares the functions of the developed system and those of existing systems. The developed system covers every one of the highlights while the existing system could not perform all the functionalities which are as follow;

Table 2.1 Comparison of Existing System and Developed System Features

Features	Amazon Dash Cart	RFID based Models	The Developed System
Scan without line of sight	No	Yes	Yes
Android App	Yes	No	Yes
OLED Screen	No	No	Yes
Bill Total	Yes	Yes	Yes
LCD screen	Yes	Yes	Yes
Online payment	Yes	No	Yes
Maintains Record	No	No	Yes
Cheap	No	Yes	Yes

2.5 Summary

The key application constructs are covered in this section that incorporates application development using Java and Kotlin, Arduino Coding using C, ESP 8266 coding using C and the assembling of hardware are explained. The existing systems which include Amazon Dash Cart and RFID based models are explained. The existing system features are also described.

CHAPTER 3

REQUIREMENTS SPECIFICATION

3.1 Introduction

In the chapter, system modeling is done and use case diagrams are designed to show the response of the system in given scenarios. Every model represent a specific view or prospective of that system. Graphical notation is used for the presentation of system modeling and these graphical notations are based on Unified Modeling Language i.e. UML. System modeling provides analysts with a thorough grasp of the system, as well as assisting developers in comprehending the software's working flow and the modeling technique that will be employed by the mechanism to share information with users. The system design reveals that in which environment system works and what will be its response. The modeling is truly helpful in the advancement of the system as it serves to have a traditional strategy to discuss about the ideas of different types of modeling.

3.2 Interface Requirements

The main interface of the application is developed in Kotlin using Android Studio IDE. ESP 8266 is the microchip used for the OLED screen interface which is programmed in C to display the desired information on the OLED screen. Arduino Uno having embedded instruction coded in C language that is used to transfer instructions from the RFID scanner to the microchip for further processing.

3.2.1 Hardware Interface Requirements

The following are hardware requirements for the development and testing of the system:

- Laptop/Desktop
- RAM 4GB or higher
- CPU: 64-bit dual-core 2.5Ghz or higher
- Arduino IDE
- Android Studio
- Android supported mobile device
- OS: Windows 7 SP1+, 8, 10
- Graphic card: 1 GB RAM
- RFID scanner 13.56 MHZ
- RFID tags 13.56 MHZ
- Arduino UNO
- OLED 0.96 inch 128 X 64
- 3.5‘’ TFT LCD 16X2 Module for Arduino

3.2.2 Software Interface Requirements

The requirements of software interface are given below:

3.2.2.1 Android Studio

It's an Application Framework (IDE) for designing Android applications. It offers significantly more features that upgrade your efficiency when developing Android applications, Designing GUI, portable applications and so forth with the assistance of android studio, we can make code just as local code.

3.2.2.2 Java

Java is a universally useful language that is class based and OOP too. It is a figuring stage for application development. Java is quick, secure and solid programming language. It contains a bunch of libraries, compiler and for their execution too.

3.2.2.3 Kotlin

It is a cross-platform, universally useful programming language. Although Kotlin is designed to work seamlessly with Java, and the JVM version of Kotlin's main program relies on the Standard Java Library, type inference allows for more concise syntax.

3.3 Functional Requirements

The system's fundamental functions are as follows:

- System will allow online payment through the application.
- Products info will be visible to the user at the current time.
- Total will be available to be reviewed.
- QR code scan will connect hardware components with the software application.
- Both manual and online payment can be done using the application.
- Online payment will be time and resource saver as well.
- Online payment contains many procedure for the payment not only the bank accounts.

3.4 Use Cases Model

The interaction between system and external actors is clarified by a use case to accomplish an objective. Actors should have the option to take choices; however, a human performer is not required. An actor might be a person or a system.

3.4.1 Use Cases Diagram:

In figure 3.1 the whole system use case diagram has been described.

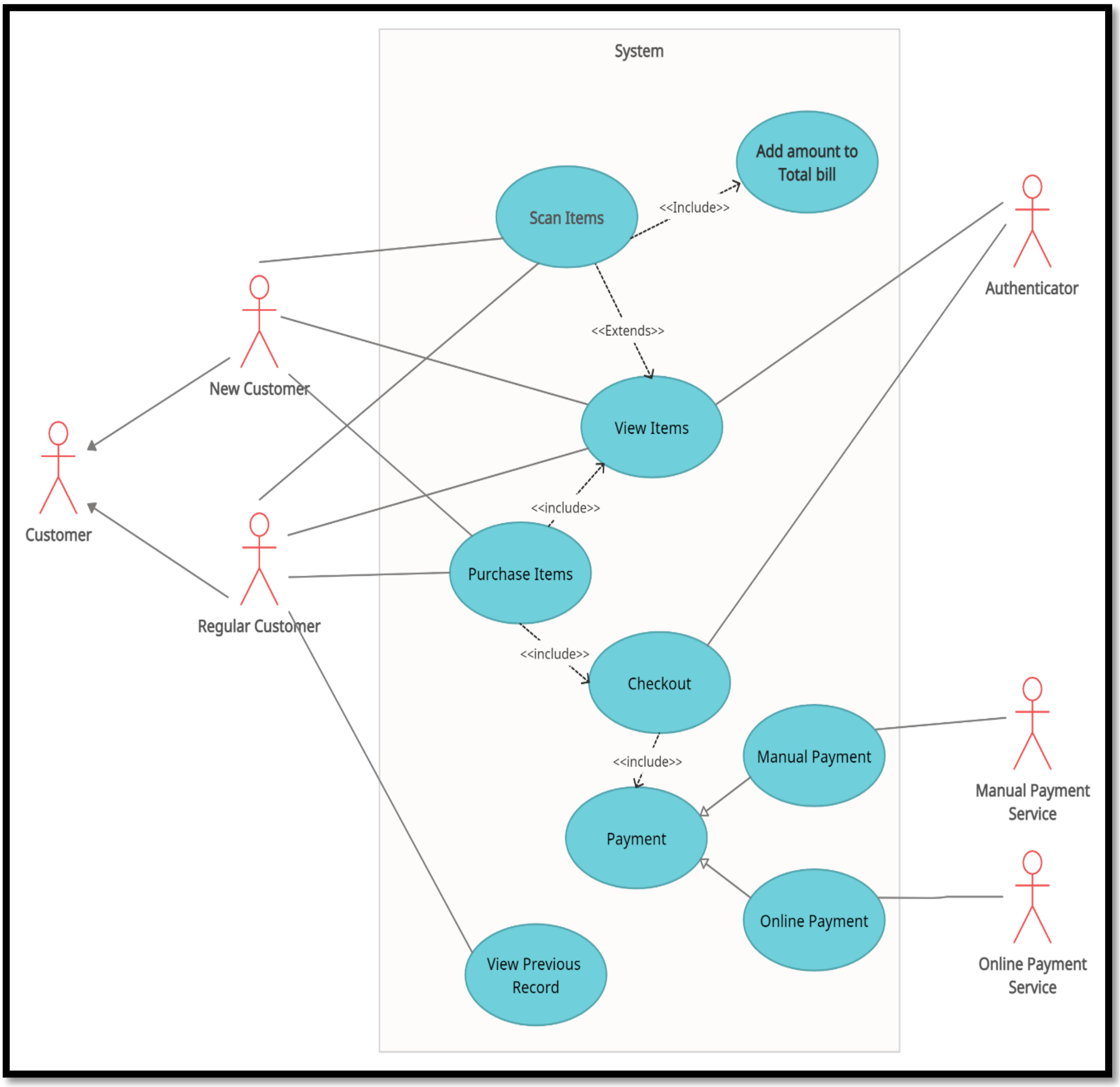


Figure 3.1 System Use Case Diagram

3.4.1.1 Online Payment Use Case Diagram

Figure 3.2 describes how the user will perform online payment.

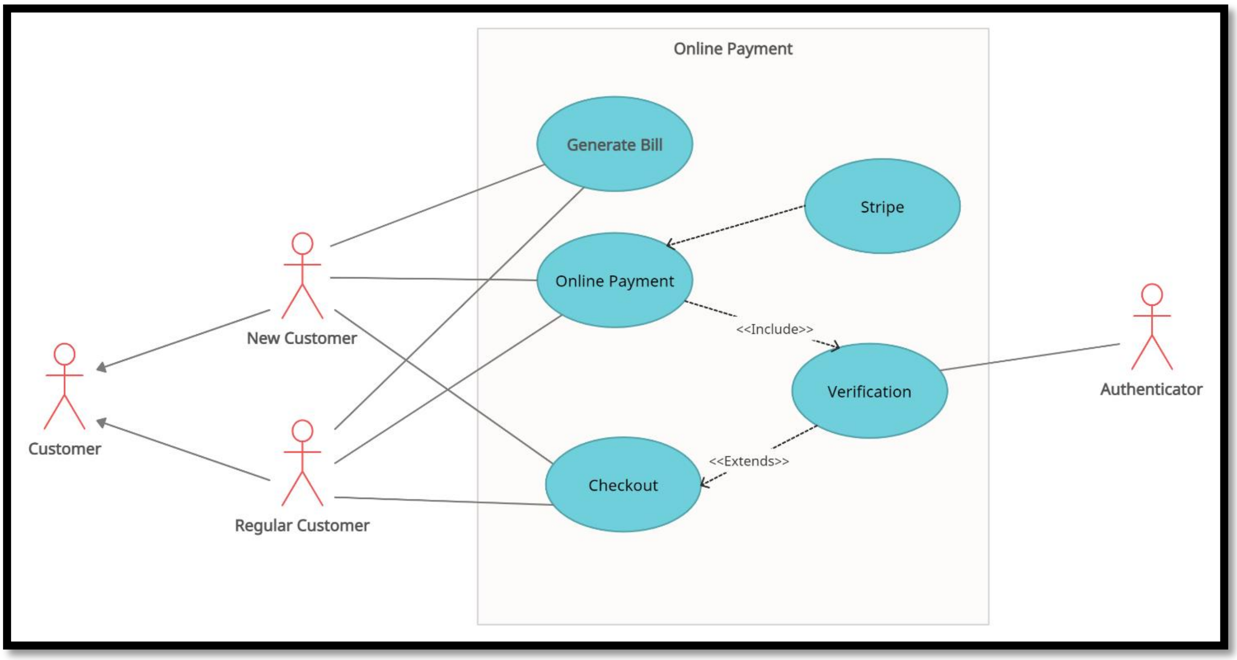


Figure 3.2 Online Payment Use Case Diagram

3.4.1.2 Manual Payment Use Case

Figure 3.3 describes how the user will perform manual payment.

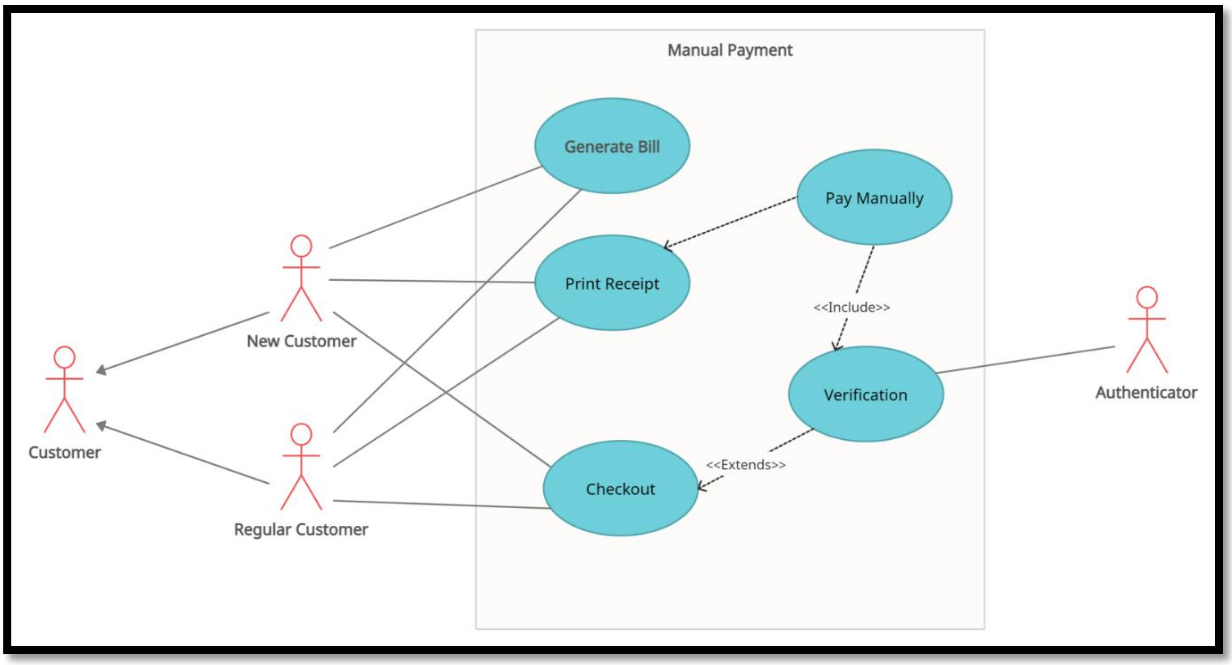


Figure 3.3 Online Payment Use Case Diagram

3.5 Use Cases

The use cases of this system are given below:

3.5.1 Scan Product Use Case

Table 3.1 explains how the user will scan a product with the RFID scanner. This use case requires the pre-condition that the RFID scanner is in active state.

Table 3.1 Scan Product

Use Case – 1	Scan Product		
Brief Description	User wants to scan the product that he/she wants to buy and scan it through RFID scanner		
Goal	To buy a desired product		
Pre-conditions	RFID scanner is in active state		
Post conditions	The user scans the product and the product is scanned successfully.		
Failed End Condition	User failed to scan the product.		
Primary	Users (Customers)		
Basic Events Flow	**Steps**	**Actions**	**System Response**
	1	A new user selects a cart.	The system is ready to add products.
	3	The user scans the product and presses the add button to add it to the total bill.	System displays the item details and price on the LCD screen with total bill.
Alternative Flow	**Steps**	**Actions**	**System Response**
	3a	User is unable to select a product to scan.	The System waits for the user.
	3b	User is unable to scan the product properly.	System is waiting for the user to scan the product properly.

