Abstract

All of us have been shopping in supermarkets and malls. Most of the times we require a trolley to place our purchases. Every time we have to pull the trolley from rack to rack for collecting items and at the same time also do calculation of those items and need to compare it with our budget. After this procedure, comes the long process of waiting in queue for billing. So, to avoid all of these tedious tasks, we are introducing new concept that is "SMART TROLLEY FOR MEGA MALL". In modern era, for automation of mall we are developing a microprocessor based SMART TROLLEY. The customer simply has to hold the barcode side of the product wrapper in front of barcode scanner. Then corresponding data regarding product will be sent to the server and a bill will be generated as well. The system will be placed in all the trolleys. As we put the products, the cost will get added to total bill. Thus the billing will be done in the trolley itself. Item name and its cost will be displayed on LCD.

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Synopsis

1.1   Project Title

IOT Based Shopping Trolley For Mega Mart Billing System

1.2   Project Option

In-House Project

1.3   Internal Guide

1.4   Sponsorship and External Guide

- Sponsorship: IN-HOUSE Project

- External Guide:

1.5   Technical Keywords

Shopping malls, LCD display,Trolley,Bar code Scanner.

1.6   Problem Statements

Smart Trolley system using IoT to reduce time required for billing at supermarkets/shopping malls

1.7   Abstract

All of us have been shopping in supermarkets and malls. Most of the times we require a trolley to place our purchases. Every time we have to pull the trolley from rack to rack for collecting items and at the same time also do calculation of those items and need to compare it with our budget. After this procedure, comes the long process of waiting in queue for billing. So, to avoid all of these tedious tasks, we are introducing new concept that is "SMART TROLLEY FOR MEGA MALL". In modern era, for automation of mall we are developing a microprocessor based SMART TROLLEY.

The customer simply has to hold the barcode side of the product wrapper in front of barcode scanner. Then corresponding data regarding product will be sent to the server and a bill will be generated as well. The system will be placed in all the trolleys. As we put the products, the cost will get added to total bill. Thus the billing will be done in the trolley itself. Item name and its cost will be displayed on LCD.

Thus, the project aims to save time waiting in the queue and this enhance the overall shopping experience.

1.8 Goal and Objective

- Scan items purchases by customer at the trolley itself.

- Easier generation of final bill.

- Reducing the time spent by customer at the billing counter.

- Terminate long queues at the billing counter.

- Thus, enhance the overall shopping experience.

1.9 Relevant Mathematics Associated With The Project

System Description:

- Input : Barcode

- Output: Bill

- Success Condition: Generation of bill

- Failure: System Crash,barcode data not found

1.10 Name Of Journals Where Paper Can be Published

1. IEEE Journal-I
2. SPPU Conference
3. IJSER Journal
4. CSI Conference

1.11   Review Of Conference Paper

- Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks published in SENSORCOMM 2013 : The Seventh International Conference on Sensor Technologies and Applications

- IOT Based Intelligent Trolley for Shopping Mall published in c 2016 IJEDR | Volume 4, Issue 2 | ISSN: 2321-9939

- AUTOMATED SHOPPING TROLLEY published in International Journal of
  Advanced Research in Biology Engineering Science and Technology (IJARBEST) Vol. 2, Special Issue 10, March 2016

- Automated Shopping Trolley for Super Market Billing System published in International Journal of Computer Applications (0975 – 8887) International Conference on Communication, Computing and Information Technology (ICCCMIT-2014)

- RFID Based Automatic Billing Trolley published in International Journal of
  Emerging Technology and Advanced Engineering Website: www.ijetae.com
  (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 3, March 2014)

1.12   Plan of Project Execution

Sr.no.	Task	Duration	Start Date	End Date
1	Planning	19	01-08-2017	19-08-2017
2	Requirements	10	20-08-2017	30-08-2017
3	Feasibility ok	7	05-09-2017	12-09-2017
4	Analysis	6	20-09-20167	26-09-2017
5	Design	9	27-09-2017	04-10-2017
6	Coding Phase1	15	05-10-2017	19-10-2017
7	Coding Phase2	20	03-11-2017	25-11-2017
8	Code Review	13	07-12-2017	19-12-2017
9	Testing	15	01-01-2018	10-01-2018
10	Documentation	28	01-03-2018	28-03-2018

Chapter 2

Technical Keywords

2.1   Area Of Project

IOT Based Project using embedded system. Product can be used in various shopping marts.

2.2   Technical Keywords

- **IOT:The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to connect and exchange data.Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.**

- **Raspberry Pi:A Raspberry Pi is a credit card-sized computer originally designed for education, inspired by the 1981 BBC Micro. Creator Eben Upton's goal was to create a low-cost device that would improve programming skills and hardware understanding at the pre-university level.The Raspberry Pi is slower than a modern laptop or desktop but is still a complete Linux computer and can provide all the expected abilities that implies, at a low-power consumption level.**

- **LCD display: A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome.**

- **Barcode Scanner: A barcode reader (or barcode scanner) is an electronic device that can read and output printed barcodes to a computer, Like a flatbed scanner, it consists of a light source, a lens and a light sensor translating optical impulses into electrical ones. Additionally, nearly all barcode readers contain decoder circuitry analyzing the barcode's image data provided by the sensor and sending the barcode's content to the scanner's output port.**

Chapter 3

Introduction

3.1 Project Idea

In the modern world, every supermarket and hypermarkets employ shopping baskets and shopping trolleys in order to aid customers to select and store the products which they intend to purchase. The customers have to drop every product which they wish to purchase into the shopping cart and then proceed to checkout at the billing counter. The billing process is quite tedious and highly time consuming and has created the need for shops to employ more and more human resource in the billing section, and yet waiting time remains considerably high. In this paper, we seem it fit to propose the "Intelligent Shopping Basket" which aims to reduce ,and possibly eliminate the total waiting time of customers, lower the total manpower requirement and expenses for markets and increase efficiency overall. In a world where technology is replacing the ways we pursue everyday activity, the future of the retail industry also lies in more and more automated devices.

3.2 Motivation Of The Project

- Technology has advanced majorly and life has been made simpler by these developments. However, the systems present in supermarkets and shopping malls is remained pretty much the same. The process of billing in these places is cumbersome and agonizingly time consuming.

- As the number of items purchased increases, the time required to scan each item and generate the final bill increases linearly.

- The main aim behind this project is to enhance the shopping experience of the customers by efficient generation of bill using IoT based smart trolley, thereby saving a lot of precious time and man-power.

3.3   Literature Survey

3.3.1   Existing Techniques

3.3.1.1 Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks published in SENSORCOMM 2013

- Barcode scanner attached to every shopping cart. this design includes a camera-based barcode scanner, which is fitted to the cart. The barcode scanner identifies a product so that its price can be determined from the database.

- The weight attribute of a product has been chosen for a way to double-check the identity of product in order to detect deception.

- A load-cell has been configured as a weight sensor .If the weight of a product estimated by the load-cell is not the same as the actual weight of the product, it is interpreted as a case of discrepancy.

- The decision-making process make use of Image Processing. While the barcode of the product is being scanned, a picture of the product is taken by the same camera that also works as the barcode scanner. There is a slab attached to the top of the cart which is meant to play the role of placing the products into the cart when it is triggered to do so, instead of the customer having to put the product into the cart by himself.

