A
Project Report
on

SMART SHOPPING CART

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Certificate

This is to certify that the project report entitled **"SMART SHOPPING CART"** is hereby approved as a creditable study carried out and presented by

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in a manner satisfactory to warrant of its acceptance as a pre-requisite in a partial fulfillment of the requirements for the degree of Bachelor of Engineering in Electronics & Telecommunication Engineering of Sant Gadge Baba Amravati University, Amravati during the Session 2022-23.

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Abstract

The modern age of technology in which most of the customer needs to wait in the supermarket for shopping because it is a highly time-consuming process. A huge crowd in the supermarket at the time of discount offers or weekends makes trouble to wait in long queues because of a barcode-based billing process. In this regard, the Internet of Things (IoT) based Smart Shopping Cart is proposed which consists of Radio Frequency Identification (RFID) sensors, Arduino microcontroller, Bluetooth module, and Mobile application. RFID sensors depend on wireless communication. One part is the RFID tag attached to each product and the other is RFID reader that reads the product information efficiently. After this, each product information shows in the Mobile application. The customer easily manages the shopping list in Mobile application according to preferences. Then shopping information sends to the server wirelessly and automatically generates billing. This experimental prototype is designed to eliminate time-consuming shopping process and quality of services issues. The proposed system can easily be implemented and tested at a commercial scale under the real scenario in the future. That is why the proposed model is more competitive as compared to others.

Acknowledgement

We would like to take this opportunity to express our heartfelt thanks to our guide Dr. D.D.Nawgaje for his esteemed guidance and encouragement, especially through difficult times. His suggestions broaden our vision and guided us to succeed in this work. We are also very grateful for his guidance and comments while designing part of our project and learnt many things under his leadership. Also we would like to thank to Dr. M. N. Tibdewal, Head of Electronics and Telecommunication Department, all teaching and non-teaching staff of EXTC Department for their encouragement and suggestions for our project.

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Abbreviations

Wi-Fi	- Wireless Fidelity
RFID	- Radio Frequency Identification
ESP	- Extrasensory Perception
MCU	- Microcontroller Unit
I2C	- Inter Integrated Circuit
LCD	- Liquid Crystal Display
USB	- Universal Serial Bus

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Chapter 1

Introduction

Introduction:

Internet of Things has brought a new uprising in industrial, financial and environmental systems. So, lets us know about it. IOT refers to the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators and connectivity which enables these objects to connect and exchange data between the devices. In this era of Internet of Things, interactions among physical objects have become a reality. Every object in this world is on the verge of getting connected together with the help of Internet. In this project let us try to focus on a Smart Shopping System using ultra high frequency RFID tags which have not been well implemented in the past. The major advantage of such system is that people can get rid of standing in long queues waiting for their turn for billing the items. So here RFID is introduced meaning Radio Frequency Identification Tag which uses electromagnetic fields to automatically identify and track tags attached to objects. In the implementation couple of components is used such as the Ultra High Frequency RFID Tags which is very inexpensive and has a range up to 12m followed by the Micro Controller which is primarily used for Data Processing. LCD Touch Panels which are equipped with User Interface. So, the moment the customer grabs his byte, the cart will search in for the price of the item from the cloud and display it on the LCD panel, due to which the customer can decide whether their item is worth for his penny or not. The existing system of shopping is a long process and consumes lot of time like choosing the products, waiting in the queues, scanning the products and checking out. This is a lengthy process and it can use the trending cutting edge technology of IOT to reduce the time and solve the problems.

With the increase in internet technology, food items are available at our doorstep whenever needed. But the experience of going to mall and shopping the things all by ourselves has its own advantages and disadvantages as well. 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 customer has to drop every product which they wish to purchase into shopping cart and then proceed to checkout at the billing counter. The billing process is quite tedious and

time consuming and has created the needs for shops to employ more human resource in the billing section.

To decrease the time at billing, RFID arrangement has been proposed. Each advanced mobile truck will be provided with an RFID reader, Raspberry pi 3, Arduino, and LCD. That keen truck can naturally be reading those things place under a truck through another RFID spectator. The framework holds the things joined for RFID tag. RFID reader proceeds with the tag data when it is required to add or remove items from the trolley.

To add the items to the cart, the add items button should be clicked and to remove the item the subtraction button should be clicked. While reading, it will read the expired date also. If the item has an expired date, then the red led will indicate and a buzzer will be on or else green led will indicate. After finishing shopping, we move to the billing section. The items information is sent to the central billing server; it will calculate the total amount of purchased items so, and it will be displayed on the webpage. It will be easy to pay the amount directly without waiting.

1.1 Motivation:

- There are several situations which cannot be handled by humans. Shopping centres or malls provides a great convenience to customers, where all the products of varying choices are found under one roof.
- A smart trolley comprises of the RFID module which helps in easy scanning of the products to be purchased.
- This product is specially developed for people of all age groups.
- It also has a simplified LCD display which shows the products details when scanned.
- It helps the customer to get the bill for their purchase in a flexible manner.

1.2.Literature review:

As per our knowledge only few papers were found in the literature for the automated shopping trolley for supermarket using RFID. The automated shopping trolley for supermarket billing system implemented by Sainath (2014), exploited barcode for billing of products, where customer scans the product using barcode technology. The bill will be forwarded to the central billing system where customer will pay them by showing unique id. The limitation of barcode scanning requires line of sight for scanning and it should be fixed within its boundary. Cash register lines optimization system using RFID technology by Budic (2014), developed a system for shopping using RFID. The RFID is employed for scanning products and the information is stored in the database which could be paid online or in a central bill. It also uses web application to maintain entire shopping details. It requires maintenance of web application server. No necessary steps have been taken for the products that are accidentally dropped into the trolley by the customer. IOT based intelligent trolley for shopping mall by Dhavale Shraddha (2016), applied RFID technology for billing during purchase in shopping malls and IOT is used for bill management by means of ESP module. The payment details will be sent to the server by which central billing unit will deal with customer's payment. The ESP module will be working as a short distance Wi-Fi chip for wireless communication. But there is a drawback which includes constraints such as distance and interference. Server will be busy if customers are high and internet connectivity should be stable for finishing the process. Smart shopping trolley using RFID by Komal Ambedkar (2015), implemented smart way of shopping trolley with RFID and ZigBee by which bill is generated by scan of products in the reader and bill transmitted to central billing department by which bill can be paid at the counter which is a major difficulty for the customer. Smart shopping cart with customer-oriented service by Hsin-Han Chiang (2016), accomplished a concept of automated shopping trolley with automated billing where they used face recognition for customer authentication. It is not a simple process as face recognition of customers during shopping hours will not be easy and accurate as malls can be crowded. Many errors are possible while using recognition for authentication.

1.3. Objectives:

- The main purpose of our project is to reduce the time spent while waiting in the queue at the billing counter.
- RFID Reader /Writer is mounted upon the cart which scans the object placed inside the cart in real time and display the bill amount on the mounted LCD, thereby, reducing the total time taken by a person during checkout.
- RFID is also meant for scanning multiple items providing higher security.
- As shoppers add and remove items, a display on the cart adjusts the total price.

1.4.System Overview:

A smart shopping cart is a technology-enhanced version of a traditional shopping cart that uses sensors and software to provide real-time information and enhance the shopping experience. Here is a high-level overview of the system components of a typical smart shopping cart:

Hardware components:

Sensors and tracking systems: These are used to detect and log products as they are added to the cart, and to track the location of products within the cart.

Display and user interface: The cart is typically equipped with a touch screen or other interface to provide real-time information to the user, such as total cost and suggested products.

Payment system: The cart may be equipped with a built-in payment system or the ability to interface with mobile payment systems.

Connectivity: The cart typically has a WiFi or cellular data connection to transmit data to the retailer's backend system.

Software components:

Operating system or software platform: This provides the software infrastructure to run the smart shopping cart.

Algorithms and data processing systems: These are used to track products, calculate total cost, and suggest related products or promotions.

Interfaces: The system interfaces with external systems, such as payment processors and the retailer's backend system.

Backend systems:

Retailer's backend system: This is the system that receives and processes data from the smart shopping cart, such as product sales and user data.

Analysis system: This system is used to analyze the data collected by the smart shopping cart, such as sales data and user behavior.