3.5.2 Scan QR Code Use Case

The table below explains how to scan QR code through android application. This use case does require a pre-condition that the QR code is generated and is available on the OLED screen to be scanned. Scanning the QR code is necessary for the properly working of the android application.

Table 3.2 Scan QR code

Use Case – 2	Scan QR Code		
Brief Description	User wants to scan the QR Code through mobile application. The QR Code is visible on the OLED screen.		
Goal	To get the total bill on application for payment process.		
Pre-conditions	The QR Code is generated on the OLED screen.		
Post conditions	The QR code is scanned by the user and the application is showing the total bill on the android phone for payment process.		
Failed End Condition	User failed to scan the QR code		
Primary	Users (Customers)		
Basic Events Flow	**Steps**	**Actions**	**System Response**
	1	A user starts scanning products through RFID scanner.	The System asks the user to press the add button if they want to add the item in total bill.
	2	The user presses generate total bill button.	The system creates a QR code on OLED screen having total bill.
	3	The user scans the QR code to pay the bill (online or manually)	System displays the total bill on the mobile application.

Alternative Flow	Steps	Actions	System Response
	1a	A user doesn’t scan products through RFID scanner.	The System waits for the user.
	2a	User doesn’t presses generate total bill button and QR code isn’t generated.	System is waiting for the user to press the button to create QR code.

3.5.3 Manual Payment Use Case

Table given below describes how manual payment will be done by the customer. The pre-condition for this use case are given below.

Table 3.3 Manual Payment

Use Case - 3	Manual Payment
Brief Description	When the customer is done with the shopping he/she will have to follow a payment method for the payment procedures. For that they will either use a manual payment or online payment method. Here they will do payment manually.
Goal	Customer should be able to do manual payment.
Pre-conditions	Customer has done shopping and wants to do manual payment.
Post conditions	Customer checks out after doing manual payment.
Failed End Condition	Manual payment is not done by the customer.
Primary	Customer
Secondary Actors	Authenticator
Dependency	Include manual.

Basic Events Flow	Steps	Actions	System Response
	1	Customer buys some products and scans it through QR Code scanner.	System allows customer to scan the products and shows the product details.
	2	Shopping is done by the customer and is ready to check out.	System asks the customer for payment procedure.
	3	Customer does manual payment.	System accepts manual payment from the customer and payment is done. Now the customer can check out.
Alternative Flow	**Steps**	**Actions**	**System Response**
	3a	Customer goes for online payment.	System accepts online payment from the customer.
	3b	Manual Payment is not authorized by the authenticator.	System cancels the payment.

3.5.4 Online Payment Use Case

Table 3.4 shows how online payment will be done by the customer. The pre and the post conditions are given below. This use case does have primary and secondary actors as well. Customer will act as primary actor because customer is the one doing shopping. System is designed according to the needs of the customer. The secondary actors are the authenticator, the one who is responsible for checking the whole process of payment method that is done by the customer. Authenticator checks whether the customer has done the payment or not and verify it.

Table 3.4 Online Payment

Use Case – 4	Online Payment.		
Goal	Customer will be able to do online payment through bank account or easy paisa.		
Pre-conditions	Customer has done shopping and wants to do online payment.		
Post conditions	Customer checks out after doing online payment.		
Failed Condition	Online payment is not done by the customer.		
Primary	Customer		
Secondary Actors	Authenticator		
Dependency	Include online.		
Basic Flow	**Steps**	**Actions**	**System Response**
	1	Customer buys some products and scans it through QR Code scanner.	System allows customer to scan the products and shows the product details.
	2	Shopping is done by the customer and is ready to check out.	System asks the customer for payment procedure.
	3	Customer does online payment.	System accepts online payment from the customer and payment is done. Now the customer can check out.
Alternating Flow	**Steps**	**Actions**	**System Response**
	3a	Customer goes for manual payment.	System accepts manual payment from the customer.
	3b	Error is coming while doing online payment.	System cancels the payment.

3.6 Non-Functional Requirements

A non-functional essential is a necessity that determines standards which are used to evaluate the activity of a system. These requirements are critical as well to make sure the system works accordingly.

3.6.1 Security

The system is being connected to different bank account applications so unauthorized access must be limited in this system for this specific purpose. During online payment processes, security must be ensured so that the information of the customer is kept secured.

3.6.2 Safety

The system stores user’s sensitive data so it is required to be backdoor free.

3.6.3 Flexibility

The system should be adaptable enough to deal with minor errors such as rescanning of the item if not properly scanned or deleting any item from the list by rescanning that specific item you want to remove.

3.6.4 Testability

All modules of the system will be tested already but still any type of testing can be performed on the system to confirm its effectiveness and user conditions.

3.6.5 Maintainability

The system is designed in a way that allows easy changes and extension to the code.

3.6.6 Portability

System which has been developed for android platform, it must be compatible for all versions of android.

3.6.7 Reliability

As the system provides real time functionalities it should be reliable enough to display all results on time.

3.7 Resource Requirements

Several software/hardware resources are needed to complete this project. The programming languages which are used in the system's development are Java, kotlin and C++. Required resources that are used in this system are mentioned below.

3.7.1 Hardware Requirements

The following hardware requirement for development and testing of the system are required:

- Laptop/Desktop
- RAM (Random Access Memory) 4GB or higher
- CPU: 64-bit dual-core 2.5 GHz or higher
- Hard drive minimum 300GB
- Arduino IDE
- ESP 8266
- Android Studio
- Android supported mobile device
- OS: Windows 7 SP1+, 8, 10
- Graphic card: 1 GB RAM
- RFID scanner and tags 13.56 MHZ
- Arduino UNO
- OLED 0.96 inch 128 X 64
- 3.5‘’ TFT LCD 16X2 Module for Arduino

3.7.2 Software Requirements

The system's software interface requirements are as follows:

3.7.2.1 Android Studio

For the development of android application, kotlin is used as it gives an adaptable, secure platform for developing applications. The applications that are created utilizing kotlin are convenient, secure, and can take the advantage of local capacities of the device.

3.7.3 Human Effort

Human effort is dedication of individuals for completion of their tasks. Table 3.11 shows the active participation of all the team members in relevant part of the project. And the tasks that were done by the team members.

Table 3.5 Human effort

	Sohaib Aftab	**Mohammad Ahmed**	**Ghazala Zainab**
Requirement Analysis and Information Research	Yes	Yes	Yes
Project Planning	Yes	Yes	Yes
Proposal Report	Yes	Yes	Yes
System modeling	Yes	Yes	Yes
Interface Design	Yes	Yes	Yes
Application Development	Yes	Yes	Yes
Hardware Development	Yes	Yes	Yes
Combining H/W And S/W	Yes	Yes	Yes
Implementation	Yes	Yes	Yes
Documentation	Yes	Yes	Yes
Progress Report	Yes	Yes	Yes
System Testing	Yes	Yes	Yes
Evaluation	Yes	Yes	Yes
Final Report writing	Yes	Yes	Yes
Presentation and Demonstration	Yes	Yes	Yes

3.8 Database Requirements

This system does not require any database as it stores all its data in the default data directory which is /data/data/<package_name>.

3.9 Project Feasibility

A feasibility study is conducted to examine whether the project is attainable within the time and spending plan.

3.9.1 Technical Feasibility

Because the system built is an Android-based programme, it can run on any Android-based operating system.

3.9.2 Operational Feasibility

The system detects QR code through the scanner and represents the details of the specific item on the LCD display. In addition to that a total is los being kept for the customer to end shopping at any spot during the whole shopping process.

3.9.3 Legal & Ethical Feasibility

The system is fairly and immorally feasible as:

- It does not violate any law.
- It is simply intended for the help of individuals.
- Components data is secure.

3.10 Summary

The system's flow has been explained in detail in this chapter. Every software feature is subdivided into sub-features, and similar features are grouped together. To lessen the system's complexity and raise its impenetrability, every element of the system is presented separately. In addition, the use case model and all of the use cases have been clearly clarified. In this part, all of the system's functional and non-functional needs are listed.

CHAPTER 4

SYSTEM MODELING

4.1 Introduction

The developed system's modeling is carried out in the following chapter using system design, design method, interface design, and the 4+1 view model of architecture. The process of developing theoretical system’s model is generally termed as system modeling, with every model shows a different view or interpretation of the system.

4.2 System Design

The analyst understands the system modeling is used to understand how the system works and what models are utilized to correlate with clients. The atmosphere and the characteristics how the system functions are exhibited in system design.

4.3 Design Approach

The following are the most common design methodologies used in software engineering:

- Top-down Design Approach
- Bottom-up Design Approach

4.3.1 Top-down Design Approach

All needs are gathered and listed in the Top-Down design philosophy; the system is then separated into modules based on the requirements. Top down design approach is helpful where the requirements are not available accurately. It also permits the structural control of the system.

4.3.2 Bottom up Design Approach

This technique demands for the very fundamental comprehension of system elements leads to the development of a product. In this method, all of the fundamental mechanisms of the system are acknowledged to us, and we improve and combine them which direct toward a better product. System is developed by adopting this top down method.

4.4 Interface Design

The visual structure of the elements that a client can link in a site or actual object is referred as user interface design. This system’s target audience is people of every age. From kids to the elderly anyone can use it.

4.4.1 High-fidelity Prototype

A high-fidelity prototype is a computer-based visual representation of an object that is as close as feasible to the final design in terms of features and functionality. The major goal of employing high-fidelity prototypes is to use them in formative evaluation so that the target audience can validate that the product is exactly what they want.

4.4.1.1 QR Code Scanning

Figure 4.1 shows the opening screen that will be visible to the user when they will open the application.

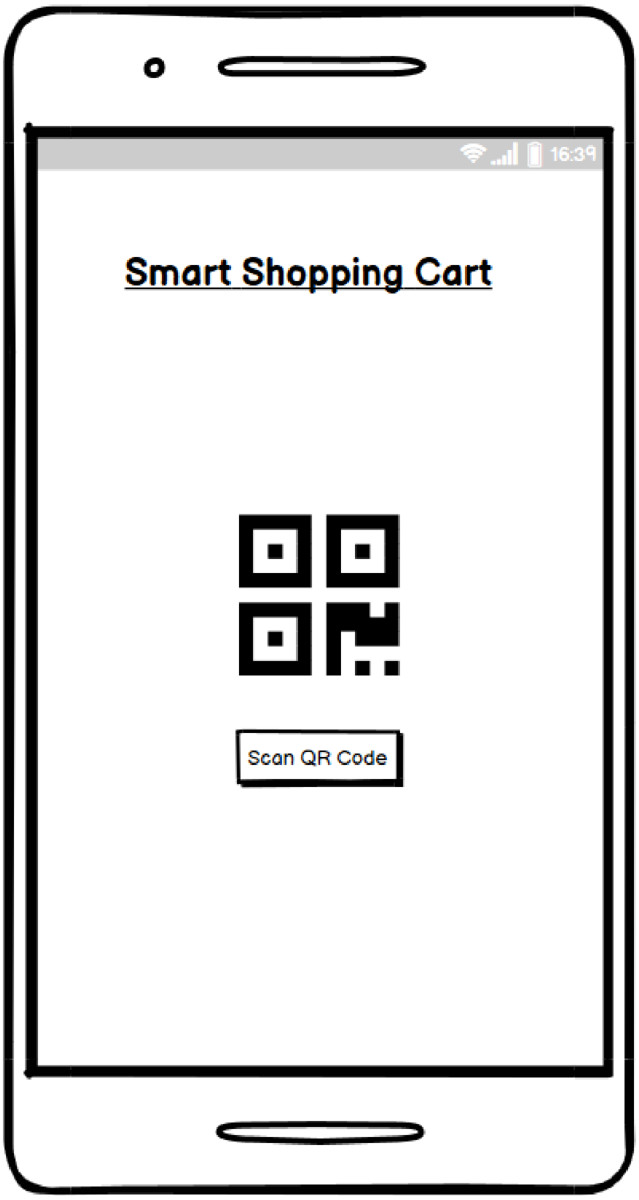


Figure 4.1 QR Code Scanning

4.4.1.2 Scan Done

Figure 4.2 shows the scanning screen that the user will see if the user is able to scan the QR code successfully. The total bill will be visible to the user and then the user can move on to the payment process.