- The person places the product on this slab once the scanning is over. Another picture of the product is taken just before the slab lets the product into the cart. Both the images are stored locally in the system present at the cart. An image comparison algorithm is run on these two images to find if they are the same products. If they are not found to be the same, it is interpreted as a case of discrepancy.

3.3.1.2 IOT Based Intelligent Trolley for Shopping Mall published in c 2016 IJEDR | Volume 4, Issue 2 | ISSN: 2321-9939

- It has two sections transmitter section and receiver sections. First initialize the power of kit then it is ready to use for customer.

- If customer wants to purchase any product then he/she has to put the product in the trolley. As soon as the product falls in the trolley the RFID reader read the RFID Tag place on the product. This RFID reader is connected to the microprocessor.

- Microprocessor crosschecks the information get from RFID reader and information in the memory of microprocessor. If the information get match then the cost of product, name of product and the total bill display on the LCD. If user wants to remove any product then

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he/she simply remove that product from the trolley then LCD again display the name of product, cost of product and the total bill.

• ESP transfer the information to the main server which is in the range. This main server has its own cloud from that owner can access the information from anywhere and anytime with the help of user ID and password.

3.3.1.3 AUTOMATED SHOPPING TROLLEY published in International Journal of Advanced Research in Biology Engineering Science and Technology (IJARBEST) Vol. 2, Special Issue 10, March 2016

• The structure of the goods carrier consists of the robotic structure and the color sensor, which is used to navigate the robotic goods carrier along the particular way. The keypad is used to give the commands to the controller for where the robotic carrier has to move on.

• It has the product code reader inbuilt. The use of product code reader is to read the bar codes of all products to define the prices of the products.

• Depend on the signal from the reader, the controller display the price of the each product by using the LCD display. The wireless billing system is made up of the zigbee communication module.

3.3.1.4 Automated Shopping Trolley for Super Market Billing System published in International Journal of Computer Applications (0975 – 8887) International Conference on Communication, Computing and Information Technology (ICCCMIT-2014)

• In this approach 2 barcode scanners are used, first is at entry point from which we will add the product in the trolley, and another is at exit point from where we take out the product from trolley which we don't want to buy.

• when we add the product it will be scanned by the scanner while putting it in trolley.

• A wireless smart device makes note of all the scanned commodities of the particular trolley and it is linked with the mall's backend database which contains information of the product i.e. Price and available stock. The scanned devices are added in the bill and the total cost and number of products are displayed on the LCD Display.

3.3.1.5 RFID Based Automatic Billing Trolley published in International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 3, March 2014)

- When the customer purchase a product, she/he first scans the RF tag of the product using the RFID reader and then places it into the trolley .

- Information stored in system's memory is compared with the lookup table.

- At the same time ARM processor sends the same information to computer for billing purpose.

- Used IR sensor for counting purpose.

- After completion of shopping, a key is pressed Indicating final billing of all the products.

- Thus the final information of all products is transmitted to computer with the help of serial communication and the final billing is done by computer.

Chapter 4

Problem Definition And Scope

4.1   Problem Statement

Smart Trolley system using IoT to reduce time required for billing at supermarkets/shopping malls

4.1.1   Goal and Objects

Goal:

- The system will be based on IoT technology aims to simplify billing process and reduce time spent in shopping.

- The supermarket's/shopping mall's human workload is reduced and efficiency of the process is increased.

- Hence the main goal of the project is making the operation of supermarkets easier and also greatly enhance the shopping experience of consumers.

- This system will benefit both, the customer(end user) and the market staff.

Objective:

- **Scan items purchased by customer at the trolley itself.**

- **Easier generation of final bill.**

- **Reducing the time spent by customer at the billing counter.**

- **Terminate long queues at the billing counter.**

- **Thus, enhance the overall shopping experience.**

4.2   Major Constraints

1.Customer work increased as they have to scan all product while shopping.
2.Hardware requirement is more.

4.3   Methodology of Problem Solving And Efficiency Issues

4.4   Outcomes

1.When customer has finished shopping, bill generated at counter already and only payment is to be made.
2.Total amount displayed on the trolley via display.

4.5   Application

To enhance the shopping experience of the customers by efficient generation of bill using IoT based smart trolley, thereby saving a lot of precious time and manpower.

4.6   Hardware Resources Required

1.USB Barcode Scanner
2.Raspberri pi 3
3.Battery/Power Bank
4.LCD display
5.LEDs 6.Button

4.7 Software Resources Required

1.HTML
2.CSS
3.PHP
4.MYSQL
5.BOOTSTRAP
6.JAVA SCRIPT

Chapter 5

Project Plan

5.1 Project Estimate

5.1.1 Reconciled Estimates

5.1.1.1 Cost Estimation

- USB Barcode Scanner : 1700 Rs.

- Battery or Power Bank : 100 to 700 Rs

- 10 Jumper Wires : 50 Rs.

- Basket :420 Rs.

- LCD Display :150 Rs.

- 3 LEDs: 3 Rs.

5.1.1.2 Time Estimation

Sr.no.	Task	Duration	Start Date	End Date
1	Planning	19	01-08-2017	19-08-2017
2	Requirements	10	20-08-2017	30-08-2017
3	Feasibility ok	7	05-09-2017	12-09-2017
4	Analysis	6	20-09-20167	26-09-2017

5	Design	9	27-09-2017	04-10-2017
6	Coding Phase1	15	05-10-2017	19-10-2017
7	Coding Phase2	20	03-11-2017	25-11-2017
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9	Testing	15	01-01-2018	10-01-2018
10	Documentation	28	01-03-2018	28-03-2018

5.1.2   Project Resources

1.Hardware:

- **USB Barcode Scanner**

- **Raspberri pi 3**

- **Battery/Power Bank**

- **LCD display**

- **LEDs • Button**

2.Software:

- **HTML**

- **CSS**

- **PHP**

- **MYSQL**

- **BOOTSTRAP**

- **JAVA SCRIPT**

- **Python**

5.2   RISK MANAGEMENT W.R.T. NP HARD ANALYSIS

5.2.1   Risk Identification

- **THEFT DETECTION is one of the major challenges.**

- **Scanning of incorrect item.**

5.2.2 Risk Analysis

	Risk Analysis	Impact		
ID	**Risk Description**	**Probability**	**Schedule**	**Quality**	**Overall**
1.	Failure Of Hardware	Low	Low	High	High
2.	Security	Low	Low	Low	Low
3.	Server Down	Low	Medium	High	High

Impact	Value	Description
Very high	> 10%	Schedule impact or Unacceptable quality
High	5 − 10%	Schedule impact or Some parts of the project have low quality
Medium	< 5%	Schedule impact or Barely noticeable degradation in quality Low Impact on schedule or Quality can be incorporated

Figure 5.1: Risk Impact Defination

Probability	Value	Description in Percentage
High	Probability of occurrence is	**<25**
Medium	Probability of occurrence is	**<25**
Low	Probability of occurrence is	**>50**

Risk Id	1
Risk Discription	Failure Of Hardware
Category	Embedded Environment
Source	Software Requirement Specification Documents
Probability	Low
Impact	High
Response	Mitigate
Risk Status	Identified
Risk Id	2
Risk Discription	Security
Category	Security
Source	Software Requirement Specification Documents
Probability	Low

Impact	Low
Response	Mitigate
Risk Status	Identified

Risk Id	3
Risk Discription	Server Down
Category	System
Source	Software
Probability	Low
Impact	High
Response	Mitigate
Risk Status	Identified

5.3   Project Schedule

5.3.1   Project Task Set

- **Barcode scanner for taking input.**

- **Microprocessor for processing and transmission of taken input.**

- **Cloud is used for data storage**

- **Web pages used for bill generation and details of item purchase.**

Chapter 6

Software Requirement Specification

6.1   Introduction

6.1.1   Purpose And Scope Document

Purpose: Smart Trolley system using IoT to reduce time required for billing at supermarkets/shopping malls. The system will be based on IoT technology aims to simplify billing process and reduce time spent in shopping.The supermarket's/shopping mall's human workload is reduced and efficiency of the process is increased. Hence the main goal of the project is making the operation of supermarkets easier and also greatly enhance the shopping experience of consumers.This system will benefit both, the customer(end user) and the market staff.