Overall, a smart shopping cart system is designed to enhance the shopping experience by providing real-time information and suggesting related products or promotions. It also provides valuable data to retailers to help optimize inventory management and improve the overall shopping experience.

1.5.Outline of project:

Chapter-1: Defines basic definition of smart shopping cart and its day to day use in daily life in various fields. The problem associated in time consumption of customer recognition is addressed and how a smart shopping cart can be a solution to this problem is discussed. A brief overview of the system designed is explained in detail.

The components description and their importance in building the smart shopping cart are mentioned in chapter-2. Implementation and Component study of smart shopping cart is also studied in this chapter.

The product detection which is one of the important aspects of the project is discussed in chapter-3. It also covers the basics of smart shopping cart processing and use of it in this project. The flow chart of the image processing and algorithm is discussed step by step in this chapter.

Chapter-4: Includes all the actual hardware and software used in this project. The circuit diagram of the smart shopping cart and its software setup procedure are explained in this section.

Chapter-5: Gives the details about the experimental results associated with the smart shopping cart and recognition.

Finally, conclusions and future scope discussed in Chapter-5.

Chapter-6: References.

Chapter 2

Basic Concepts

Components:

2.1 NodeMCU:ESP8266 :

NodeMCU is an open-source firmware and development kit that helps you to prototype or build IoT products. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems.

Specifications of NodeMCU-

•Microcontroller : ESP-8266 32-bit

•Operating Voltage: 3.3V

•Input Voltage : 4.5V-10V

•Digital i/o pins: 11

•Analog i/p pins : 1

•Flash memory : 4MB

•SRAM: 64kb

- Processor: L106 32-bit RISC microprocessor core based on the Ten silica Diamond Standard 106Micro running at 80 or 160 MHz
- Memory
  - 32 KB instruction RAM
  - 32 KB instruction cache RAM
  - 80 KB user-data RAM
  - 16 KB ETS system-data RAM
- External QSPI flash: up to 16 MB is supported (512 KB to 4 MB typically included)
- 17 GPIO pins
- Serial Peripheral Interface Bus (SPI)
- I²C (software implementation)
- I²S interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2
- 10-bit ADC (successive approximation ADC)

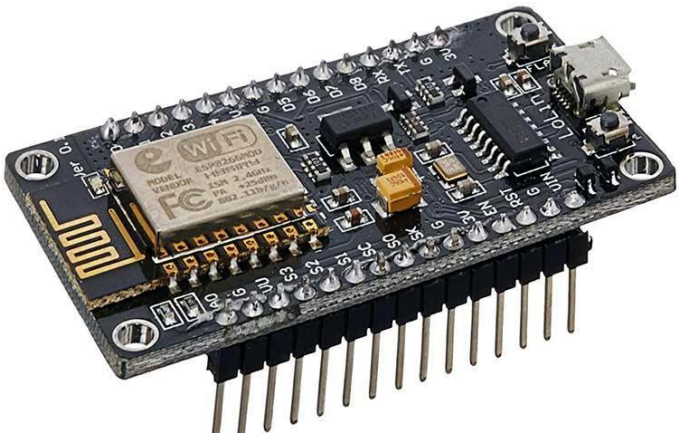


Fig.2.1.1: ESP8266

2.2 RFID Module:

Radio Frequency Identification (RFID) is wireless non-contact method, use radio frequency electromagnetic field as a medium for communication for the purpose of identifying and tracking tag attached to the object. The RFID system is a combination of RFID reader and a transponder also known as tag.

RFID Frequency bands

RFID system can be classified according to the radio frequency used to communicate between the RFID systems components. The radio frequency is defined as the frequency of the sine wave generated by the reader to send a request to the tag Rate of data transfer is influenced by the frequency of the carrier wave used to carry the data between the tag and its reader. RFID tags and reader have to tune to same frequency in order to communicate effectively. RFID system typically uses one of the following ranges. The frequency range and some feature shown in table below.

Frequency Band	Common Frequency	Communication range	Data Rate
Low Frequency	125KHz	15cm-20cm	Low
High Frequency	13.56MHz	10cm-1m	Low to Moderate
Ultra-high Frequency	868-928MHz	3m-7m	Moderate to High
Microwave	2.45 & 5.0 GHz	10m-15m	High

Table 2.2.1 RFID Frequency Bands

An RFID system will typically comprise the following:

- An RFID device (tag).
- A tag reader with an antenna and transceiver
- A host system or connection to an enterprise system

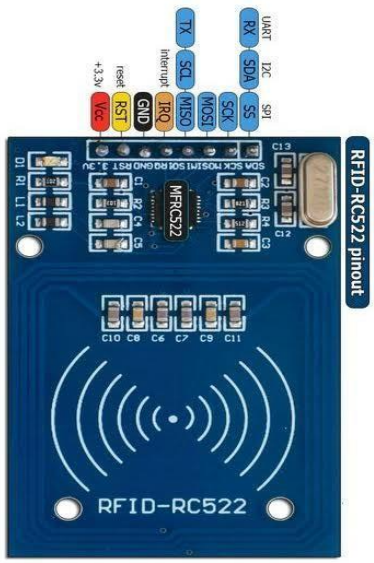


Fig.2.2.1: RFID module

2.3 RFID Tag:

An RFID tag is a microchip combined with an antenna in a compact package: the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification. Tags are classified by the manner in which they derive their operating power, even though the power levels required are invariably very small (micro to milli watts). Tags are either passive or active.

2.3.1 Active Tags:

An RFID tag is an active tag when it is equipped with a battery that can be used as a partial or complete source of power for the tag's circuitry and antenna. Some active tags contain replaceable batteries for years of use others are sealed units. It is also possible to connect the tag to an external power source

The advantages of an active RFID tag are:

- It can be read at longer distances than passive tag.
- It may have other sensors that can use electricity for power,

The disadvantages of an active RFID tag are:

- The tag cannot function without battery power, which limits the lifetime of the tag.
- The tag is typically more expensive.
- The tag is physically larger, which may limit applications.

2.3.2 Passive Tag:

A passive tag is an RFID tag that does not contain a battery, the power is supplied by the reader thus have a low range limited up to few meters. When radio waves from the reader reach the chip's antenna, the coiled antenna within the tag forms magnetic field electricity and energizing the circuit that can power up the microchip in the tag. The tag is able to send back any information stored on the tag by reflecting the electromagnetic waves.

The advantages of a passive tag are:

- The tag functions without a battery, these tags have a useful life of twenty years or more.
- The tag is typically much less expensive to manufacture.
- The tag is much smaller and lighter in size than active tag.

The disadvantages of a passive RFID tag are:

- The tag can be read only at very short distances, typically a few feet at most. This greatly limits the device for certain applications.
- It may not be possible to include sensors that can use electricity for power.

The tag remains readable for a very long time, even after the product to which the tag is attached has been sold and is no longer being tracked.

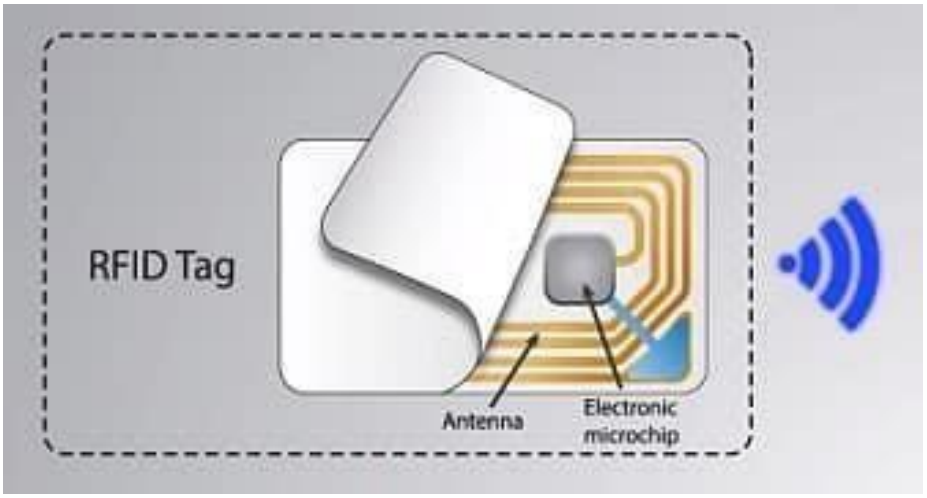


Fig.2.3.2a: RFID Tag

2.3.3 RFID tag structure :

The RFID tag is a small device which stores and sends data to RFID readers. The tag's antenna picks up signals from an RFID reader and then returns the signal, usually with some additional data (like a unique serial number or other customized information). Fig. shows the basic internal structure of the RFID transponder RFID tag contains a copper coil known as antenna. The main function of the coil is to provide power to the chip as well as to work as an antenna to receive and transmit data. Two wires from coil are connected with a chip i.e., microchip is attached to an antenna. The chip is the heart of the RFID tag. The microchip stores the unique ID and incorporates the necessary logic circuitry for functioning of the tag. It has an internal EEPROM to store the unique ID

The antenna in an RFID tag is a conductive element that permits the tag to exchange data with the reader. Passive RFID tags make use of a coiled antenna that can create a magnetic field using the energy provided by the reader's carrier signal.