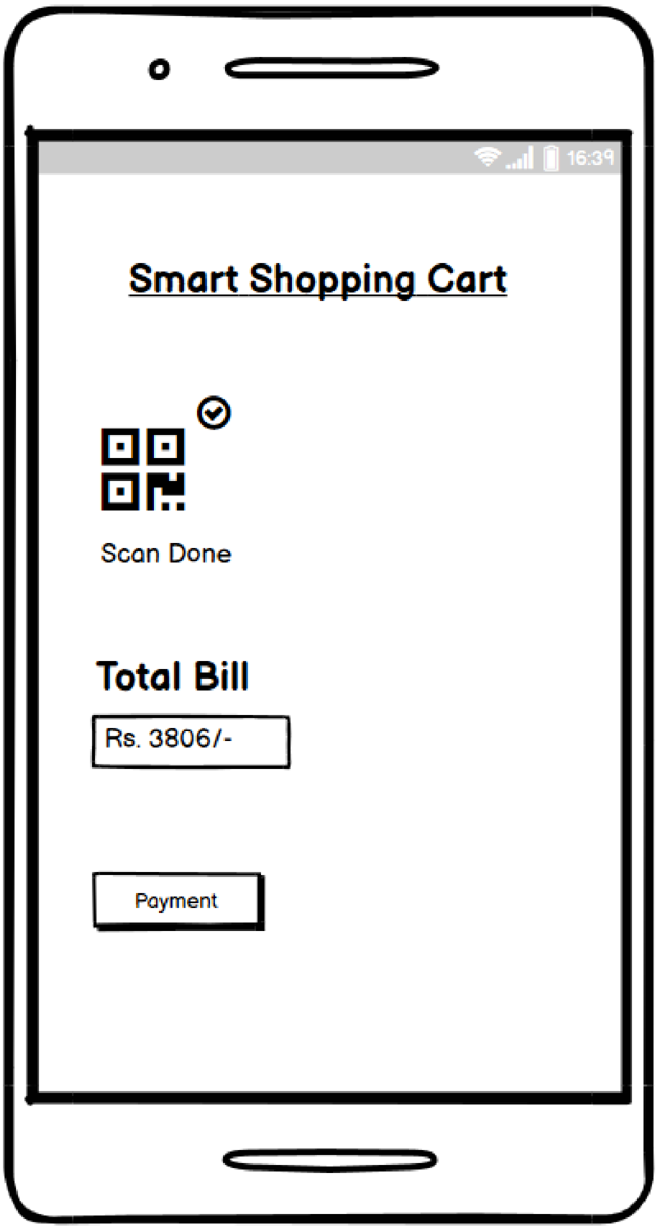
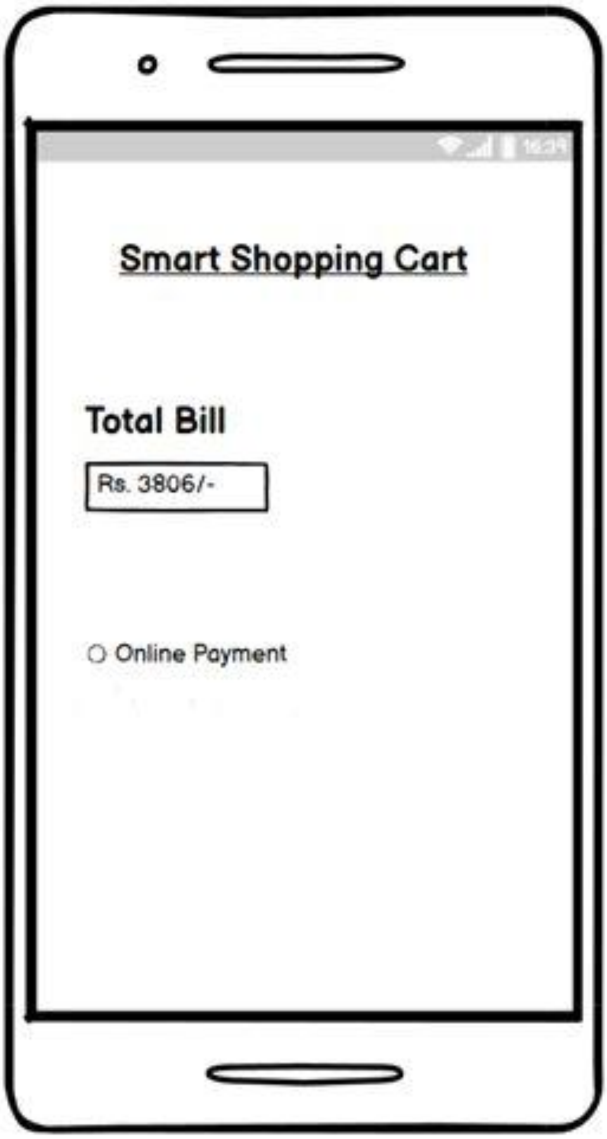


Figure 4.2 Scan Done

4.4.1.3 Payment Option

Figure 4.3 shows payment process that the user will use to pay for the shopping that is done by the user.



Smart Shopping Cart

Total Bill

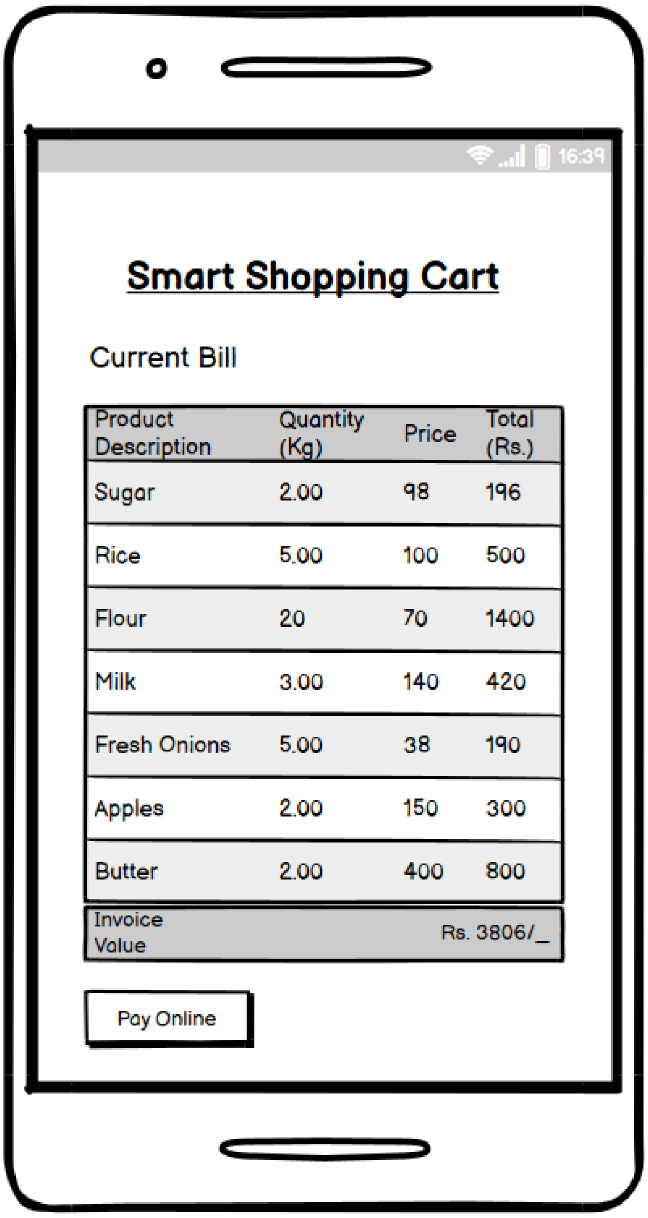
Rs. 3806/-

○ Online Payment

Figure 4.3 Payment Option

4.4.1.4 Current Bill

Figure 4.4 shows the current bill that the user can visualize. Details of every item will be mentioned in the bill. The quantity, price and the total cost of a single item will be available on this receipt. In the end total invoice is also given with the payment option.



Smart Shopping Cart

Current Bill

Product Description	Quantity (Kg)	Price	Total (Rs.)
Sugar	2.00	98	196
Rice	5.00	100	500
Flour	20	70	1400
Milk	3.00	140	420
Fresh Onions	5.00	38	190
Apples	2.00	150	300
Butter	2.00	400	800
Invoice Value			Rs. 3806/_

Figure 4.4 Current Bill

4.4.1.5 Account Details

Figure 4.5 shows the personal credentials form that the user will fill out for the online payment process, Debit/Credit card number, card expiry date, first and last name etc will be entered by the user and then he/she can submit the information

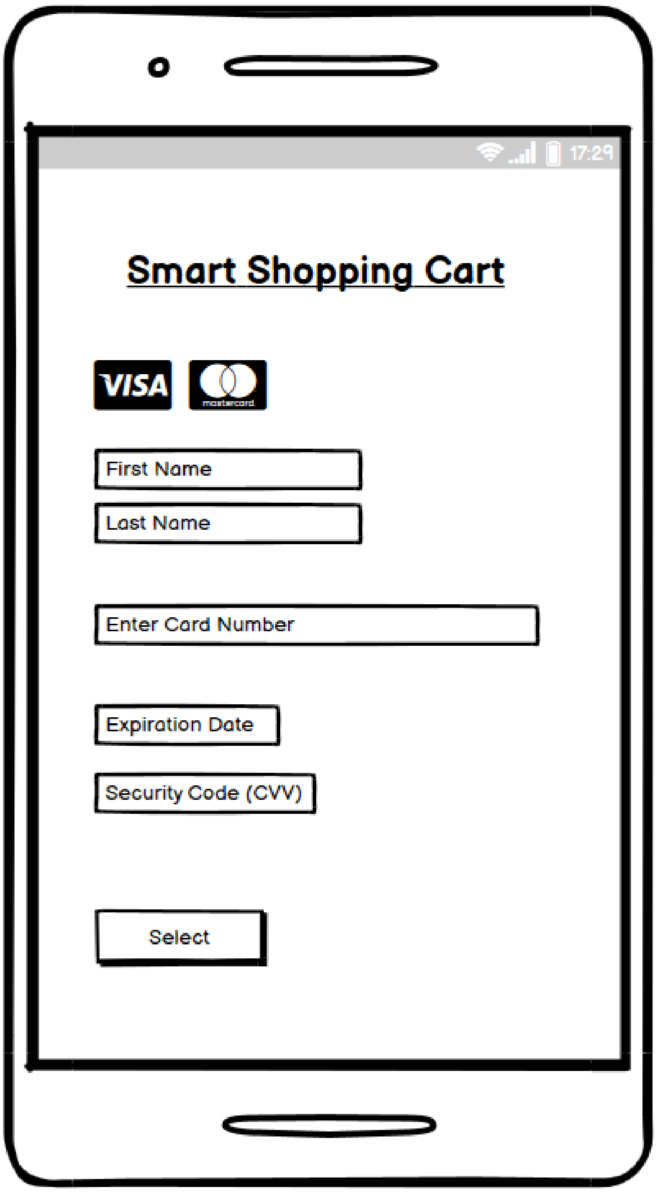
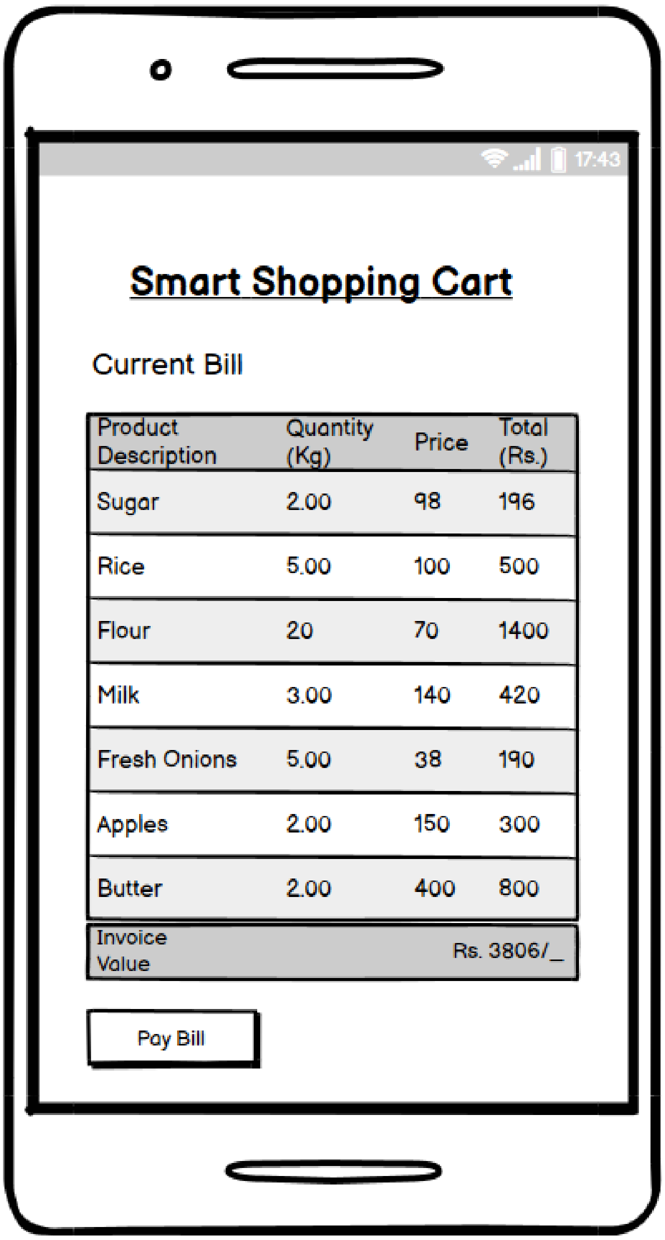


Figure 4.5 Account Details

4.4.1.6 Pay Bill

Figure 4.6 shows the pay bill form, if the credentials that the user entered are correct then this page will be available for the user to finalize the payment of the shopping.



Smart Shopping Cart

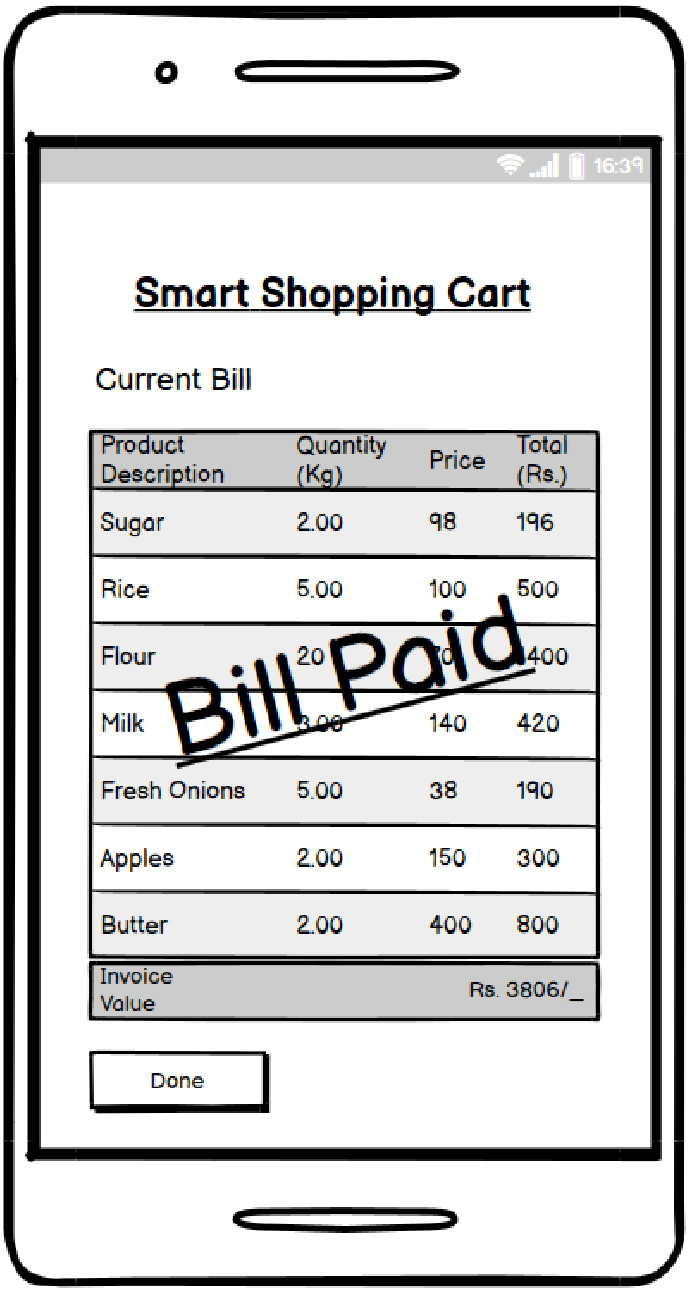
Current Bill

Product Description	Quantity (Kg)	Price	Total (Rs.)
Sugar	2.00	98	196
Rice	5.00	100	500
Flour	20	70	1400
Milk	3.00	140	420
Fresh Onions	5.00	38	190
Apples	2.00	150	300
Butter	2.00	400	800
Invoice Value			Rs. 3806/_

Figure 4.6 Pay Bill

4.4.1.7 Bill Paid

Figure 4.7 will be visible to the user if the bill is paid successfully. A receipt is generated as well so that the user can view it.