    Scope: 1.The Product is a new Self-contained Product.

2.It hasn't yet been implemented in India.

6.2   USAGE SCENARIO

6.2.1   Use-Cases

A use case diagram is a graphic depiction of the interactions among the elements of a system. A use case is a methodology used in system analysis to identify, clarify, and organize system requirements.
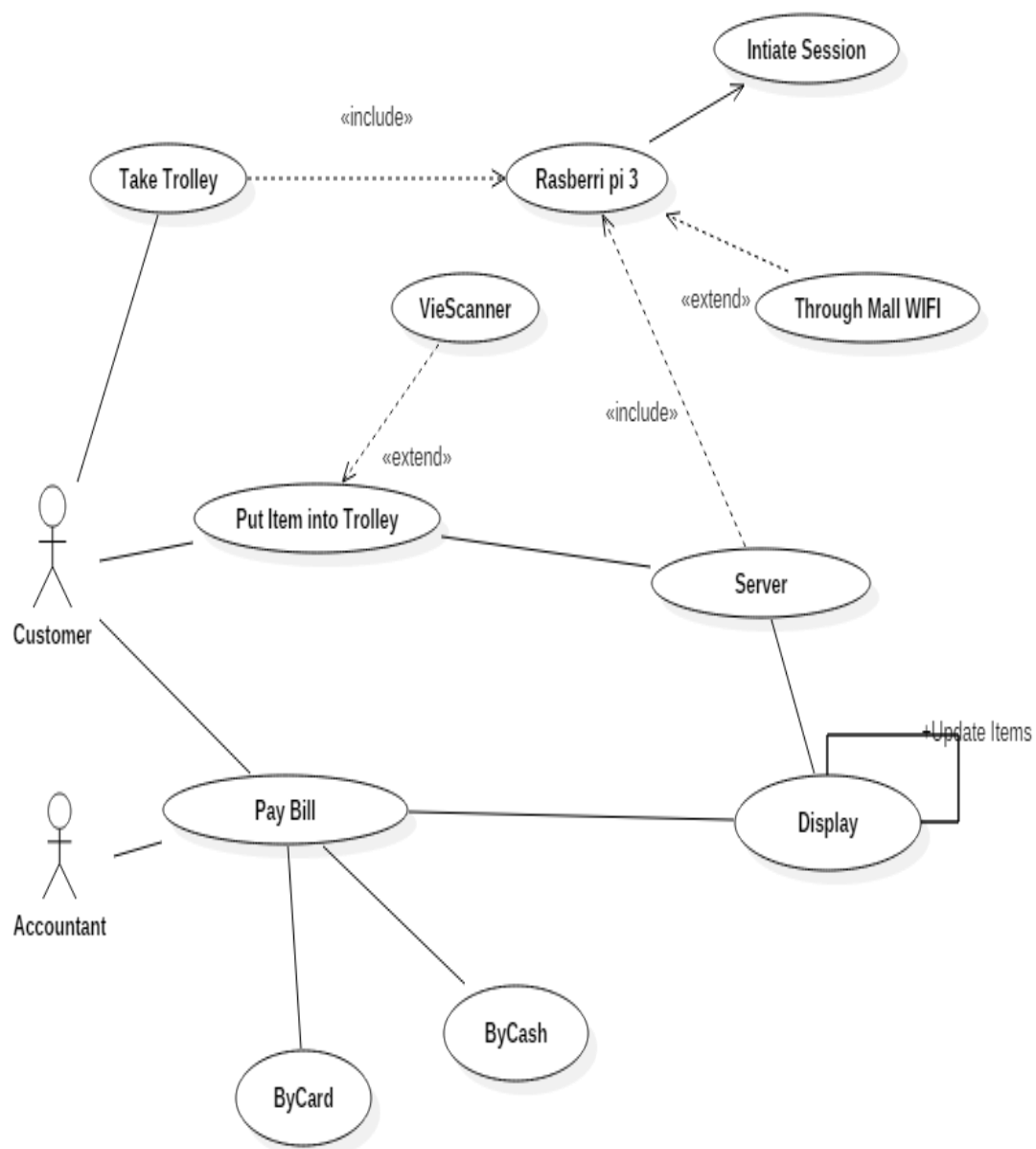
Figure 6.1: Use-Case Diagram

6.3   Functional Models And Decription

6.3.1   Activity Diagram

Activity diagram is another important diagram in UML to describe the dynamic aspects of the system.

Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another.
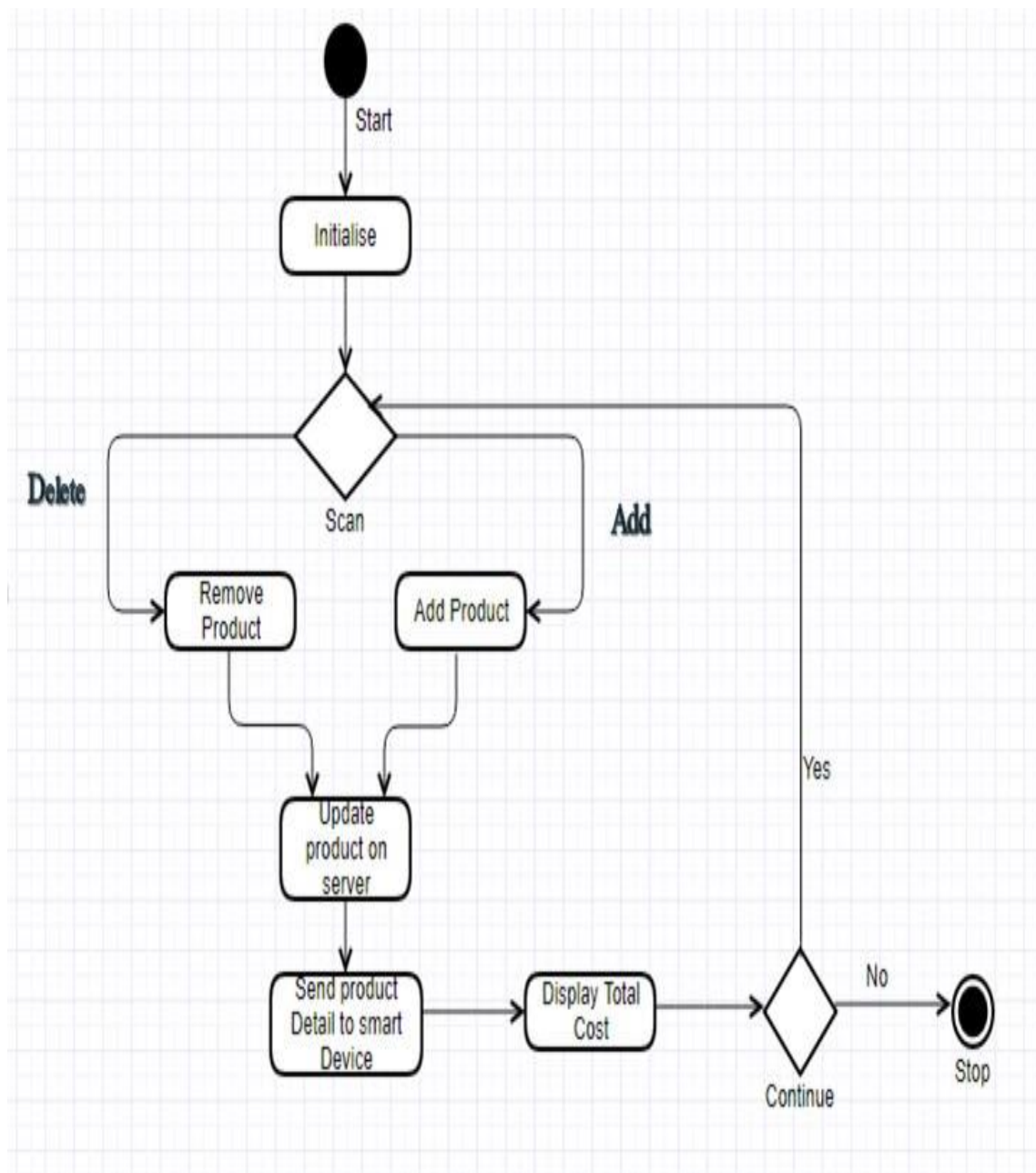
Figure 6.2: Activity Diagram