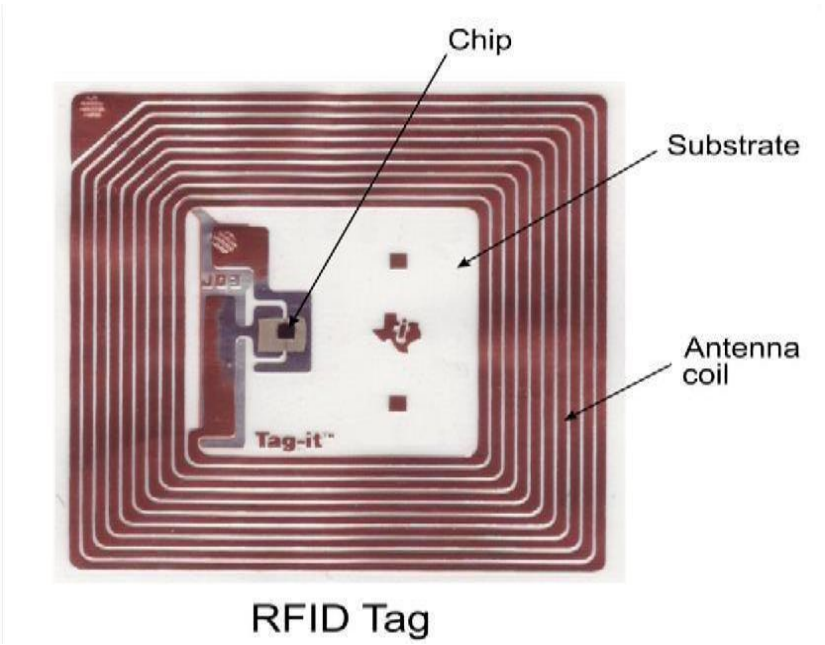


Fig.2.3.2b: RFID Tag

2.4 RFID Reader:

The reader has an antenna that emits radio waves; the tag responds by sending back its data. The reader receives the modulated waves and converts them into digital data. A number of factors can affect the distance at which a tag can be read (the read range) RFID readers are usually a microcontroller-based unit with a wound output cost. The overall function of an RFID reader is to provide the way of communicating with the tags and facilitating data transfer. The reader continuously emits the radio waves called as active reader, it works with passing tag and reader which does not emit the radio wave called a passive reader, it only receives the signal from active tag.

Fig.2.4.1: RFID Reader

The communication between RFID reader and tag is done by electronic coupling. Electromagnetic couplings systems are systems in which a magnetic field is used to transferring data or power. Electromagnetic coupling techniques are generally applied to RFID systems operating in the low to medium frequency bands, with relatively short reading distances. The reader antenna loop and the tag coil windings establish a loosely connected "space transformer" resulting in power transfer across short bidirectional reading distances. Maximum power transfer between the reader antenna coil and the tag coil occurs when the two coupled coils are placed or aligned in the same plane.

In this we used EM-18 active RFID reader module operating at 125 kHz. The Reader module comes with on-chip antenna and powered up with a 5v power supply. The Transmit pin of the module sends data to microcontroller. Show the passive tag within the reading range and the unique number is thrown at the output.

2.5 LCD:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector.

It uses very small amounts of electric power, and is therefore suitable for use in battery powered electronic devices.

For an 8-bit data bus, the display requires a +5V supply plus 11 10 lines.

For a 4-bit data bus it only requires the supply lines plus seven extra lines.

When the LCD display is not enabled, data lines are tri-state which means they are in a state of high impendence (as though they are disconnected) and this means they do not interfere with the operation of the microcontroller.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16-2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reason being: LCDs are economical: easily programmable, have no limitation of displaying special and even custom characters (unlike in seven segments), animations and so on. In this system . we are using these 16-2 LCDs for displaying various message for customer information. It is possible by interfacing these LCDs to corresponding core controllers.

A 16-2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5*8 dots with cursor. This LCD has two registers to operate the LCD module, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is ASCII value (8 bits) of the character to be displayed on the LCD. The pin diagram of a 16-2 Character LCD display fig 2.5**.**

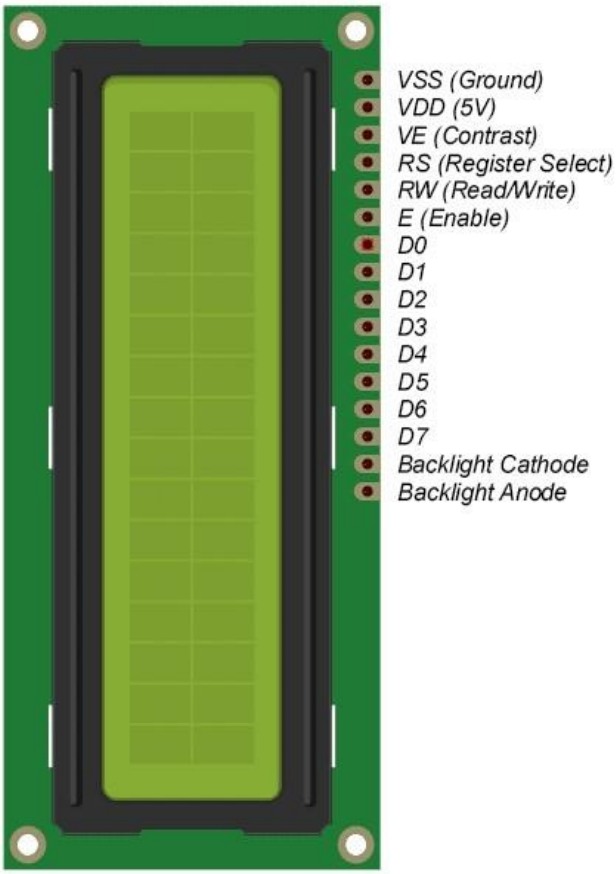


Fig.2.5.1: LCD

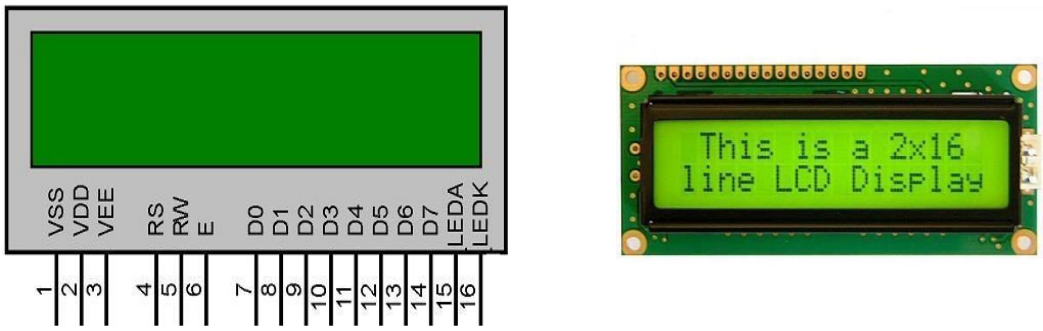


Fig 2.5.2: LCD (2*16) Pins and display

Pin no	Name	Function
1	GND	Ground 0V
2	VCC	Supply voltage;5V(4.7V-5.3V)
3	VEE	Contrast Adjustment; through a variable resistor

4	RS	Register selects; Selects command when low and data when high
5	R/W	Low to write to the register, High to read from the register
6	EN	Sends data to data pins when a high to low pulse is given
7	DB0	Data bus bit 0
8	DB1	Data bus bit 1
9	DB2	Data bus bit 2
10	DB3	Data bus bit 3
11	DB4	Data bus bit 4
12	DB5	Data bus bit 5
13	DB6	Data bus bit 6
14	DB7	Data bus bit 7
15	LED+	Backlight VCC(5V)
16	LED-	Backlight Ground(0V)

Table.2.5.1: Pin Description of LCD

Chapter 3

Product Detection

3.1 Working:

A smart shopping cart is a next-generation shopping cart that uses a combination of hardware and software to provide a seamless shopping experience for customers. The hardware components of a smart shopping cart typically include a touchscreen display, barcode scanner, RFID reader, weight sensors, and a payment system. The software components include a mobile application and a backend system that processes the data collected by the hardware.