Smart Shopping Cart

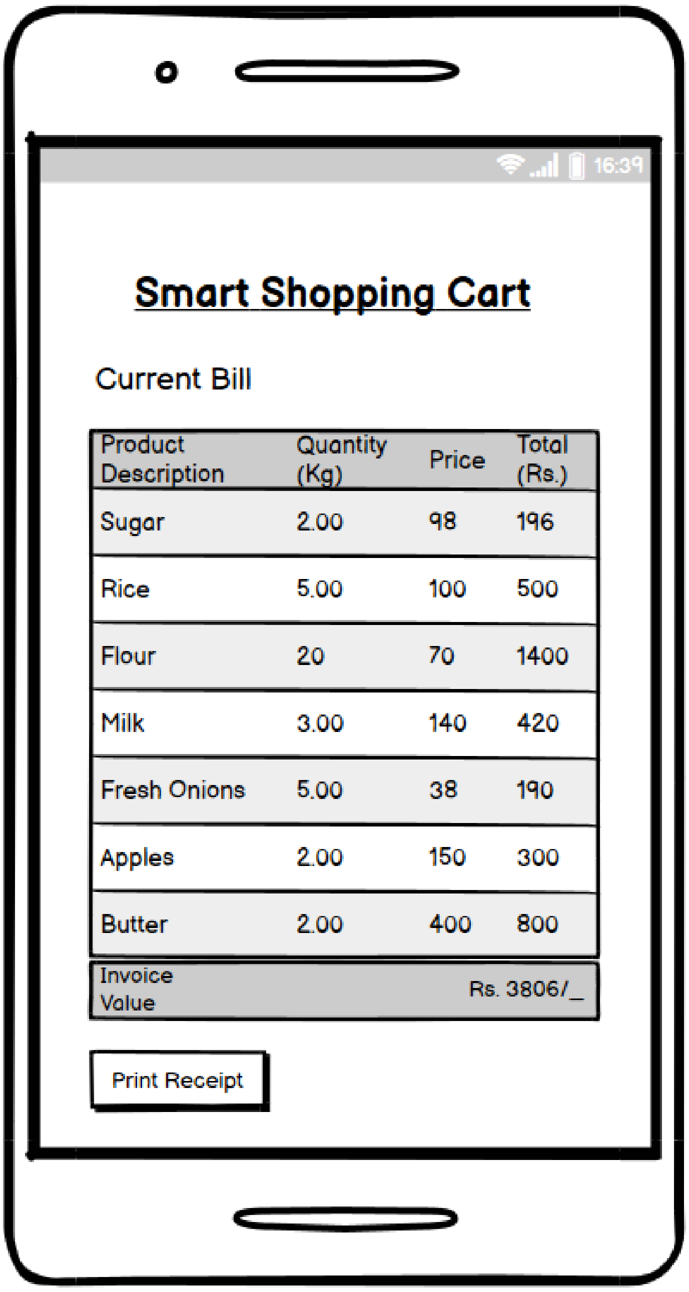
Current Bill

Product Description	Quantity (Kg)	Price	Total (Rs.)
Sugar	2.00	98	196
Rice	5.00	100	500
Flour	20.00	70	1400
Milk	3.00	140	420
Fresh Onions	5.00	38	190
Apples	2.00	150	300
Butter	2.00	400	800
Invoice Value			Rs. 3806/_

Figure 4.7 Bill Paid

4.4.1.8 Print Receipt

Figure 4.8 shows the final paid receipt of the shopping. User can print this receipt, save it in the form of an image in the phone's gallery or share it as well.



Smart Shopping Cart

Current Bill

Product Description	Quantity (Kg)	Price	Total (Rs.)
Sugar	2.00	98	196
Rice	5.00	100	500
Flour	20	70	1400
Milk	3.00	140	420
Fresh Onions	5.00	38	190
Apples	2.00	150	300
Butter	2.00	400	800
Invoice Value			Rs. 3806/_

Figure 4.8 Print Receipt

4.5 4+1 View Model of Architecture

This architectural model aids in the resolution of all issues related to software architecture communication. This architecture clarifies the building elements of a software system. The category of architecture has four perspectives: development, logical, physical, and process.

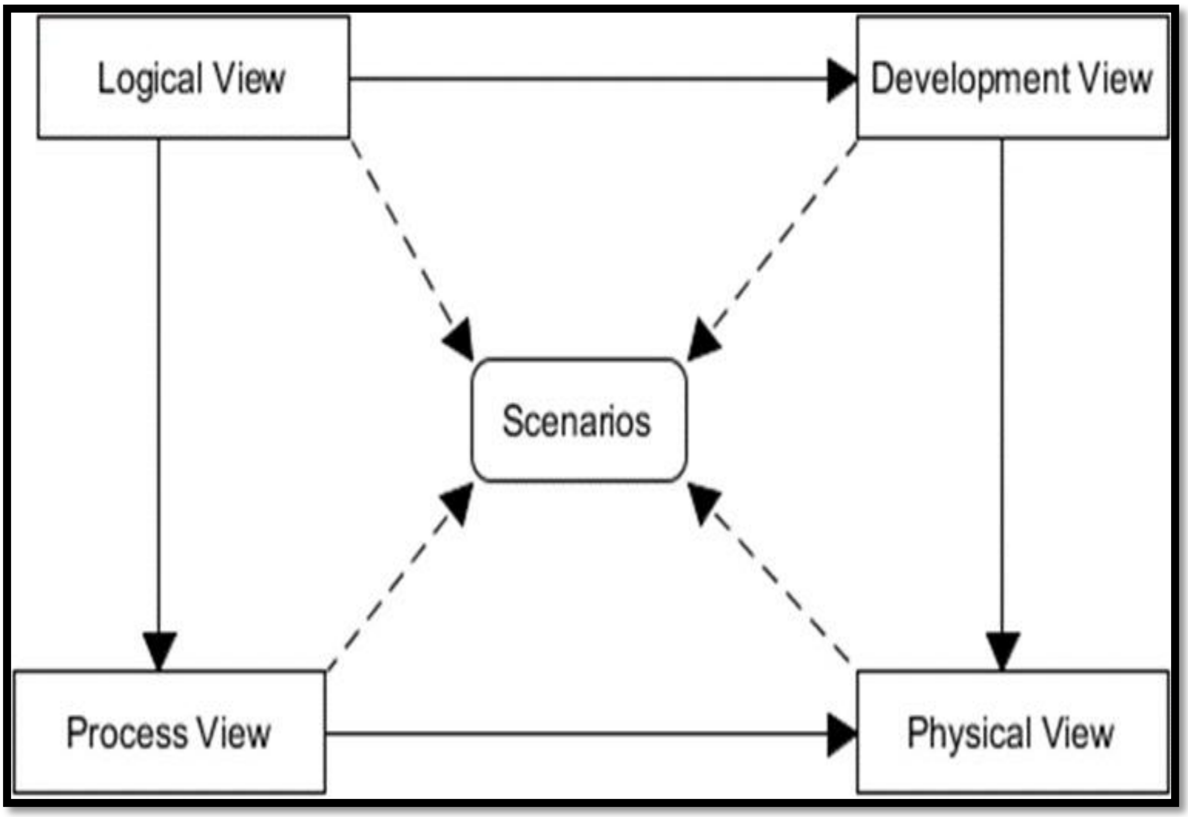


Figure 4.9 4+1 View Model of Architecture

4.5.1 Logical View

It basically links the functional necessities, what the framework ought to offer as far as administrations to its clients.

4.5.1.1 Class Diagram

The class diagram is extensively exercised by the software system developers throughout the event of a system and system design. Classes, methods and their relations are the part of class diagram. Classes, characteristics, methods, and relationships between classes are depicted in the diagram below. Six classes make up the class diagram. Classes are Smart shopping cart, Scan Product, Start Shopping, Payment Mode, Manual payment method and online payment method. Each class of system has its own characteristics and functionalities. One to one, one to many and many to many are the three types of relations that exist among the classes.

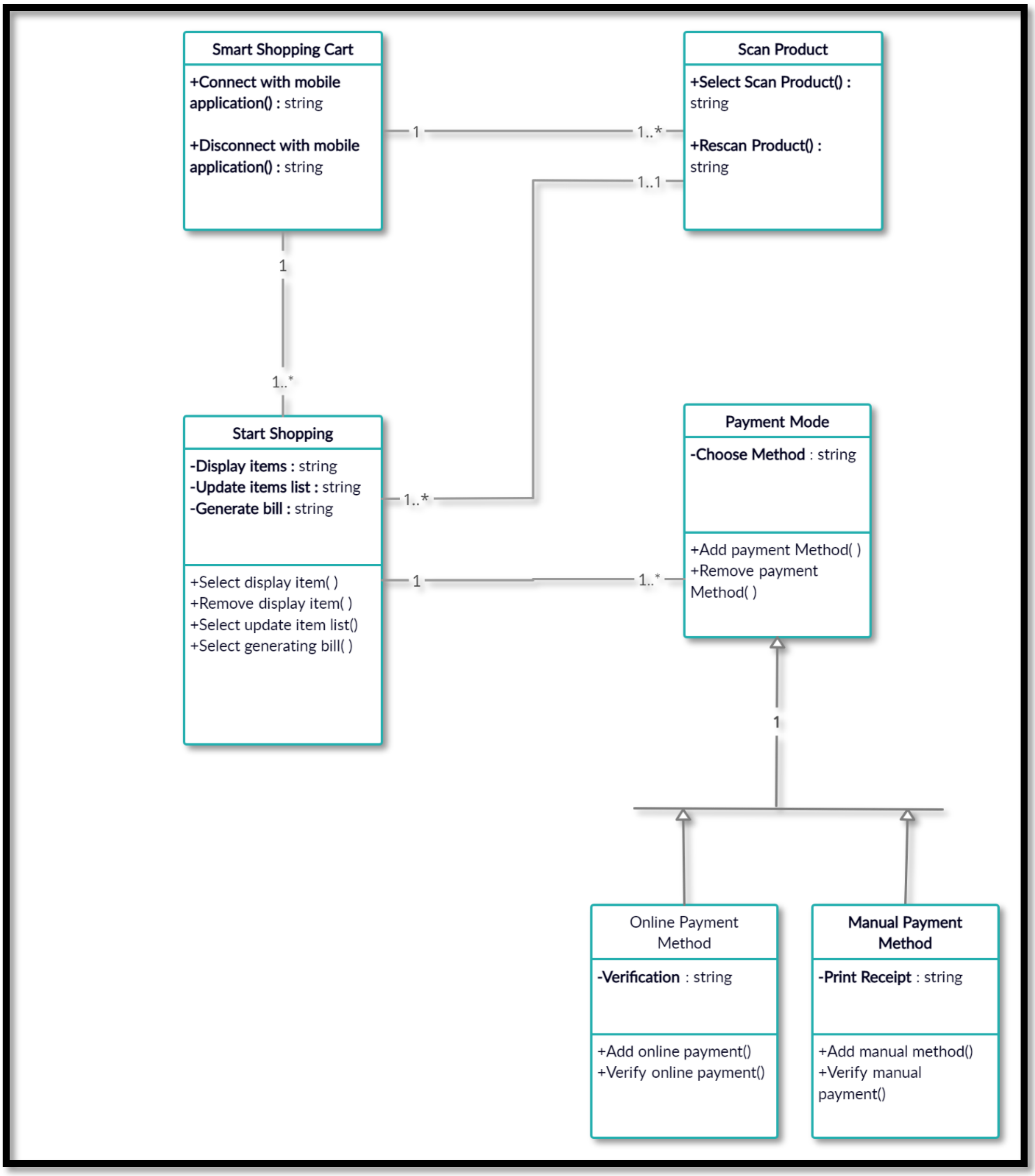


Figure 4.10 Class Diagram

4.5.2 Process View

This view takes some non-functional requirements, such as execution and accessibility into account which also assist in resolving various issues like dissemination, liabilities in the system and error resistance.