6.3.2   Design Constraints

1. **THEFT DETECTION is one of the major challenges.**
2. **Scanning of incorrect item.**

6.3.3 State Diagram

The states are represented in ovals and state of system gets changed when certain events occur. The transitions from one state to the other are represented by arrows.
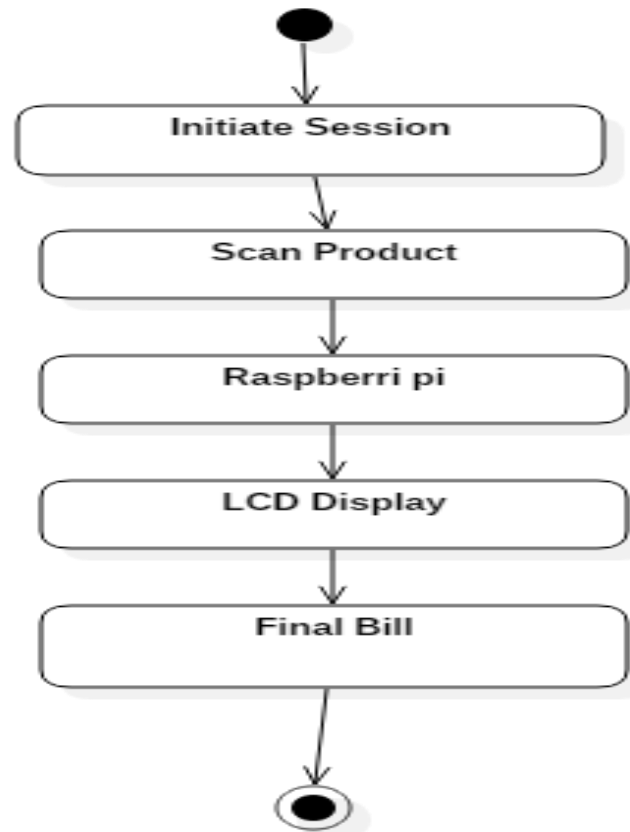
6.3.3.1 Software Interface

Figure 6.3: State Transition Diagram
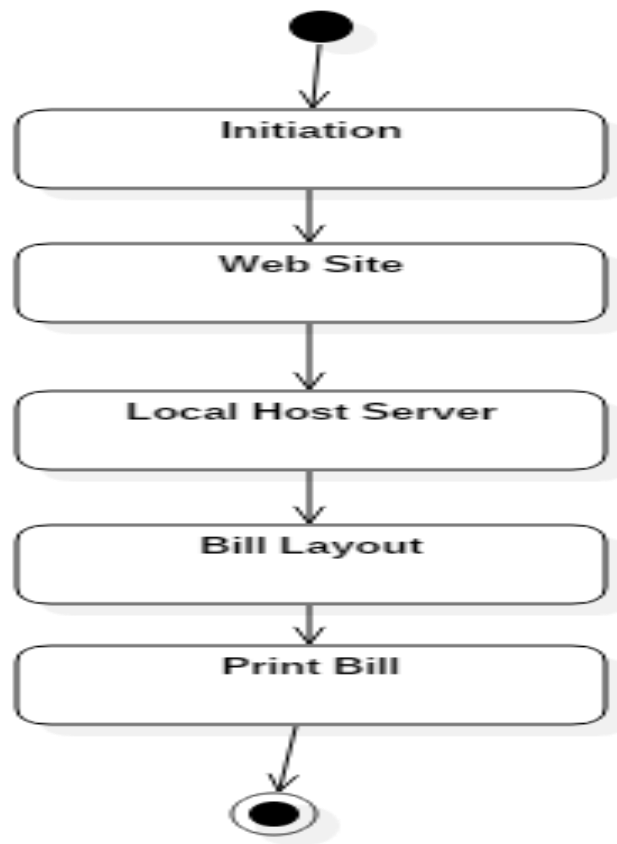
6.3.3.2 Hardware Interface

Figure 6.4: State Transition Diagram

Chapter 7

Details Design Document Using Apendex A And B
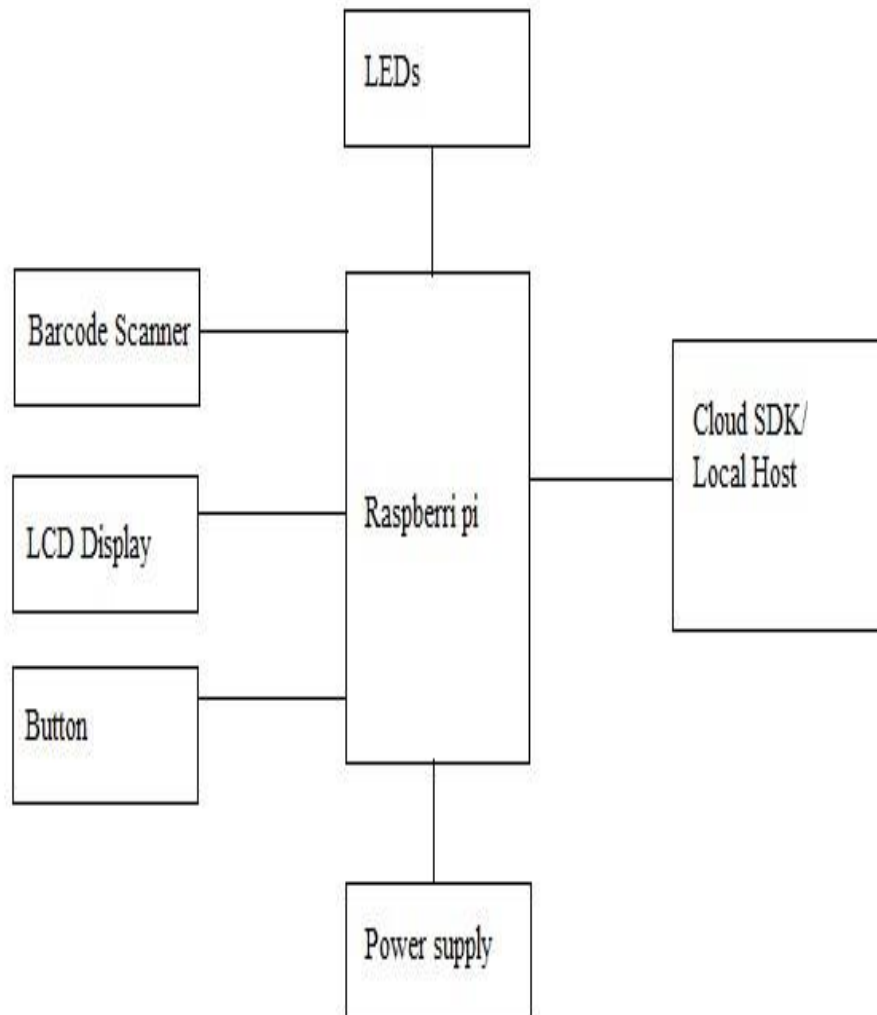
7.1   Architecture Design