Here is how a smart shopping cart typically works:

1. Customer scans a QR code or uses an app to log in to the cart.
2. The cart's touchscreen display greets the customer and displays product recommendations, promotions, and other personalized content.
3. As the customer adds products to the cart, the weight sensors detect the change in weight and update the cart's inventory in real-time.
4. The barcode scanner and RFID reader scan each item as it is added to the cart, and the system adds it to the customer's digital shopping list.
5. The customer can use the cart's touchscreen display to view the list of items in their cart, adjust quantities, and remove items.
6. When the customer is ready to check out, they can use the payment system integrated into the cart to pay for their items.
7. After payment, the cart's backend system updates the store's inventory and generates a digital receipt for the customer.

Smart shopping carts are designed to make the shopping experience more convenient and personalized for customers while also providing retailers with valuable insights into consumer behaviour and preferences.

To decrease the time at billing, RFID arrangement has been proposed.

Each advanced mobile cart will be provided with an RFID reader, Raspberry pi 3, Aurdino, and LCD. That keen cart can naturally be reading those things place under a truck through another RFID spectator. The framework holds the things

joined for RFID tag. RFID reader proceeds with the tag data when it is required to add or remove items from the trolley. To add the items to the cart, the add items button should be clicked and to remove the item the subtraction button should be clicked. While reading, it will read the expired date also. If the item has an expired date, then the red led will indicate and a buzzer will be on or else green led will indicate. After finishing shopping, we move to the billing section. The items information is sent to the central billing server; it will calculate the total amount of purchased items so, and it will be displayed on the webpage. It will be easy to pay the amount directly without waiting.

The raspberry pi3 consists of a product database. This system has been adopted over the cloud environment as a cloud application. Here, the billing information/data are stored in a cloud server in a secured manner. This system uses cryptographic algorithms such as AES and DES for performing encryption and decryption process for the secured storage on cloud. The steps of the proposed data cloud based automatic billing application are as follows:

Step 1: Read the data (Billing Information) from the application.

Step 2: Call AES algorithm for encryption on the billing information.

Step 3: The client sends the request to the cloud server for accessing the data.

Step 4: Cloud server call the RBAC algorithm for verifying the user.

Step 5: If the user is authorized user then access the cloud data and call DES algorithm for decrypting the data. Else access denied.

Step 6: Display the billing information which is extracted from the cloud server. The proposed secured storage algorithm is used for enhancing the performance of cloud based automatic billing application.

Here, the billing data can be encrypted and decrypted for providing security to the data on a cloud server.

Moreover, it uses RBAC for accessing the billing application securely in the proposed cloud-based automatic billing system for the smartcard. The server sends the data by using HTML and PHP to the webpage.

3.2 Implementation

The implementation of a smart shopping cart with hardware products interfacing involves the integration of various components, including sensors, displays, scanners, and payment systems. Here are the hardware products that are typically interfaced in a smart shopping cart:

Touchscreen Display: A touchscreen display is a critical component of a smart shopping cart. It provides customers with an interactive interface that they can use to navigate the cart's features and functions. The display should be large enough to display product information, promotions, and recommendations.

Barcode Scanner: A barcode scanner is used to scan the barcode of each product as it is added to the cart. The scanner should be fast and accurate to ensure that the correct product is added to the customer's shopping list.

RFID Reader: An RFID reader is another way of identifying products. RFID tags are attached to products, and when they come in proximity to an RFID reader, the reader can detect the tag's information. This makes the checkout process faster as products do not have to be scanned individually.

Weight Sensors: Weight sensors are used to detect the weight of products as they are added to the cart. The sensors are typically placed on the cart's surface and can detect even small changes in weight. This information is used to update the cart's inventory in real-time.

Payment System: A payment system is integrated into the cart to allow customers to pay for their items. The payment system should be secure and support a variety of payment methods such as credit cards, debit cards, and mobile payments.

Power Supply: A smart shopping cart requires a power supply to run its various components. This can be achieved through rechargeable batteries or by plugging the cart into a power outlet.

IoT Connectivity: The smart shopping cart should be connected to the internet to allow for real-time data processing and communication with the store's backend system.

Integrating these hardware products into a smart shopping cart requires careful planning and design to ensure that all components work together seamlessly. The software components that drive the cart's functions must also be carefully integrated with the hardware to provide customers with a smooth shopping experience.

3.3 Interfacing of components

Interfacing of hardware components in a smart shopping cart is typically done using various technologies and protocols, including:

Serial Communication: Serial communication is a common way of interfacing different components in a smart shopping cart. It involves transmitting data between devices one bit at a time, using a protocol such as RS-232 or RS-485.
This is often used for interfacing weight sensors and barcode scanners.

USB: USB is another common interface used for connecting devices in a smart shopping cart. USB is a standard protocol for transmitting data between devices and is often used for connecting touchscreens and payment systems.

Wi-Fi: Wi-Fi is a wireless networking protocol that allows devices to connect to the internet or local network. It is often used for connecting smart shopping carts to a store's backend system or to provide customers with access to online services, such as product information or promotions.

The choice of interface technology depends on the specific hardware components and their capabilities, as well as the requirements of the smart shopping cart application. In addition to the physical interface, software protocols and APIs are also used to communicate between the different hardware and software components in a smart shopping cart.

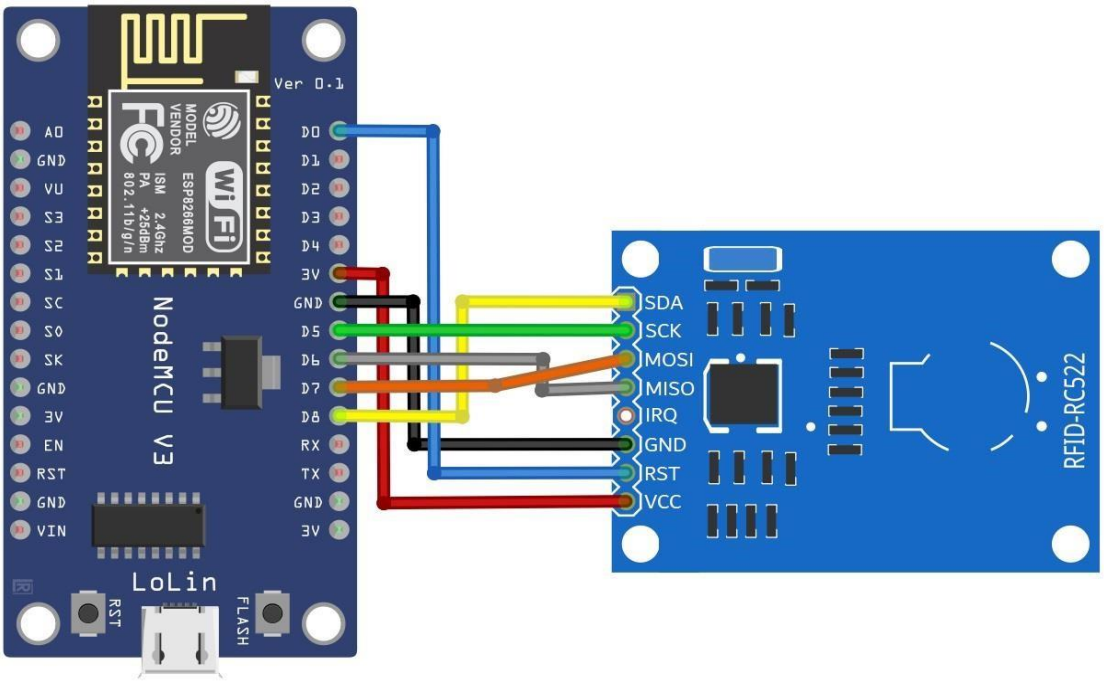


Fig.3.3.1: Interfacing of RFID and ESP8266

Connection setup of RFID and ESP8266:

RFID-RC522 PIN	ESP8266 PIN
SDA	D4
SCK	D5
MOSI	D7
MISO	D6
IRQ	UNUSED
GND	GND
RST	D3
3.3V	3.3V

Table 3.3.1: Connection setup of RFID and ESP8266

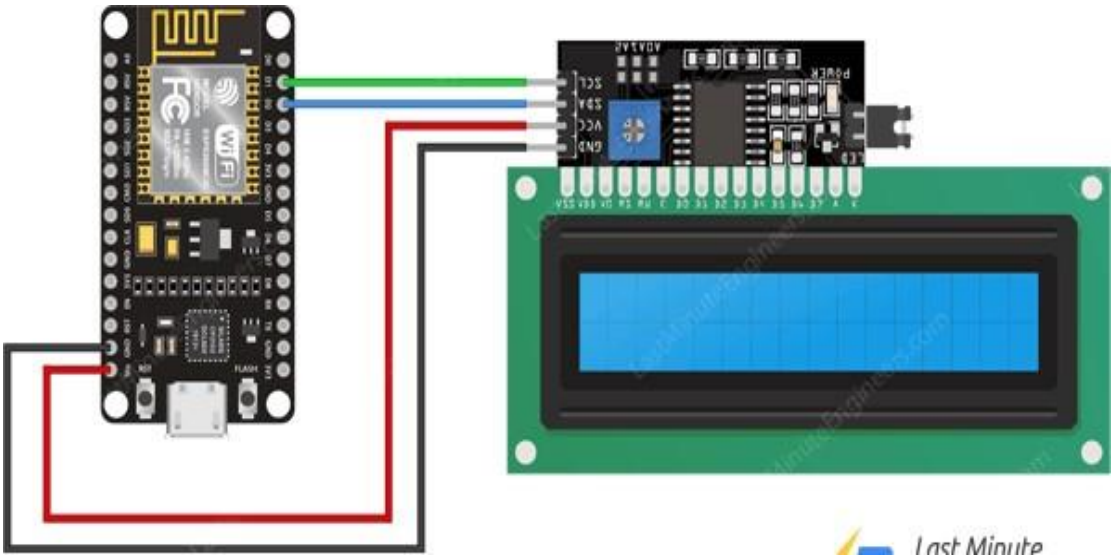


Fig.3.3.2: Interfacing of I2C Module, LCD and ESP8266

Connection setup of ESP8266, I2C Module and LCD:

LCD I2C Pin	ESP8266 Pin
GND	GND
VCC	VCC
SDA	D2
SCL	D1

Table 3.3.2: Connection setup of ESP8266, I2C Module and LCD

3.4 Website Design:

Designing a website for a smart shopping cart involves creating a user interface that is easy to navigate and provides customers with a seamless shopping experience. Here are some key considerations when designing a website for a smart shopping cart:

User Interface Design: The website should have a clean, modern design with intuitive navigation that makes it easy for customers to find what they are looking for. The user interface should also be responsive, so it works on a variety of devices, including smartphones and tablets.

Product Listings: The website should display a comprehensive list of available products with clear images, descriptions, and prices. Customers should be able to search for products based on keywords, categories, or brand names.

Shopping Cart: The shopping cart should be prominently displayed on the website, showing customers the items they have added to their cart, their total cost, and any applicable discounts or promotions.

Payment Gateway: The website should have a secure payment gateway that supports multiple payment options, including credit cards, debit cards, and mobile payments. The payment gateway should be easy to use and provide customers with clear instructions for completing their transactions.

Personalization: The website should offer personalized recommendations based on a customer's browsing history, purchase history, and preferences. This can be achieved through the use of machine learning algorithms and other data analysis tools.

Customer Service: The website should provide customers with easy access to customer service, including a chatbot or live chat feature, email support, or a phone number they can call for assistance.

Data Analytics: The website should collect and analyze data on customer behavior, such as browsing and purchasing history, to provide insights into customer preferences and to optimize the website's performance.

Overall, the website for a smart shopping cart should be designed with the customer in mind, providing a seamless and personalized shopping experience that is easy to use and secure.

XAMPP WORKING ENVIRONMENT:

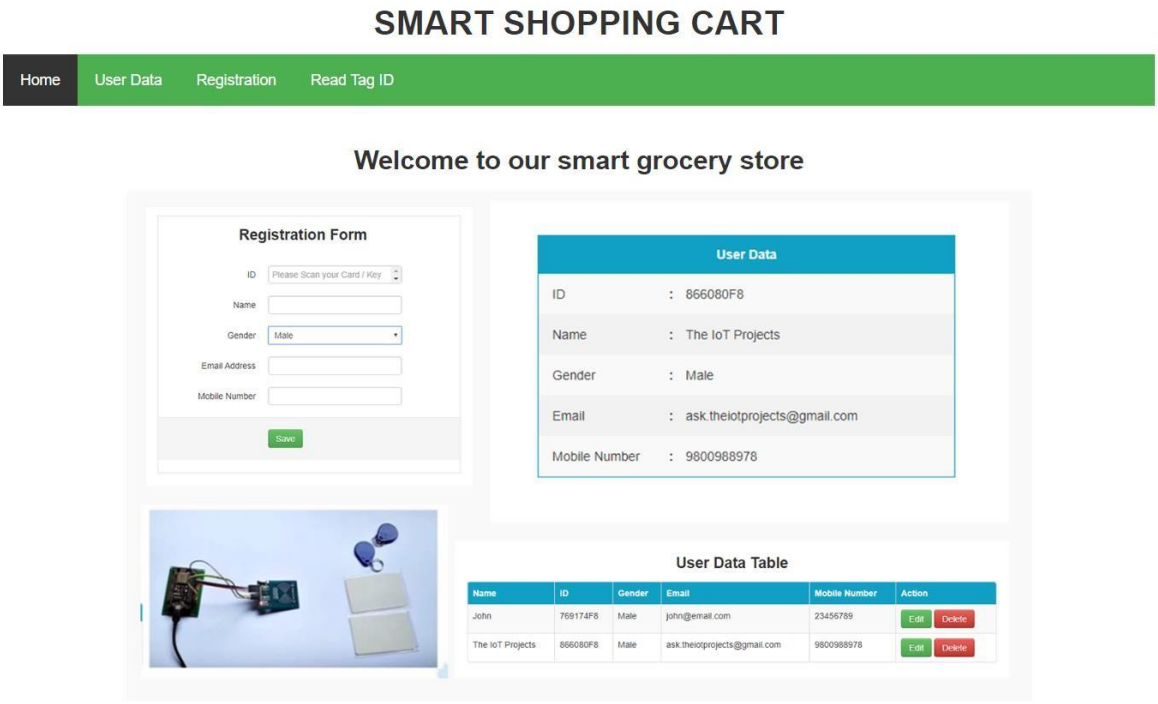


Fig.3.4.1a: XAMPP Working Environment

Working of website:

1. If the user is new to the shop, he/she must first create an account on the website.
2. Login credentials should be given like username and password.
3. Search button is to find a specified product in the shop.
4. Cart gives the total checkout of a customer.
5. This website is easy to use and dynamic that is also used in mobile phones.
6. The total data of the customer will be stored in form of SQL tables in owners server.