4.5.2.1 Activity Diagram

The entire performance of the produced system is depicted in this system activity diagram. This system activity diagram shows each and every activity done step by step. The process view conveys coexistence, classification, unifiers, capacity, and expandability. The activity can also be described as a system operation. The Figure 4.15 illustrates a schematic that depicts the transition from one action to the next. First the customer will get a cart if he/she wants to connect it with the app they can do it otherwise it can be done in the end of shopping. Now they can start shopping. They will have to scan products they want to buy through RFID scanner. If the product is scanned its price and details will be displayed on the LCD screen otherwise the customer will have to scan the product again. When the scan is done a current bill is being generated with that items list and item details are also displayed. If you want to continue shopping you can scan next product otherwise you can end your shopping. When the shopping ends the payment procedure part comes. Receipt is generated and now you can choose payment method i.e. online or manual payment. For online payment you will have to choose a payment mean like bank account or easy paisa. After that the app will ask you for your credit card info and the payment will be done. For manual payment a receipt will be printed and it will be saved to your gallery. Customer will have to show it to some authorize person who will receive the payment manually. When the bill is paid and is verified you can end your shopping.

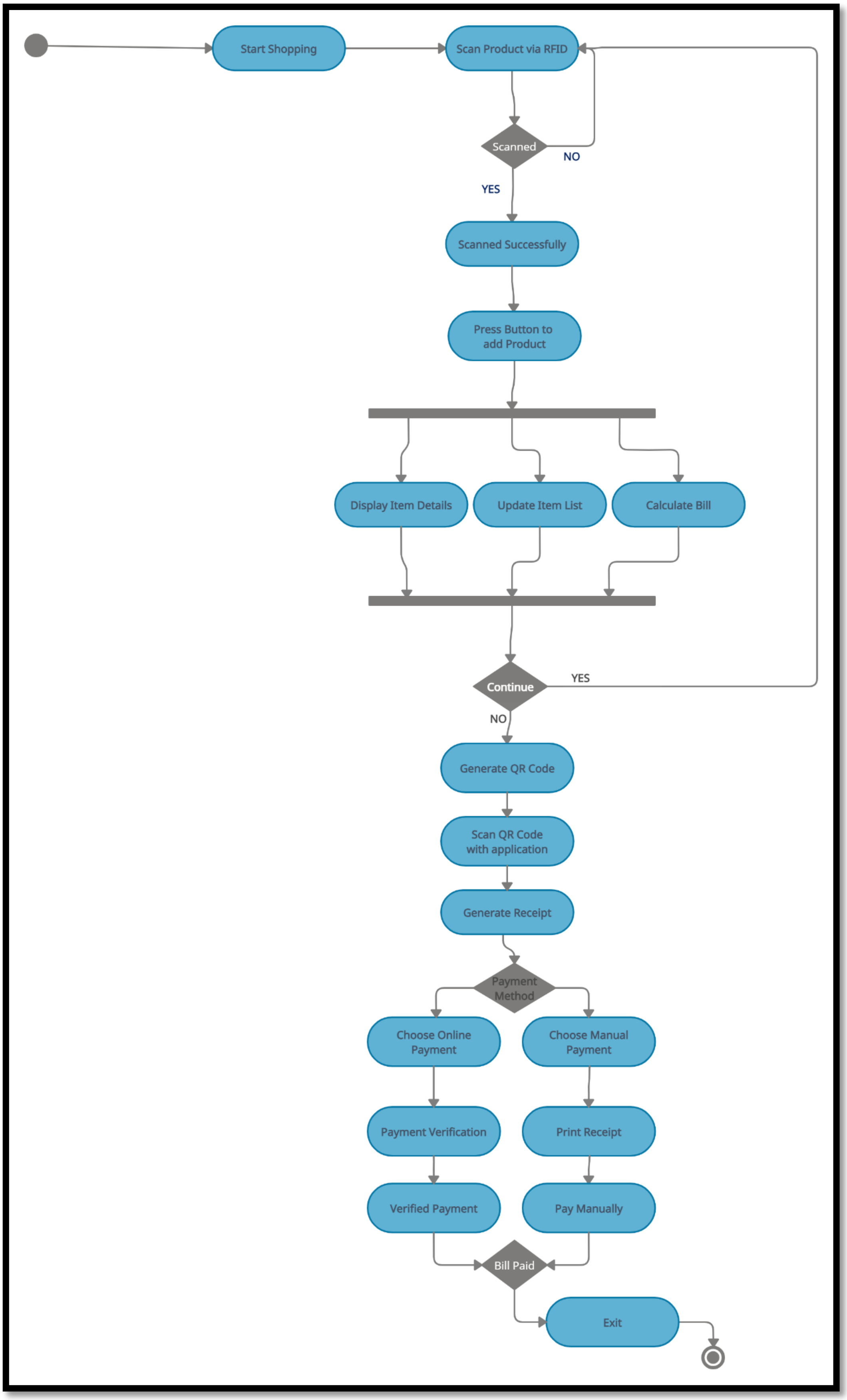


Figure 4.11 Activity Diagram

4.5.2.2 State Machine Diagram

Figure 4.16 classifies to show the dynamic functioning of a process. State machine shows the current state of the system in a given input. Step by step states that are accomplished by the system is shown in this diagram. The system's start node is its initial state, after which it moves to starting state after starting state the system move the user to next state which is connecting with app state and after that system allows the user to start shopping. Then the user can scan product and if scan is successful user can scan another product otherwise he/she will have to scan product again. After that system moves to the next state that is displaying item details updating list and generating bill as well. When the shopping is done user can now move to the payment process. System allows you to pay manually or online as well. System will be then in accepting payment state. When the payment will be done system will move to the last state that is ending shopping state.

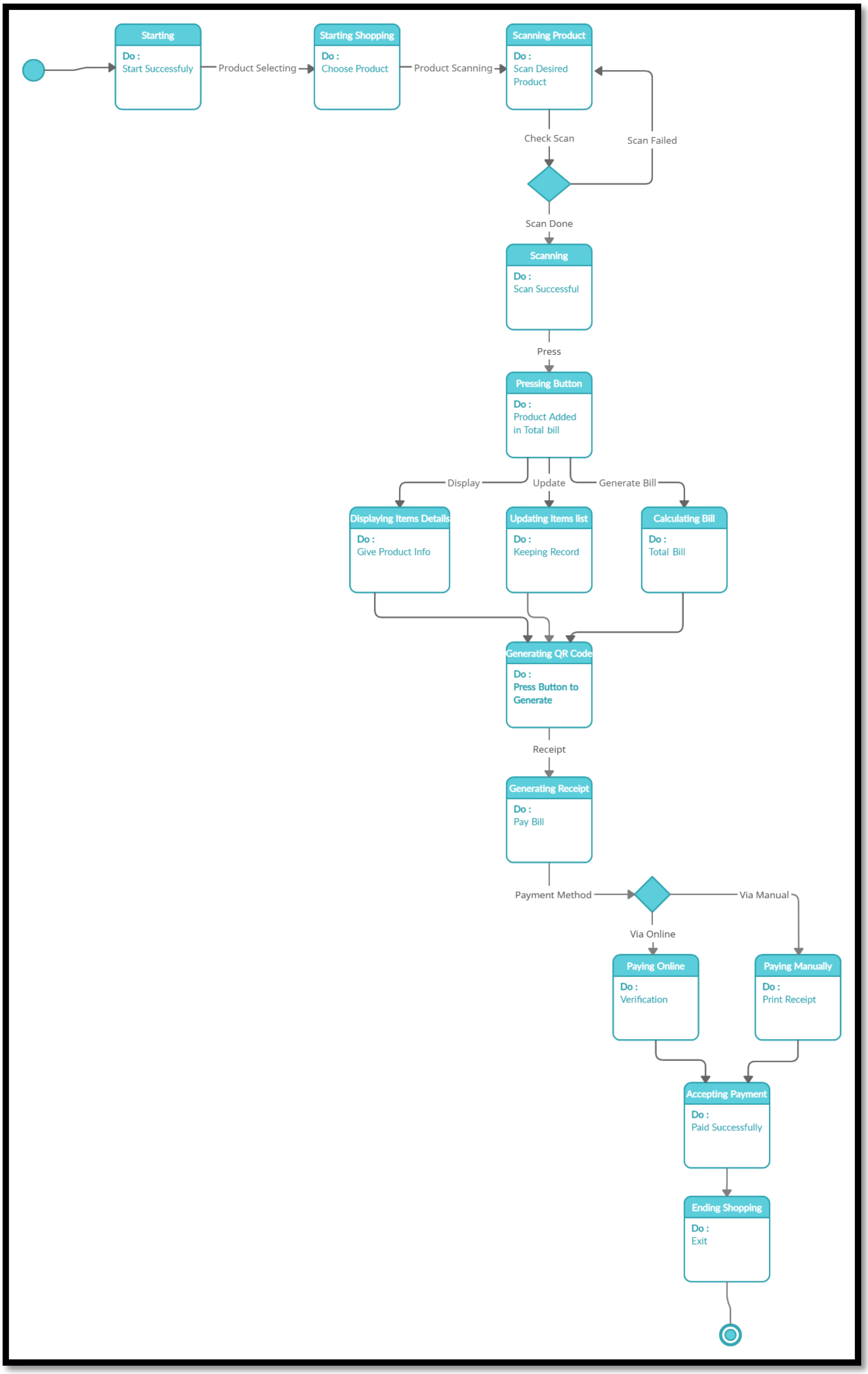


Figure 4.12 State Machine Diagram

4.5.2.3 Sequence Diagram

Figure 4.17 designates information flow between system application and the user. The user requests to connect with application then the system determines whether the user is capable of connecting or not. After that the user will be successfully connect with the application. User will also ask system for bill generating and updating items list that the system will do. Scanning and rescanning product if not scanned will also be asked by the user. After the shopping is done the customer will ask system for the payment process either online or manual payment. When the payment is done user can exit the system.

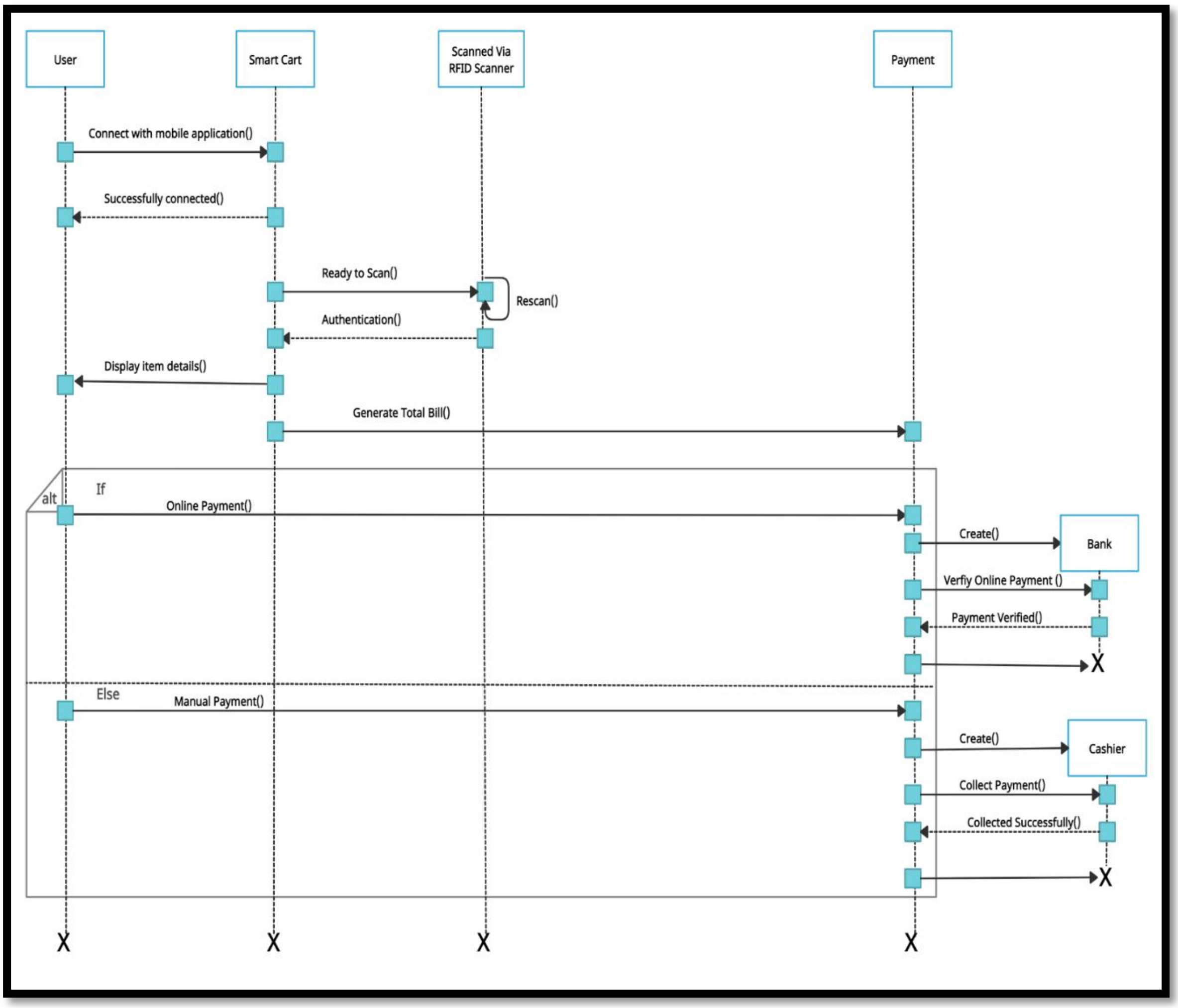


Figure 4.13 Sequence Diagram

4.5.3 Development view

The development view includes: The development perspective focuses on the actual program module that is arranged within the software architecture environment. The point of view on development includes:

4.5.3.1 Component diagram

The component diagram is a deterministic representation of a system's components and their relationships. An element or a module consisting one or more classes with a clearly outlined interface is represented by a node in a component diagram. The best measures of central tendency between all of the entities are shown in Figure 4.18. After that the user will be successfully connect with the application. User can scan product that will result in updating list and current total as well. After the shopping is done the customer can do payments either online or manual payment. When the payment is done user can exit the system.