Figure 7.1: System Architecture

Figure 7.2: System Architecture

7.2   Data Design

7.2.1   Internal software data structure

- **pinMode - Configures the specified pin to behave either as an input or an output**

- **digitalRead - Returns the value of the digital input port.**

- **digitalWrite - Sets the specified digital pin to HIGH or LOW.**

7.3   Component Design

7.3.1   Class Diagram

A class diagram is an illustration of the relationships and source code dependencies among classes in the Unified Modeling Language (UML). In this context, a class defines the methods and variables in an object, which is a specific entity in a program or the unit of code representing that entity.

- **Trolley:In this section customer scan product and the scanned barcode will be sent to trolley table. Trolley shows total amount and quantity.**

- **Trolley Table: Each trolley have it's own trolley table which is used to store a items entries of particular customer.It searches product in table,if product is not found then it'll send query to main database.**

- **Database: It resolve query which is requested by trolley table. Its functionality is to search a requested query and send to trolley table and Adding and Removing items in main database.**

- **Bill: It only consist of amount and quantity which is displayed on LCD.**

- **Final Bill: It's given to the customer after completion of shopping.**
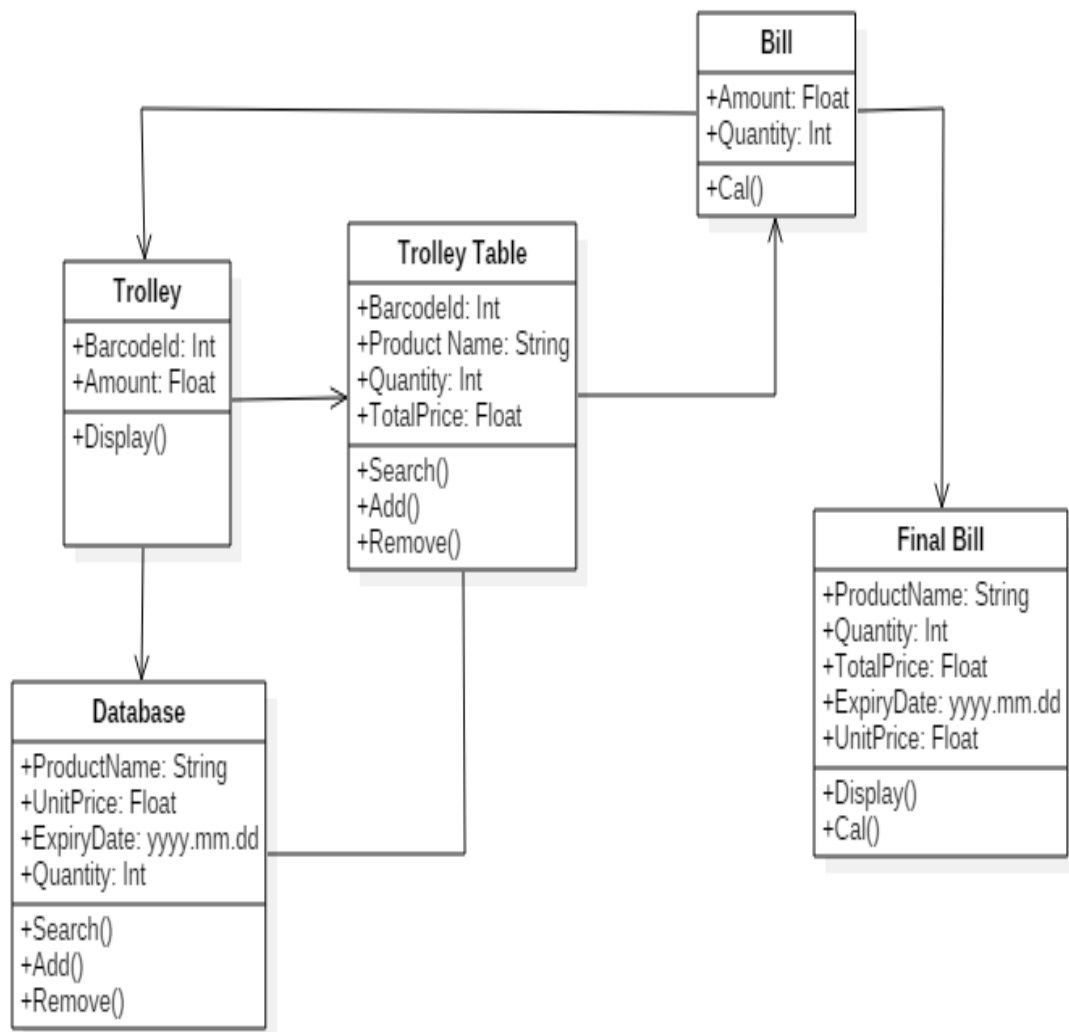 **It consist of each items Detail information like quantity,price,expiry date etc.**

Figure 7.3: Class Diagram

Chapter 8

Project Implementation

8.1   INTRODUCTION

The product created has two main components :
1. Hardware Module
2. Sever Side Module

8.1.1   HARDWARE MODULE

- The hardware module consists of the components that will be installed at the customer side.

- The microprocessor used is Raspberry Pi, which does the main task of sending the data to the server.

- A standard hand-held barcode scanner is used to scan the barcode of the items being purchased.

- After the barcode is taken, the module sends it to the server side. The server side does the necessary computations and sends the total bill amount back to the module.

- An LCD display is used to display the bill amount to the customer. A button is also provided for deletion facility of the module.

8.1.2   SOFTWARE MODULE

- The software module consists of the server side functionality.

- When Customer scan Barcode it goes to trolley table in database and start searching the barcode entry.

- If a Particular Entry is found then it increases the count of product, else go to main database for fetching product entry to trolley table.

- Bill will be generated based on items availble in trolley table.