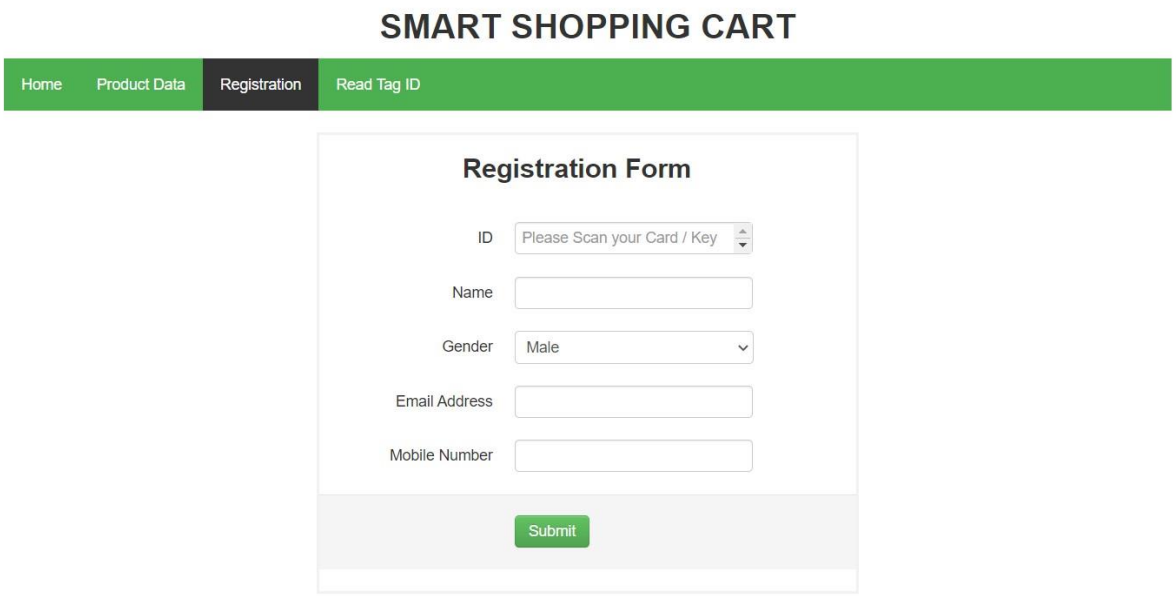


Fig.3.4.1b: XAMPP Working Environment

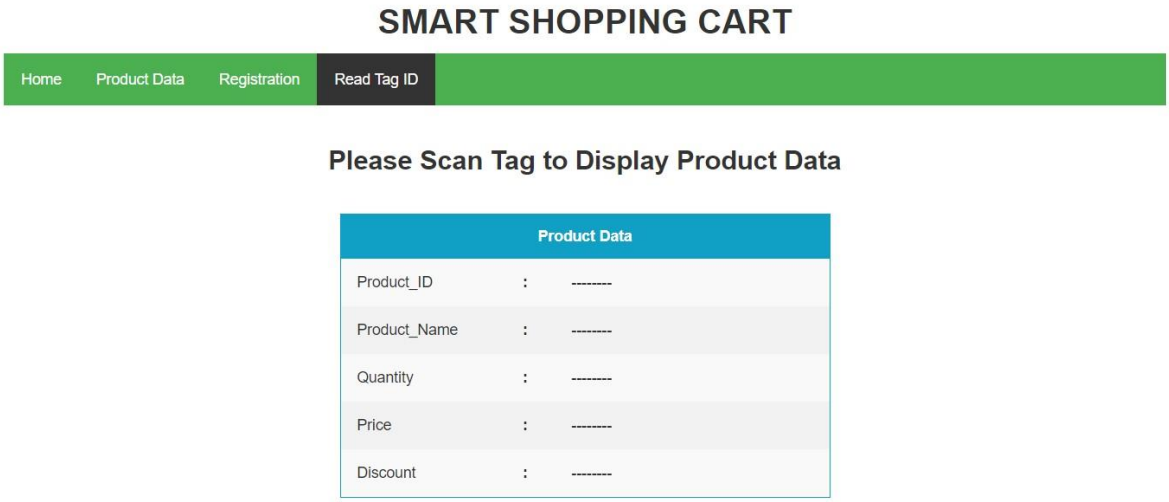
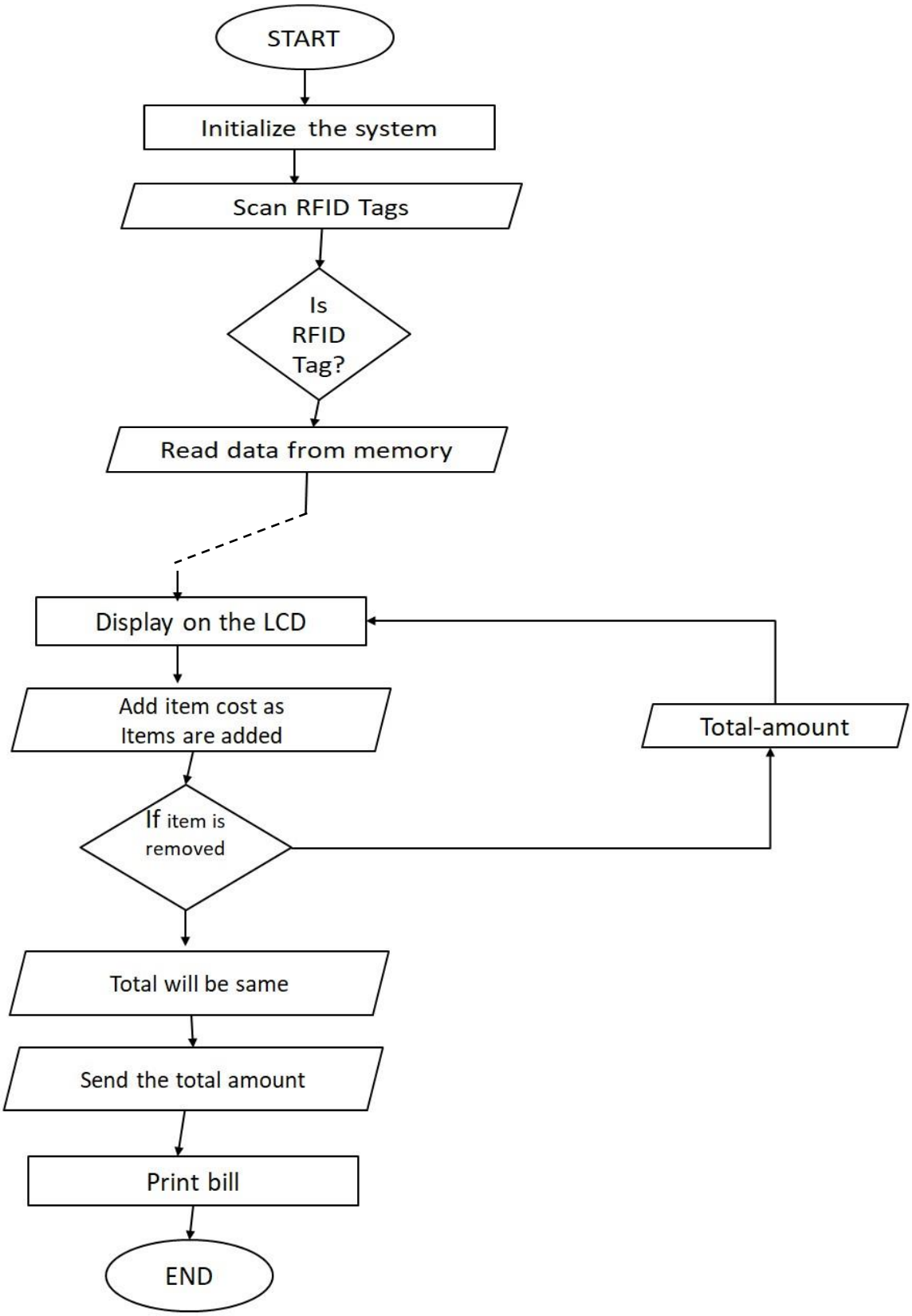


Fig.3.4.1c: XAMPP Working Environment

3.5. Flow Chart:

Here is a basic flowchart of how a smart shopping cart might work:

User enters the store and picks up a smart shopping cart.
The smart shopping cart detects the user and logs them into the system.
The user scans items as they shop and places them in the cart.
The smart shopping cart keeps track of the items added and provides real-time updates on the total cost.
The smart shopping cart can suggest related products or promotions based on the user's shopping history or preferences.
The user can review their shopping cart and make changes as needed.
When the user is ready to check out, they can pay using a mobile device or through the smart shopping cart's built-in payment system.
The smart shopping cart can provide a digital receipt and email it to the user. After the user completes their purchase, the smart shopping cart automatically logs them out of the system.
The smart shopping cart can then transmit data on the user's shopping habits, preferences, and purchases to the retailer's backend system for analysis.
Of course, the exact flowchart will depend on the specific hardware and software systems used for the smart shopping cart. But this provides a basic overview of how the process might work.