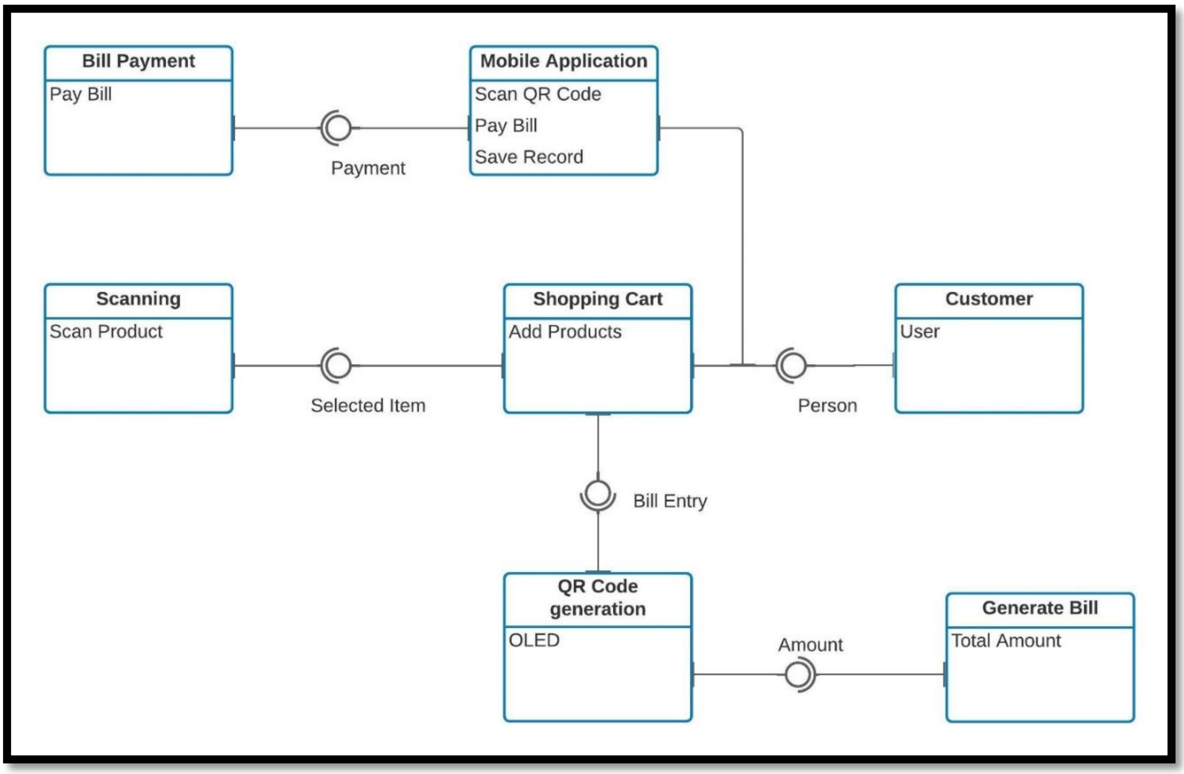


Figure 4.14 Component Diagram

4.5.4 Physical view

This view considers essentially the non-functional necessities of the system.

The physical view includes:

4.5.4.1 Deployment Diagram

The rigid picture of the system is illustrated in deployment diagrams. Physical components of the system are represented using deployment diagram. Software components are also deployed in these physical components. It consists of nodes that are related to each other. Their relation is also shown in Figure 4.19

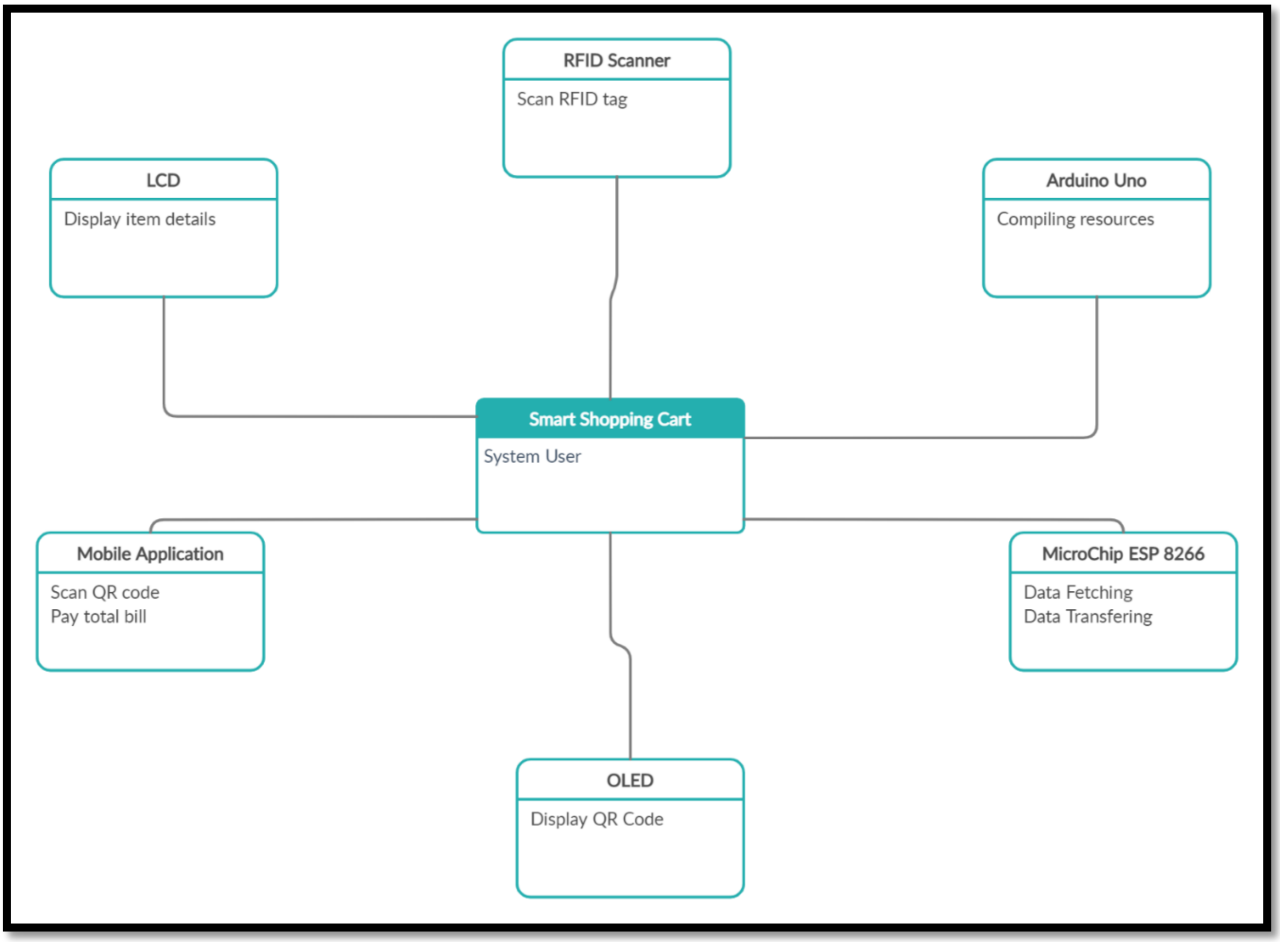


Figure 4.15 Deployment Diagram

4.6 Summary

This chapter covers the modeling aspects of system. 4+1 View is explained, which describes the system from the view point of different stakeholders. Different diagrams such as sequence diagram, deployment diagrams, activity diagram, component diagram and state machine are pinched and explained in this chapter to get much accurate understanding of the system.

CHAPTER 5

IMPLEMENTATION

5.1 Introduction

The chapter gives a concise explanation of modules used in the smart shopping cart in terms of hardware and software that the user will interact with. It includes all type of interactions that the user will have with hardware and software modules. This chapter gives insight of how modules are incorporated with each other to perform all the functionalities that are needed to successfully perform the desired tasks.

5.2 Modules

There are two types of modules used in this project i.e. the hardware parts and the software parts which are subdivided in to following manner.

5.2.1 Hardware Modules

This section briefly describes the interaction of user with all the hardware modules of the system.

5.2.1.1 Scanning Module

In the following hardware component, the user will be having an RFID scanner available on the smart shopping cart which he will use to scan the RFID tag implanted item. This module will be composed of an RFID scanner attached to an Arduino device. The Arduino device will be coded using C language.

5.2.1.2 Add Module

In this module, the user will be presented with a button which will be used to add the scanned item to the list. If the user presses the button only then will the item be added to the list of scanned items otherwise the item will be deleted automatically upon scanning next item.

5.2.1.3 QR Code Generator Module

This module will be the last hardware module that the user will interact with. Upon the completion of a user's shopping, a button will be available to generate the QR code and finalize the list of items purchased. Once the button is pressed the user will be shown a generated QR code on the OLED Screen attached to a microprocessor containing the code of QR code generation

5.2.2 Software Modules

This section briefly describes the interaction of user with all the software modules of the system. The user will have the smart shopping cart pre-installed on the user’s android device having following modules. All the modules have been developed using Kotlin language.

5.2.2.1 Main Menu

Upon opening of mobile application the user will have several options to choose from. These include scan, history, flash, select image from gallery, zoom in and zoom out.

5.2.2.2 Scan Module

In this module, the user will have the button to scan the QR code being displayed on the screen by placing the cell phone’s camera on the QR code. Upon Scanning the QR code the user will be redirected to the items list being shown in the form of a receipt.

5.2.2.3 History Module

In this module, the user will be displayed a button in the main menu to see the previous Shopping receipts. Upon selection of this button the user will be redirected to a page containing the previous shopping receipts.

5.2.2.4 Select Image from Gallery Module

In this module, the user will have an option to choose a QR code image from the gallery for scanning. Once the user has selected an image from gallery it will be scanned and the data will be displayed in the form of a receipt.

5.2.2.5 Zoom In or Out Module

In this module, the user will have an option to either zoom in or out to adjust the camera focus so it may properly scan the QR code.

5.2.2.6 Payment Module

In this module, the user will have an option to pay the generated bill with the help of an online payment method. The user will be displayed a form to be filled with the user’s credentials. Here we will use the Stripe online payment API integrated in our app to receive online payments from users.

5.3 Libraries

This section includes all the main libraries necessary for the development of this project.

5.3.1 Wire.h

The communication between Inter Integrated Circuit (I2C devices) is done by using wire.h. Two pins of microcontroller are used in simple serial communication. I2C is a two wire interface (communication is done using two pins). One of the pin is called serial clock (SCL) and the other pin is called serial data (SDA). Many slave devices can be addressed using this protocol if they are connected to the same bus [1].

5.3.2 SPI.h

SPI.h is responsible for the communication of SPI devices and Arduino. The Arduino serves as the central controller. SPI stands for Serial Peripheral Interface, and it's a synchronous data information protocol that microcontrollers use to communicate with peripheral devices (one or may be more than that) for short range communication. Two microcontrollers can also communicate with each other using SPI. When communication is done using SPI, one of the devices act as master device (microcontroller), this master device is responsible for controlling peripheral devices [2].

5.3.3 MFRC522

It is Arduino's library for MFRC522 and RC522 based modules that have been used to read and write several types of RFID cards on your Arduino using an RC522 based reader linked further through Serial Peripheral Interface (SPI) interface [3].

5.3.4 LiquidCrystal.h

The Hitachi HD44780 chipset (or compatible chipset) is found on most LCD displays, and this library allows an Arduino board to check the LCD. It is possible to use the library in either the 4-bit or 8-bit mode [4].

5.3.5 Software Serial Library

To support serial communication on digital pins, the Software Serial module is utilized that is present in Arduino i.e. other then 0 and 1, use software to duplicate the manageability. Numerous serial ports with rates up to 115200 bps are possible [5].

5.4 Dependencies

This section includes the dependencies that will be integrated in the project to attain all the desirable outputs.

5.4.1 Barcode Scanner

This dependency will be used for scanning of barcode using the mobile camera.

5.4.2 Date time picker

This dependency automatically picks up the date and time from the system and it will be used to mark the scanned QR codes history with time stamps.

5.4.3 SDP and SSP

These dependencies are used to scale the text and non-text views according to the device screen size and resolution.

5.4.4 Image Crop

This dependency will be used to crop the image from the gallery to extract the QR code from that image.

5.5 API

For the development of this project only one external API will be used.

5.5.1 Stripe

Stripe is a transaction service provider that allows business owners to accept a variety of payment methods, including credit cards, to buy now and pay later. Stripe provides developers with a prebuilt checkout page to accept online payments. The developer just needs to integrate this API with the code and make necessary changes according to their needs. The strive API build on Java will be used in our application. The reason to use this service is that it is an open source service and can be easily integrated in to any application or web-app [6].

5.6 Summary

In this chapter we have explained all the modules that the user will interact with whether it may be hardware module or software module, tools used for development of those modules, libraries that will be used for assistance with the tools, dependencies that the application must have and APIs necessary to make the functionality of our system complete. XML acts as a foundation for developing frontend design whereas Kotlin, Java and C languages are used for the development of the backend architecture.

CHAPTER 6

SYSTEM TESTING

6.1 Introduction

All the necessary documentation and reporting required for the purpose of testing and validation are in this chapter. Testing is done with the intentions to find any errors or flaws in the project and to remove them to improve the functionality of the system. In this chapter, many assessment strategies are explained. The system's primary functionalities are put to the test by creating test cases. The concepts of black box, unit, and integration testing have been discussed, as well as how they are used to evaluate capability and usability. Each test case is presented in detail using a table.

6.2 Test Methodology

The test is conducted to verify that whether the system features are operating normally or not. All features of the application and hardware are tested in software and hardware testing. The hardware's functionality and response time is observed. The output that is generated by the hardware is then passed on to the application. Each feature of the system is tested in real world environment.

6.3 Test Bed

An android mobile phone with android version 6 is used for the execution and testing of the developed android application. A test bed is an execution environment used for the testing purposes. Here system is provided with necessary software and hardware components required for generating expected outputs. An Android mobile phone with android version 9 is used for the execution and testing of developed android application. PC (personal computer) is needed to check the hardware which runs on Windows 8 or higher.