8.2 TOOLS AND TECHNOLOGIES USED

8.2.1 Front End

1.HTML
2.CSS
3.BOOTSTRAP
4.JAVA SCRIPT

8.2.2 PROGRAMMING

1.Python

8.2.3 Back End

1.PHP
2.MYSQL

8.2.4 Hardware Requirement

1.USB Barcode Scanner

2.Raspberri pi 3

3.Battery/Power Bank

4.LCD display

5.LEDs

6.Button

8.3 METHODOLOGIES/ALGORITHM DETAILS

- **Step 1: User will Take Basket.**

- **Step 2: User will scan the barcode of product using barcode scanner,it will trigger following steps.**

- **Step 3: If same product already present in the basket then it will just increase count of that product and total amount will be displayed on LCD.**

- **Step 4: If product is not present and the basket it will execute query on database and get all the details of product and will be added to the basket trolley table on server side.**

- **Step 5: If the customer is done with shopping he will goto step no 6 or goto step no 2.**

- **Step 6:The person will goto the cash counter where the cashier will enter the trolley number and he will get the final bill.**

- **step 7:The customer will pay the bill and leave the mall.**

Chapter 9

Software Testing

9.1 TYPE OF TESTING USED

9.1.1 Unit Testing

Testing of each of the units for their effective individual working. All of the hardware components have been tested separately to ensure that they are functioning properly. The server side modules such as main code for bill generation, database handling, and web page display have been tested to make sure there is no flaw in the individual operation.

9.1.2 Integration Testing

Integrating various components and testing if they are working as intended and the interaction between them is seamless has been taken care of. The modul-scanner and the module-LCD interface have both been tested for their functionality. The server side components have all been tested together as well.

9.1.3 System Testing

The complete system is tested as a whole and checked if it accomplishes the main goal. Total system working has been verified by detailed tests. Positive and negative testing has been done to ensure system can handle valid and invalid inputs effectively.

9.2 TEST CASES AND TEST RESULTS

9.2.1 Login Test Case

Username for login should be registered and correct password must be entered,in case of any wrong credentials "Login Credential" message is displayed.

- Negative Test Cases: 1.Wrong username wrong password.
  2.Wrong username correct password.
  3.correct username wrong password.

- Positive Test Cases: 1.Correct username correct password

9.2.2   Product Entry
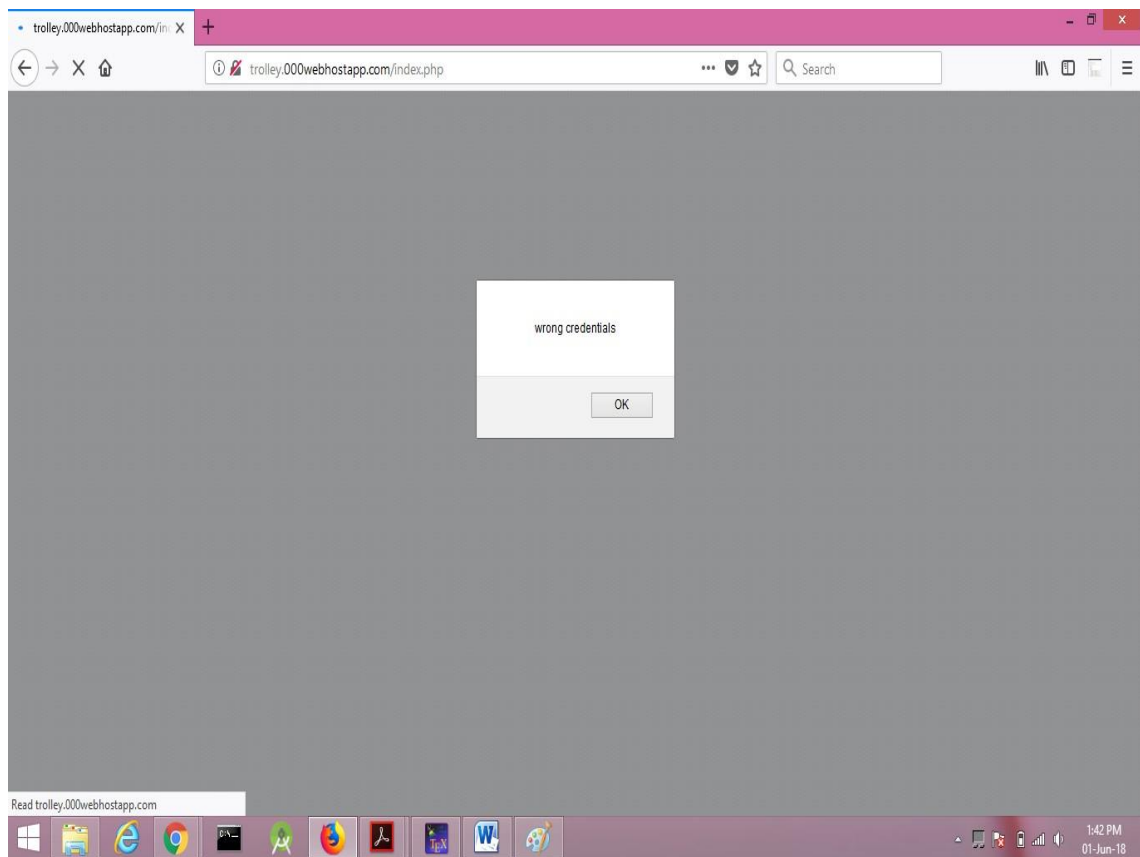
- **Negative Test Cases:**

- **Positive Test Cases:**

Figure 9.1:

Figure 9.2:
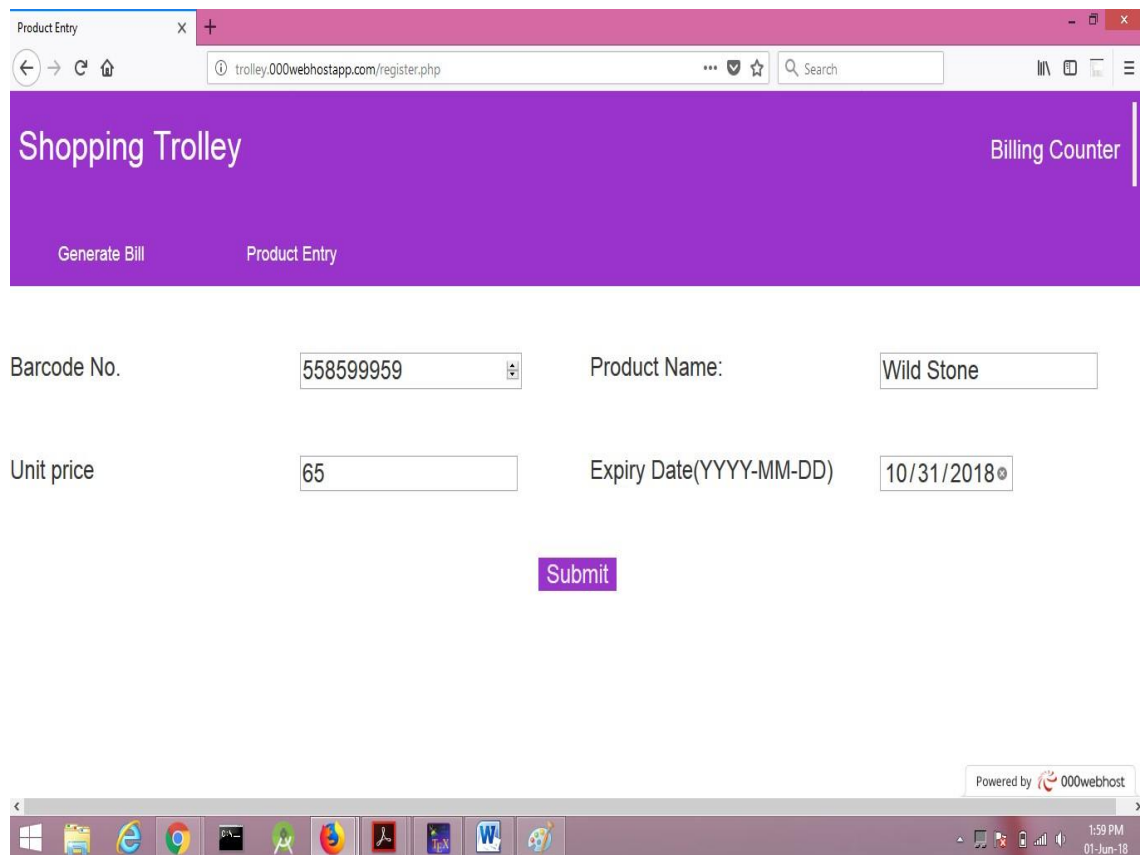
Figure 9.3:

Chapter 10
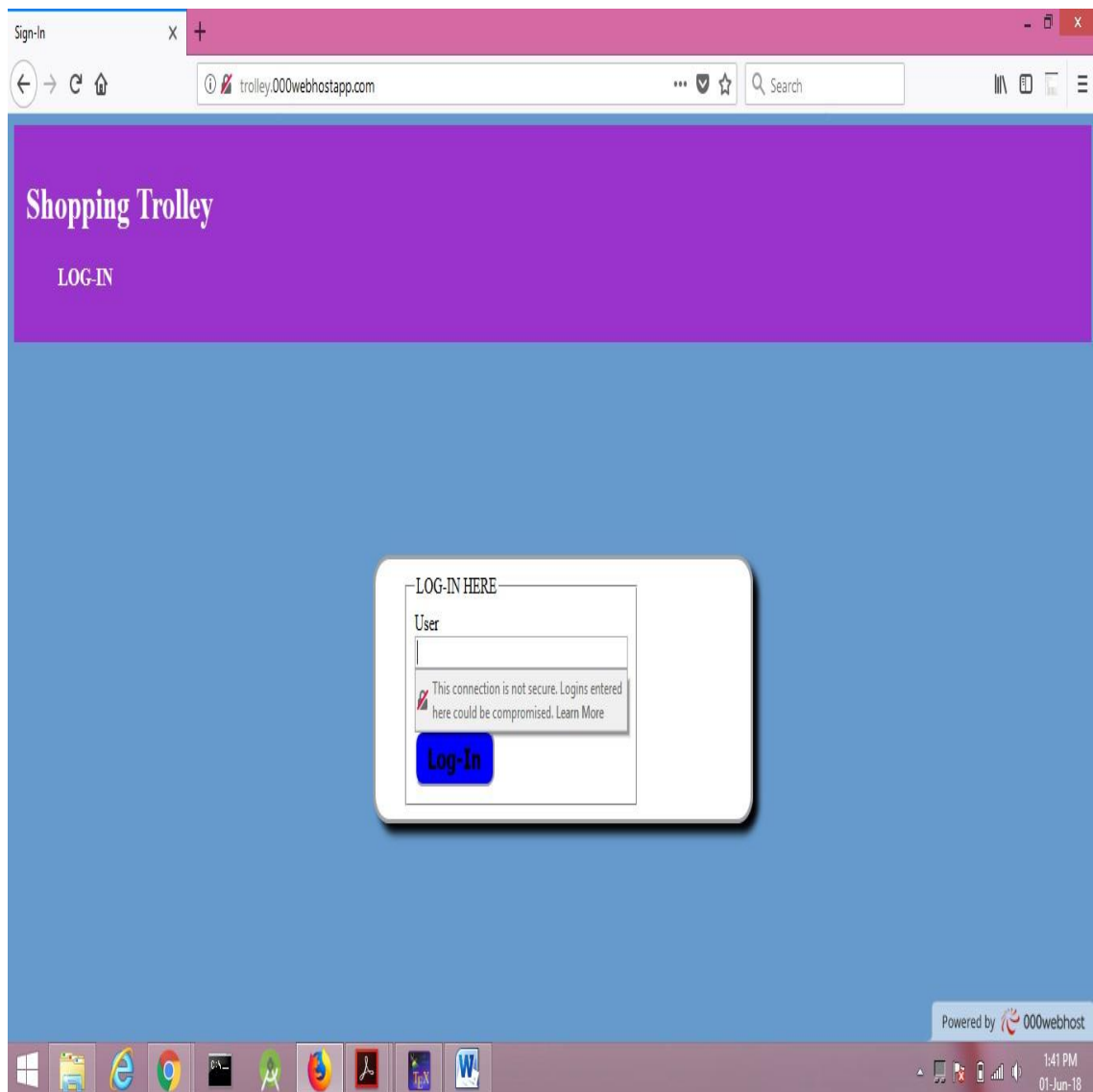
Results

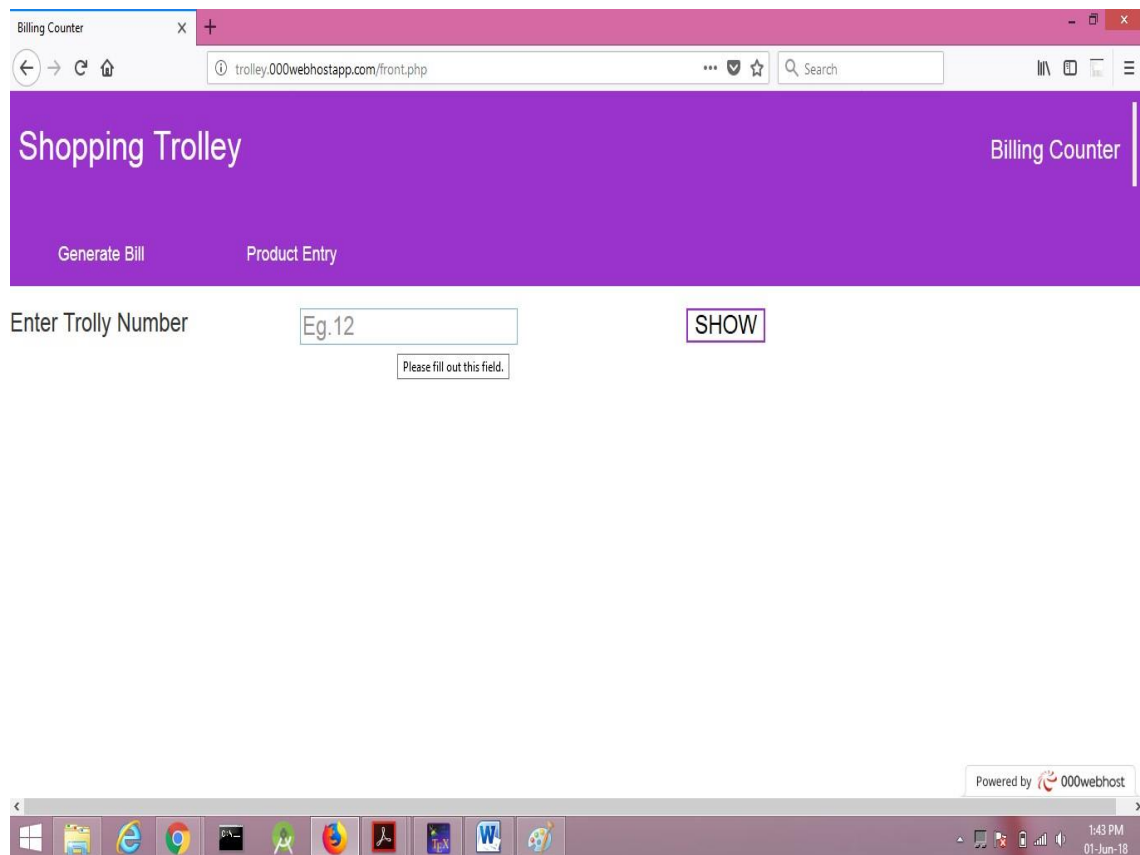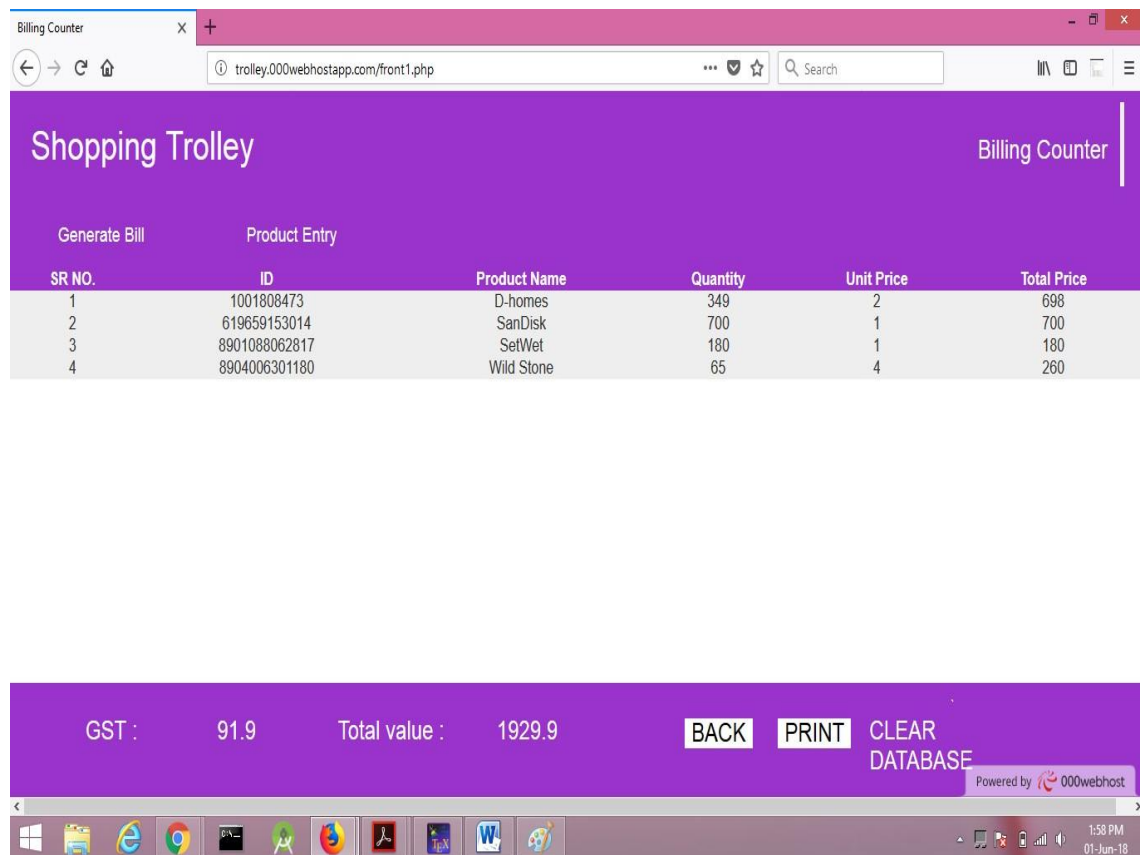## 10.1 SCREEN SHOTS

Figure 10.1:

Figure 10.2:

Figure 10.3:

Chapter 11

Deployment and Maintenance

11.1   INSTALLATION AND UN-INSTALLATION

1.Installation

- **The ready module will be provided to the client,client just have to implant it on his trolley.**

- **For generation of bill the client just have to subscribe to the services provided by the service provider and get the login credentials from administrator.**

- **The client has to provide WiFi to connect module to the server side.**

2.Un-installation 1

- **The client just have to remove the module from the trolley**

- **The client have to un-subscribe to the services.**

11.2   Maintenance

- **The client have to make sure that the module is connected to the trolley and to the server.**

- **Sometimes maintenance can be expensive ie he might have to change the whole module,or barcode scanner.**

Chapter 12

Conclusion and Future Scope

It is a smart shopping system which automates the entire billing procedure. The system which is developed highly reliable because of effectiveness of barcode scanner to scan and display the information on LCD display. By means of this paper we intent to simplify the billing process,make it swift and easy. This will take the overall shopping experience to a different level. Different parameters such as the system parameters of smart trolley like total product cost, product count are continuously display.