START
Initialize the system
Scan RFID Tags
Is RFID Tag?
Read data from memory
Display on the LCD
Add item cost as Items are added
If item is removed
Total-amount
Total will be same
Send the total amount
Print bill
END

3.6.Block Diagram:

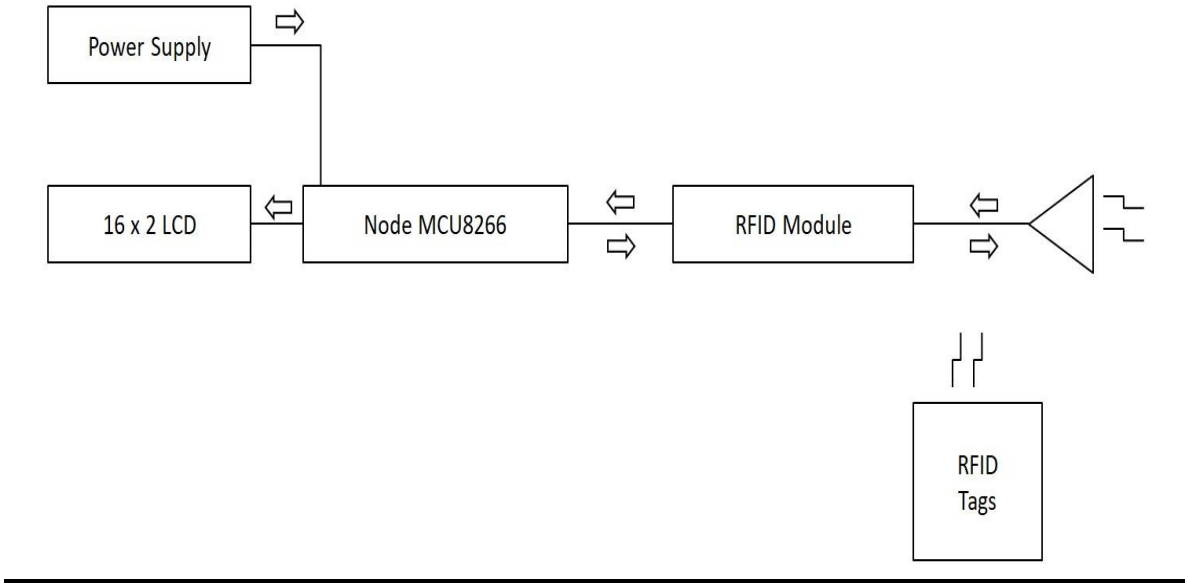


Fig.3.6.1: Block diagram

3.7 Algorithm required for product:

Here is a basic algorithm that a smart shopping cart might use:

When the user picks up the cart, the system logs them in and initializes the cart's sensors and tracking systems.

As the user adds items to the cart, the cart's sensors detect and log the products, along with their location in the cart.

The system uses the logged data to calculate the total cost of the items in real-time, and displays this information to the user.

The system can also use this data to suggest related products or promotions based on the user's shopping history or preferences.

The user can review their cart and make changes as needed.

When the user is ready to check out, the system can facilitate payment through the cart's built-in payment system or a mobile device.

The system generates a digital receipt and transmits data on the user's shopping habits, preferences, and purchases to the retailer's backend system for analysis. After the user completes their purchase, the system logs them out and resets the cart's sensors and tracking systems.

Of course, the specific algorithm used will depend on the hardware and software systems used for the smart shopping cart, as well as the specific requirements of the retailer. But this provides a basic outline of the logic that the system might use to track and manage shopping cart data.

3.8 Advantages:

Smart shopping carts offer several advantages over traditional shopping carts. Here are some of the key advantages:

Improved Shopping Experience: Smart shopping carts can enhance the shopping experience by providing features such as product recommendations, real-time promotions, and personalized coupons based on the customer's shopping history.

Time Savings: Smart shopping carts can save time for both customers and retailers. Customers can quickly and easily find the products they need, while retailers can streamline checkout processes and reduce the time spent on manual inventory tracking.

Increased Efficiency: Smart shopping carts can help retailers increase efficiency by automating tasks such as inventory management, pricing, and restocking. This can free up employees to focus on other tasks, such as customer service.

Enhanced Security: Smart shopping carts can improve security by incorporating features such as RFID tags and weight sensors to prevent theft or unauthorized removal of products from the store.

Data Insights: Smart shopping carts can provide retailers with valuable data insights, such as customer behavior, preferences, and trends. This can help retailers make informed decisions about pricing, promotions, and product placement.

Reduced Costs: Smart shopping carts can help reduce costs for retailers by eliminating the need for manual inventory tracking, reducing waste through real-time inventory management, and reducing the time and cost associated with checkout processes.

Overall, smart shopping carts can provide a more efficient and personalized shopping experience for customers, while also providing valuable data insights and cost savings for retailers.

3.9 Disadvantages:

While there are several advantages to using smart shopping carts, there are also some potential disadvantages to consider:

Cost: Smart shopping carts can be expensive to purchase and maintain, which may make them cost-prohibitive for some retailers. Additionally, the cost of implementing the necessary hardware and software infrastructure to support smart shopping carts can be significant.

Technical Complexity: Smart shopping carts require complex hardware and software systems to operate effectively. This can be challenging for retailers who lack the technical expertise or resources to manage and maintain these systems.

Data Privacy: Smart shopping carts may collect sensitive data on customers, such as purchase history and personal preferences. Retailers must ensure that this data is stored securely and used only for its intended purposes to protect customer privacy.

Reliability: Smart shopping carts rely on several interconnected systems to operate, including sensors, data networks, and software applications. Any failure in one of these systems can result in downtime or system failures, which can negatively impact the shopping experience for customers.

User Adoption: Smart shopping carts may not be familiar to all customers, and some may prefer traditional shopping carts. Retailers may need to invest in marketing and education initiatives to promote the benefits of smart shopping carts and encourage customer adoption.

Maintenance: Smart shopping carts require regular maintenance to ensure that hardware and software systems are functioning properly. This can be time-consuming and costly, particularly for retailers with large fleets of shopping carts.

Overall, while smart shopping carts offer several advantages, retailers must carefully consider the potential disadvantages and weigh them against the benefits before implementing these systems in their stores.

3.10 Applications:

Smart shopping carts have several applications in retail and other industries. Here are some of the most common applications:

Retail: Smart shopping carts can be used in retail stores to enhance the shopping experience for customers. They can provide real-time product recommendations, personalized coupons and promotions, and streamlined checkout processes.

Supermarkets: Smart shopping carts can be used in supermarkets to improve inventory management and reduce waste. They can track inventory levels in real-time and alert staff when products need to be restocked.

Hospitality: Smart shopping carts can be used in hotels and resorts to provide guests with a convenient way to order room service and other amenities. Guests can use the smart cart to browse menus, place orders, and track their purchases.

Airports: Smart shopping carts can be used in airports to provide travelers with a convenient way to shop for duty-free items and other products. They can be equipped with RFID tags to track inventory levels and prevent theft.

Smart Cities: Smart shopping carts can be used in smart cities to track waste disposal and recycling. They can be equipped with sensors to monitor waste levels and alert staff when bins need to be emptied.

Healthcare: Smart shopping carts can be used in healthcare settings to improve medication management. They can be equipped with RFID tags to track medication inventory levels and alert staff when medications need to be restocked.

Overall, smart shopping carts have numerous applications in various industries, providing businesses with a way to improve efficiency, enhance the shopping experience for customers, and reduce waste and costs.