6.4 System Test Case

To detect all possible faults and glitches in the system, application test cases are designed and executed. System testing aids in the improvement of the overall system's functionality as well as the validation that the process is based in accordance with the specifications.if system is showing any malfunctioning then finding out what that malfunction is and sorting it out with keeping the system requirements intact.

6.5 Test Cases

Test cases are circumstances that a tester uses to evaluate whether or not the system being developed satisfies the criteria. In order to test a system, test cases are planned and structured accordingly. After running the test, the tester determines which test cases were successful and which were unsuccessful. Each module is put through its paces on its own. Every test plan is created expressly for a given situation.

6.5.1 Product Scan Test Case

The TC-01 is done to check whether product is getting scanned properly or not. Scanning product is a major part of the project.

Table 6.1 Product Scan Test Case

Test Case ID	**Use Case Reference**	**QA Test Engineer**	**Name of Personnel**
TC-1	UC-1	Tester	Sohaib Aftab
Test Date	27-11-2021		
Objective	To scan product using RFID scanner		
Environment	User Mode		
Assumptions	User runs the system.		
Pre-Requisite	Arduino and all the other hardware components are working properly.		
Steps #	**Execution Description**	**Procedure Result**	
1.	User chooses a product to scan having RFID sticker	Product is chosen successfully.	
Expected Result	Product is Scanned Properly and product information is displayed on the screen.		
Actual Result	User has successfully scanned the product.		
Status	☑ Pass	□ Fail	□ Not Executed

6.5.2 Adding Product Test Case

TC-02 adding product amount is tested. System is checked whether the add button is working properly or not. When the product is scanned by the user, the product information is displayed on the LCD screen. Add button will be pressed by the user to add the scanned product into the total bill. If the amount is added to the total bill then the system will be considered as working properly. Table 6.2 shows the test case.

Table 6.2 Adding Product Test Case

Test Case ID	**Use Case Reference**	**QA Test Engineer**	**Name of Personnel**
TC-2	UC-1	Tester	Muhammad Ahmed
Test Date	12-10-2021		
Objective	User wants to add the amount of scanned product to the bill.		
Environment	User Mode		
Assumptions	User has already scanned the product successfully.		
Pre-Requisite	User is seeing the product information on the LCD screen.		
Steps #	**Execution Description**	**Procedure Result**	
1. **2.**	Check whether the add button is working properly. Check whether the amount of scanned product is added to the total bill.	Button is pressed by the user and amount is added. Total bill is updated successfully.	
Expected Result	Add button is working properly and scanned product amount is added to the total bill.		
Actual Result	User has added the product to the total bill and bill is updated as well.		
Status	☑ **Pass** □ **Fail** □ **Not Executed**		

6.5.3 QR Code Generation Test Case

Table 6.3 explains the QR Code generation test case. When the user is done with the shopping, he/she can see the total bill on the LCD screen. When the user presses “generate total bill” button, system will generate a QR code on the OLED screen to be scanned by the mobile application for payment procedure. The information gathered here will be passed on for the information delivery services for the user and QR code generation.

Table 6.3 QR Code Generation Test Case

Test Case ID	**Use Case Reference**	**QA Test Engineer**	**Name of Personnel**
TC-3	UC-2	Tester	Muhammad Ahmed
Test Date	26-11-2021		
Objective	User wants to generate a QR code having total bill on the back end.		
Environment	User Mode		
Assumptions	User has completely his/her shopping.		
Pre-Requisite	User is seeing the total bill on the LCD screen.		
Steps #	**Execution Description**	**Procedure Result**	
1.	Press generate total bill button available on the panel.	QR code will be generated on the LED screen.	
Expected Result	When generate total bill button is pressed a QR code will appear on the LED screen.		
Actual Result	User pressed the button and QR code is generated successfully.		
Status	☑ **Pass** □ **Fail** □ **Not Executed**		

6.5.4 Scanning QR Code Test Case

This test case will check the functionality of the mobile application. When the QR code is available on the LED screen to be scanned, the user will open the application on the android phone. The QR code will be scanned through mobile application to get the bill on mobile application.

Table 6.4 Scanning QR Code Test Case

Test Case ID	**Use Case Reference**	**QA Test Engineer**	**Name of Personnel**
TC-4	UC-2	Tester	Ghazala Zainab
Test Date	28-10-2021		
Objective	User wants to scan the QR code present on the OLED through mobile application.		
Environment	User Mode		
Assumptions	QR code is generated on the OLED screen.		
Pre-Requisite	QR code is generated and mobile application is in working condition.		
Steps #	**Execution Description**	**Procedure Result**	
1.	User will scan the QR code through mobile application	Camera is opened on the application to scan	
2.	Scan button is pressed by the user on application to scan the QR code.	QR code is scanned successfully.	
Expected Result	QR code is scanned successfully through mobile application by the user.		
Actual Result	User has scanned the QR code through application.		
Status	☑ **Pass** □ **Fail** □ **Not Executed**		

6.5.5 Online Payment Test Case

Table 6.5 describes if the user is able to do the online payment process. When the total bill is visible on the mobile application, the user will choose online payment process. After entering his/her credentials, the user will be able to do the payment online successfully.

Table 6.5 Online Payment Test Case

Test Case ID	**Use Case Reference**	**QA Test Engineer**	**Name of Personnel**
TC-5	UC-4	Tester	Sohaib Aftab
Test Date	23-11-2021		
Objective	User wants to do online payment process through mobile application.		
Environment	User Mode		
Assumptions	User wants to pay the bill online.		
Pre-Requisite	Total bill is displaying on the mobile application.		
Steps #	**Execution Description**	**Procedure Result**	
1.	User will select online payment method.	Online Payment process will become active.	
2.	Credentials are entered for the payment to be processed.	All the credentials are entered by the user.	
Expected Result	Online Payment is done successfully by the user.		
Actual Result	User has done online payment through mobile application.		
Status	☑ **Pass** ☐ **Fail** ☐ **Not Executed**		

6.5.6 Zoom in and out Test case

In this test case basically camera functionality is checked. The application allows camera to zoom in or zoom out to scan the QR code if the code is not properly visible. The result of current test case is that application is able to move the camera according to the requirements of the user.

Table 6.6 Zoom in and out Test case

Test Case ID	Use Case Reference	QA Test Engineer	Name of Personnel
TC-6	UC-3	Tester	Muhammad Ahmed
Test Date	22-11-2021		
Objective	User wants to zoom in and zoom out the camera to scan the QR code from the OLED screen.		
Environment	User Mode		
Assumptions	Zoom in or zoom out is required by the user to scan the QR code.		
Pre-Requisite	Mobile Application is in ready state.		
Steps #	**Execution Description**	**Procedure Result**	
1.	Zoom in or Zoom out is done by the user.	Camera will zoom in or zoom out depending upon the user needs.	
Expected Result	Camera moves according to the user needs.		
Actual Result	Application successfully zooms in or out the camera.		
Status	☑ **Pass** ☐ **Fail** ☐ **Not Executed**		

6.5.7 Scan Image from Gallery Test Case

Table 6.7 describes the scan image from gallery option. If user captures an image from the phone's camera without using the mobile application, the application will be able to grab QR code from that image as well. The application will automatically captures the QR code from that image giving out the output from the QR code.

Table 6.7 Scan Image from Gallery Test Case

Test Case ID	**Use Case Reference**	**QA Test Engineer**	**Name of Personnel**
TC-7	UC-3	Tester	Ghazala Zainab
Test Date	17-11-2021		
Objective	Application is able to scan any image from the gallery for QR code.		
Environment	User Mode		
Assumptions	User uses the mobile camera for taking picture of the QR code for better results.		
Pre-Requisite	Picture of the QR code is present in the gallery of android phone.		
Steps #	**Execution Description**	**Procedure Result**	
1. **2.**	Scan image option is available on the mobile application. Image is selected from the gallery by the user.	Application opens the phone gallery to select an image for scan. The image is scanned and QR code is scanned successfully from the image.	
Expected Result	Image is selected from the gallery by the user and QR code is successfully scanned from that image displaying its result.		
Actual Result	User has successfully scanned the image from gallery		
Status	☑ **Pass** ☐ **Fail** ☐ **Not Executed**		

6.6 Summary

The testing is done to validate the system functionalities, checking whether the system works according to the expectation or not. It is the approach to identifying system flaws and mistakes. The system's functioning is thoroughly tested before being documented. The reaction of the system to user behavior is preserved. Diverse test cases are generated to check all of the system's major and minor implementations. The obvious system performs all of the functions correctly.

CHAPTER 7

CONCLUSION AND FUTURE WORK

7.1 Overview of Chapter

The system's findings and suggestions for future research are presented in this chapter. It includes an overview of how much functionalities are successfully implemented that were discussed earlier, what milestones are achieved during the system development. Future works are also mentioned for improvement. The system restrictions are the challenges for the developers which they have to overcome in future.

7.2 System Overview

The project, “Smart Shopping Cart” is a hardware and software based system that gives users the authority to scan the grocery items while shopping and paying their bills online, eradicating the need to stand in long queues for getting their items scanned and paying bill manually to a cashier. The user can scan a grocery item that will have a pre-installed RFID tag, with an RFID scanner and add that item to the list by pressing a simple button. Upon the completion of a user’s shopping, the user just has to push another button to generate the final bill in the form of a QR code. The user can scan this code with the help of Smart Shopping Cart android app and pay their bill online. The application will be developed on Android studio using Kotlin and Java whereas for the hardware part, Arduino is used as the main micro controller, using C language for its hard coding.

7.3 Milestones Achieved

The milestones that are achieved successfully are given below:

7.3.1 Hardware Milestones

The milestones that were achieved for Hardware part of the system are:

7.3.1.1 Responsive RFID scanner

A responsive RFID scanner has been integrated in the system that can scan any RFID tag with frequency of 13.56 MHz the scanner is successfully scanning the RFID tags and sending the scanned information to the microprocessor for further processing.

7.3.1.2 LCD screen

A working LCD has been installed in the system that displays the information of scanned items.

7.3.1.3 Responsive Buttons

Two buttons have been added in the system. One to add item to the list and the other to generate the QR code, both are performing their functionalities correctly.

7.3.1.4 QR code Generator.

Upon pushing the QR code button, a QR code is successfully generated on the OLED screen, having stored the updated list of items.

7.3.2 Smart Shopping Cart Application.

The Milestones that are achieved in Smart Shopping Cart application are:

7.3.2.1 QR code Scanner

The first interface that the user sees after opening the app is the QR code scanner. That uses the cell phone's camera to scan the QR code. This has been set as the default page for the ease of the user**.**

7.3.2.2 Zoom In and Out

The user has the option to zoom in or out to focus on the QR code.

7.3.2.3 Flash Light

An option to turn the flash light on or off is also given, in case of low light the user is able to turn on the flash light.

7.3.2.4 Scan Image from Gallery

User can also scan an image of QR code from the gallery.

7.3.2.5 History

User can see the history of all the Scanned QR codes whenever needed.

7.3.2.6 Pay Online

User is able to pay the generated bill online by entering their card credentials.

7.3.2.7 Save as Image

User can also save the receipt in the form of an image in their gallery.

7.3.2.8 Share as image or text

The user has the option of sharing the receipt as a picture or as text, directly from the app.

7.4 Limitations

The system also has few limitations which will be explained in this paragraph. This application is specifically targeting the offline audience only that’s why it doesn’t have a login system. Another limitation is that this application is not available for IOs users.

7.5 Future Work

In the future, it is also feasible to create a IOs device version of the application, so that Apple users can do the same with their IO device as well. With the advancement of technology, the hardware part can also be upgraded, using active tags instead of passive tags as active tags have higher frequency and can be scanned from more distance. In the future it is also possible to make the hardware part completely as touch interface.

7.6 Summary

The project, Smart Shopping Cart is a real time system designed to help the users to save their valuable time while shopping, providing them with the ease to scan every grocery item they want themselves, and paying the bills online. This will save the user’s time as well as the hassle to stand in long queues and waiting for their turn. This system also provides the user with real time total of their bill so they can keep an eye on their budget while shopping. Smart Shopping Cart is overall a system that brings ease in to the user’s life and provides solution to their problems faced while shopping.

APPENDICES

Appendix I – User Manual

Scanning RFID Stickers

The figure A.1 shows RFID scanner. User will have to place the product having RFID sticker on the RFID scanner to scan it. If the product is scanned successfully, product details will be displayed on the LCD screen.

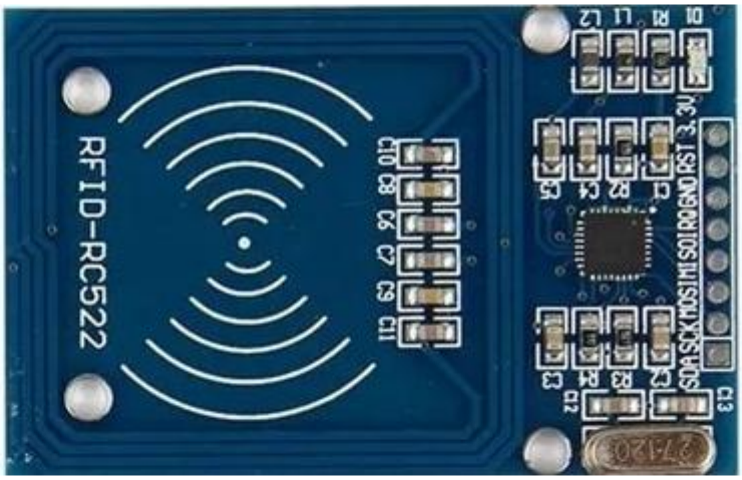


Figure A.1: RFID Scanner

Add Button

The figure A.2 shows the buttons that the user will have to press to add the scanned product into the list of products

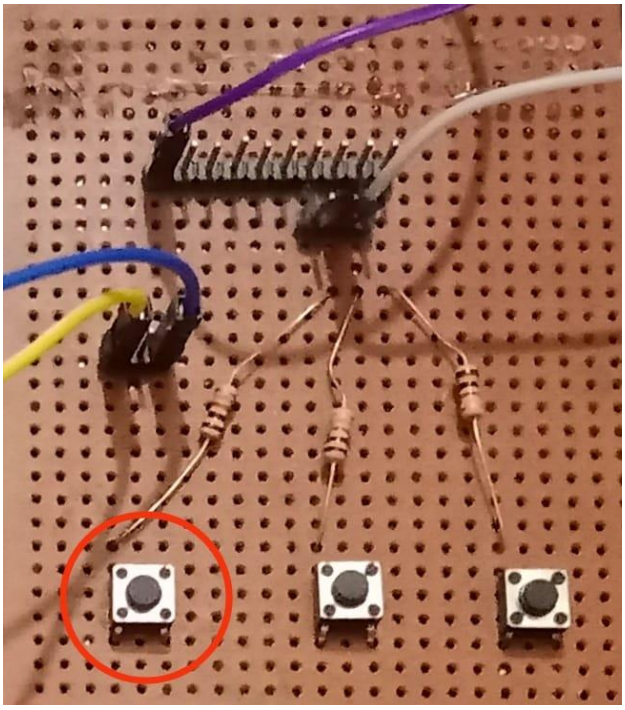


Figure A.2: Add product button

Generate QR code button

Upon completion of the user's shopping, the user will press the button shown in Fig A.3 to generate the total bill and QR Code.