Thus with the help of conclusion we can say that:

- **Automatic billing of products will be a more viable option in the future.**

- **This system is compact,efficient and shows promising performance.**

Appendices

Appendix A

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Appendix B

# Laboratory Assignment On Project Analysis Of Algorithm Design

B.1   IDEA MATRIX

IDEA	Process	Parameter
Increase	Functionality	Additional Features

Improve	User Cashier Interface	GUI And LCD
Deliver	High Performance Billing System	Remote Microprocessor
Decrease	Cost	Manpower
Eliminate	Queue	Product Scanning at system
Accelerate	Shopping Process	Bill generation
Avoid	Delay in payment process	Faster computation

Appendix C

Project Planner

C.1   Project Timeline
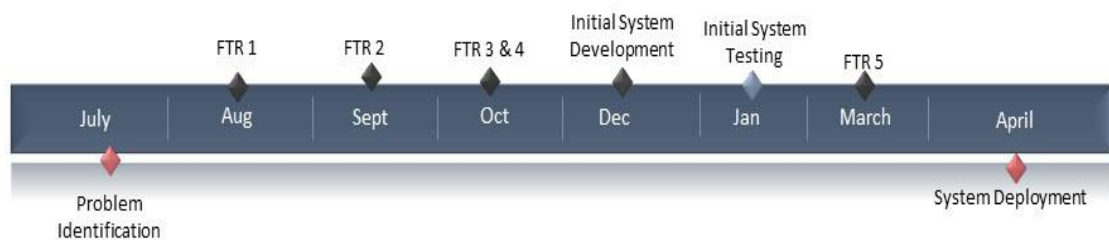
Appendix D

TERM-II:PROJECT LABORATORY ASSIGNMENTS

D.1   Project Competition and Paper Report

- Participated in Vishwacon 2018

- Paper Created awaiting response

D.2   Project Workstation

1. 000webhost : Server side
2.Raspberry Pi : customer side

D.3   Corrective Action Recommended

1. **Auto refreshing the server page after certain interval**
2. **Enabling option for deletion of items**