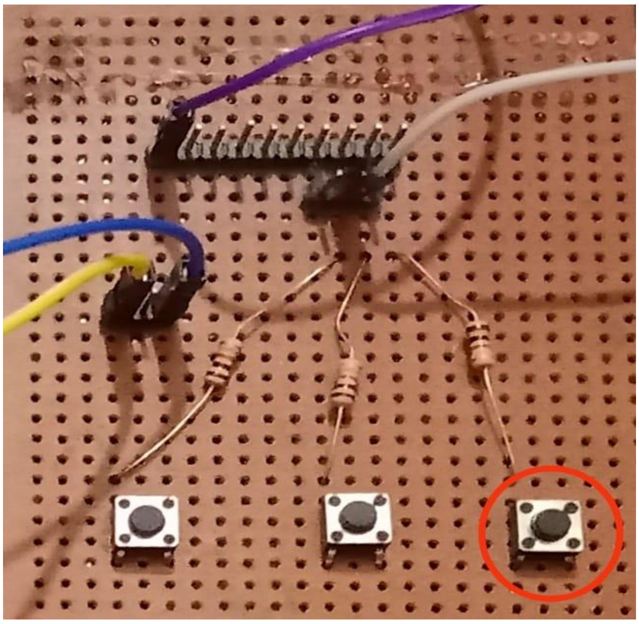


Figure A.3: Generate QR Code button

Main Menu

The figure A.4 shows the first page that the user will interact with. The user has been provided with the ease of self-opening camera; as soon as the user opens the app the camera is opened for scanning the QR-code. User has been given all the features that exist with a normal camera like zooming in/out and flashlight for better user experience.

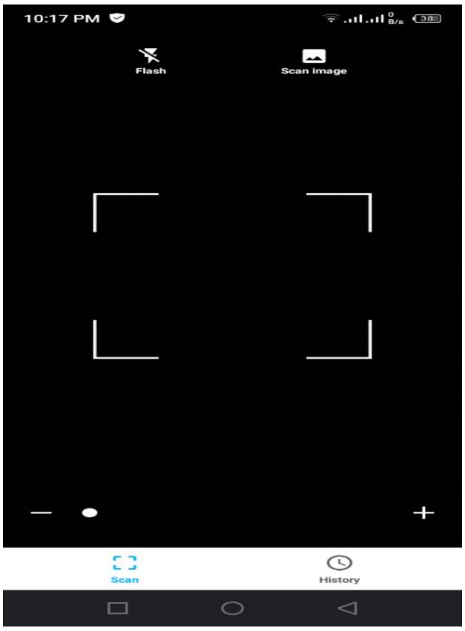


Figure A.4: Main Menu

Scan QR code

The figure A.5 shows how the user will scan the QR code by placing it on the QR code such that the QR code fits inside the given box.

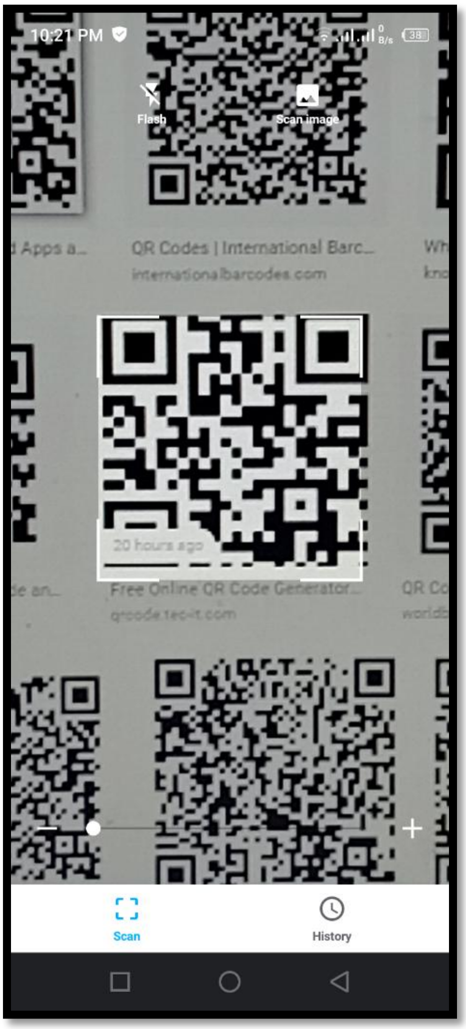
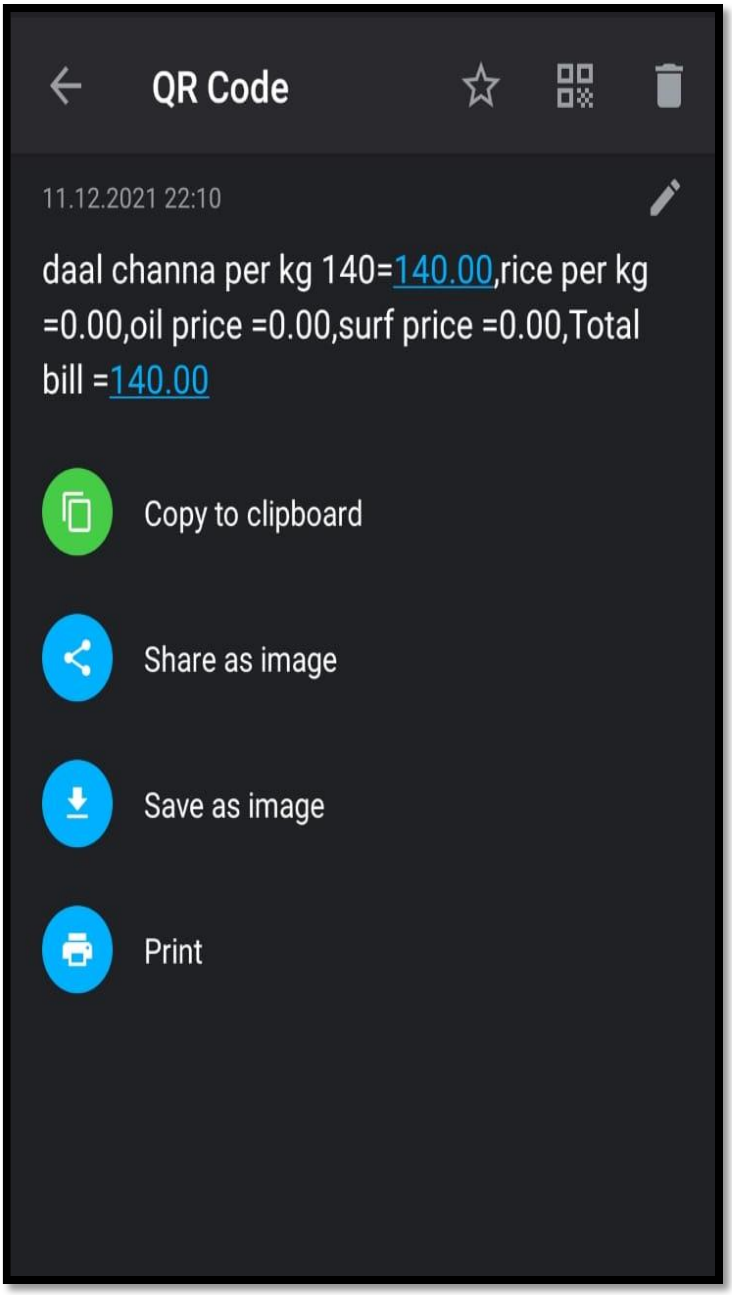

10:21 PM
Flash
Scan image
QR Codes | International Barc...
internationalbarcodes.com
20 hours ago
Free Online QR Code Generator...
qrcode.tec-it.com
Scan
History

Figure A.5: Scan QR code

Generated Bill

Once the QR code is scanned, a bill of the user’s shopping will be available with the total amount to be paid as shown in A.6.



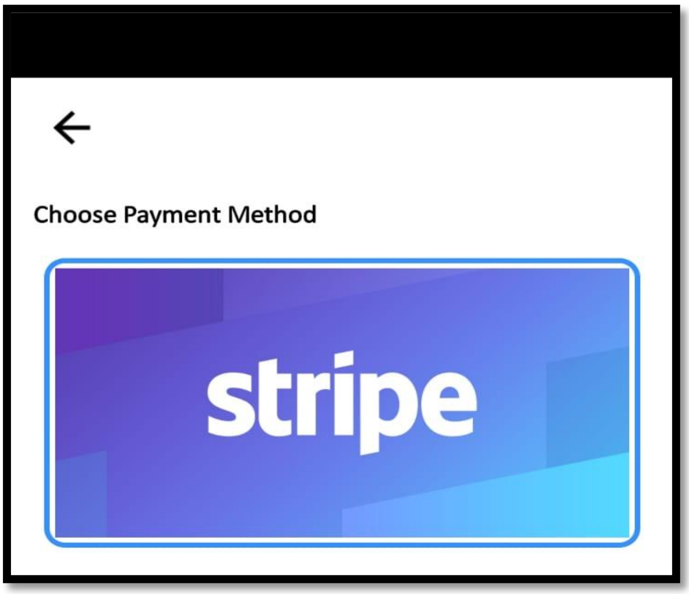
11.12.2021 22:10

daal channa per kg 140=140.00,rice per kg =0.00,oil price =0.00,surf price =0.00,Total bill =140.00

Figure A.6: Generated Bill

Choose Payment Method

User will choose the stripe payment method for the online payment.

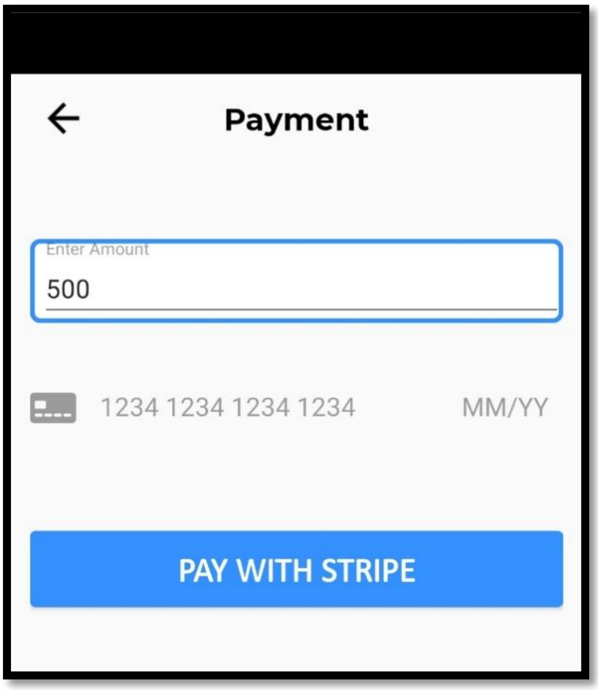


Choose Payment Method

Figure A.7: Choose Payment Method

Pay with Stripe

User will enter his/her card credentials for the payment procedure and will select the “Pay with Stripe” button to pay the total generated bill.



Payment

Enter Amount
500

1234 1234 1234 1234 MM/YY

Figure A.8: Payment with Stripe

Appendix II – Glossary

Actor: The Actor that are present in use case diagram is anything outside the system that performs communication with the system. Here actor is the user or the customer that will use the smart cart and its application.

GUI: GUI stands for Graphical User Interface. When a user interacts with an electronic device by using some graphical icons to make good user experience then this will be implementation of GUI.

Existing System: It is a system that is already developed and is in use by many people.

Sequence Diagram: The interference between an entity and a use case is depicted in the sequence diagram. It specifies how a process works in order to execute a specific task.

UML: Unified Modeling Language shows the main design of the system in a visual form. It is used in the software engineering field for better understanding of the system.

Use Case: Use case shows the relation between the system and actors (external). It describes how well an actor accesses the platform and also how particular actions are carried out.

RFID Scanner: The scanner sends and receives signals by electromagnetic field. Tags are tracked by the radio frequency they are generating.

RFID Sticker: RFID sticker consist of an antenna printed on a paper and connected to a very thin Integrated circuit. These stickers are passive RFID tags meaning that they don’t have their own energy they get the energy from RFID reader. Tag gets transmission from antenna and then the energy is passed to the internal chip of the tag. Because of this energy chip gets activated and the information is modulated by transmitting a signal back to the reader.

RC522: RC522 is a module used in our system to scan RFID stickers. The RC522 generates an electromagnetic field of 13.56 megahertz that it involves use of RFID stickers to interact directly.

QR-Code: A QR layer is composed of a black squares and a series of pixels which are representing certain piece of information. When this code is scanned by a smart phone having a QR reader app, it converts the information in to something that can be easily understood by humans.

OLED: OLED stands for Organic Light-Emitting Diode, which is a screen that can display some information in better quality then LCDs.

LCD: LCD stands for Liquid Crystal Display. It is a screen used to display some information.

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