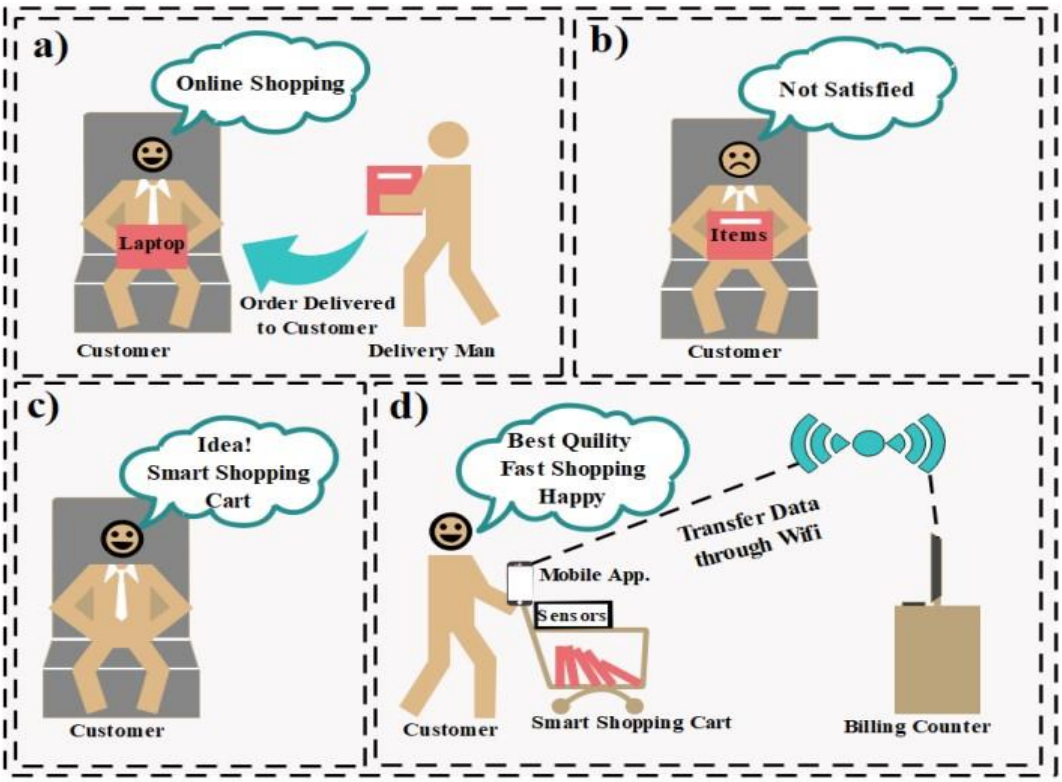


Fig.3.10.1: Real time implementation

Chapter 4

Experimental Setup

An experimental setup for a smart shopping cart could include the following components:

Hardware components:

A cart equipped with sensors and tracking systems to detect and log products as they are added to the cart.

A touch screen display or other interface to provide real-time information to the user, such as total cost and suggested products.

A built-in payment system or the ability to interface with mobile payment systems.

A Wi-Fi or cellular data connection to transmit data to the retailer's backend system.

Software components:

An operating system or software platform to run the smart shopping cart.

Algorithms and data processing systems to track products, calculate total cost, and suggest related products or promotions.

Interfaces to connect with external systems, such as payment processors and the retailer's backend system.

Experimental environment:

A test store or other environment to simulate a shopping experience.

A group of test users to use the smart shopping cart and provide feedback on the user experience.

An analysis system to process the data collected by the smart shopping cart and evaluates its effectiveness.

The specific experimental setup will depend on the goals of the experiment and the specific hardware and software components used for the smart shopping cart. However, this provides a basic outline of the components that could be included in such an experiment.

Chapter 5

Experimental Results

5.1. Results on smart shopping cart:

The experimental results of a smart shopping cart can vary depending on the goals of the experiment, the specific hardware and software components used, and the user feedback collected during the experiment. Here are some potential results that could be observed:

Improved customer experience: A smart shopping cart could improve the shopping experience by providing real-time information to the user, such as total cost and suggested products. This could result in increased customer satisfaction and loyalty.

Increased sales: By suggesting related products or promotions based on the user's shopping history or preferences, a smart shopping cart could potentially increase sales for the retailer.

More efficient inventory management: By tracking product sales in real-time, a smart shopping cart could provide valuable data to retailers to help optimize their inventory management.

Technical limitations: Some potential technical limitations of a smart shopping cart could include sensor errors or inaccuracies, connectivity issues, or issues with the software platform.

User acceptance: The success of a smart shopping cart will depend on user acceptance. If users find the system easy to use and helpful, it could become a valuable addition to the shopping experience. However, if users find the system confusing or intrusive, it may not be successful.

Overall, the experimental results of a smart shopping cart will depend on a variety of factors, including the hardware and software components used, the experiment design, and user feedback.

5.2.Ground level results on Smart Shopping Cart Detection :

The ground level results of a smart shopping cart can vary depending on the implementation, hardware and software components used, and the specific goals of the system. Here are some potential results that could be observed at the ground level:

Improved customer experience: A smart shopping cart can enhance the shopping experience by providing real-time information to the user, such as total cost and suggested products. This can result in improved customer satisfaction and loyalty.

Increased sales: By suggesting related products or promotions based on the user's shopping history or preferences, a smart shopping cart could potentially increase sales for the retailer.

More efficient inventory management: By tracking product sales in real-time, a smart shopping cart can provide valuable data to retailers to help optimize their inventory management, leading to more efficient stocking and better use of shelf space.

Technical limitations: Some potential technical limitations of a smart shopping cart include sensor errors or inaccuracies, connectivity issues, or issues with the software platform.

User acceptance: The success of a smart shopping cart depends on user acceptance. If users find the system easy to use and helpful, it can become a valuable addition to the shopping experience. However, if users find the system confusing or intrusive, it may not be successful.

Impact on retailer operations: The implementation of a smart shopping cart can impact the retailer's operations, as they may need to invest in new systems, modify store layouts, and train employees on how to use the new technology.

Overall, the ground level results of a smart shopping cart will depend on a variety of factors, including the specific hardware and software components used, the implementation, and user feedback.

5.3 Conclusion and Future scope :

In conclusion, smart shopping carts have the potential to revolutionize the shopping experience by providing real-time information and personalized recommendations to customers while also providing valuable data to retailers. The technology is still relatively new, and while there are some technical limitations and challenges to adoption, the benefits to both customers and retailers are significant.

The future scope of smart shopping carts is vast, as there are many potential directions for innovation and improvement. Some potential areas for future development include:

Enhanced personalization: Smart shopping carts could be further developed to provide even more personalized recommendations and promotions based on individual shopping history, preferences, and even biometric data.

Integration with online shopping: Smart shopping carts could be integrated with online shopping platforms to provide a seamless shopping experience across both online and in-store channels.

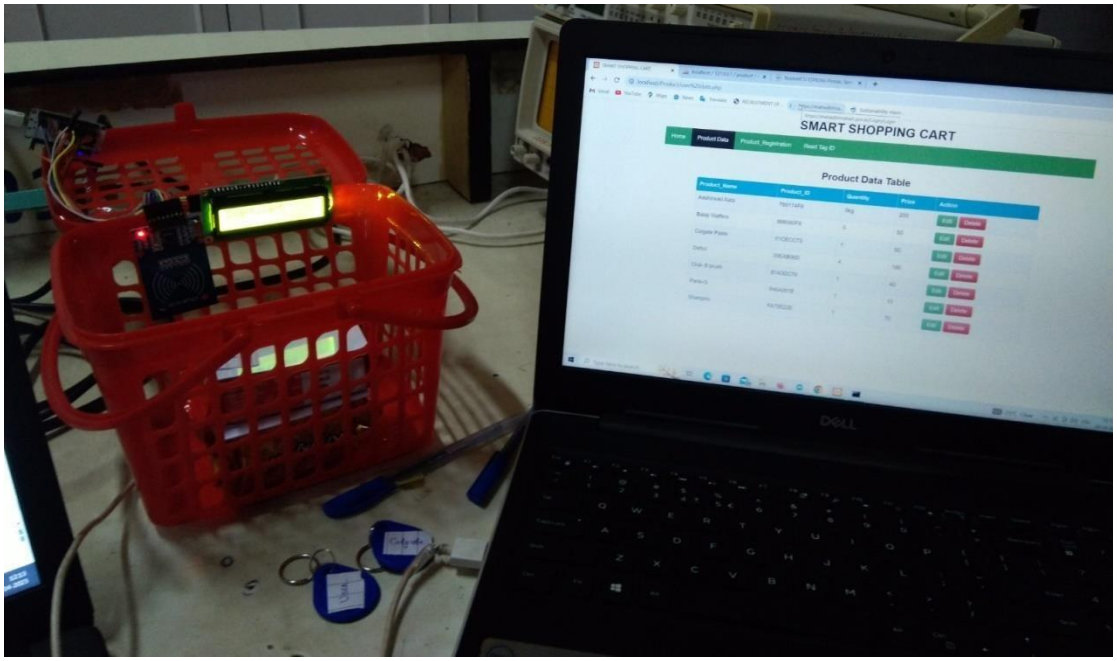
Advanced analytics: As more data is collected by smart shopping carts, retailers will be able to use advanced analytics tools to gain deeper insights into customer behavior and preferences.

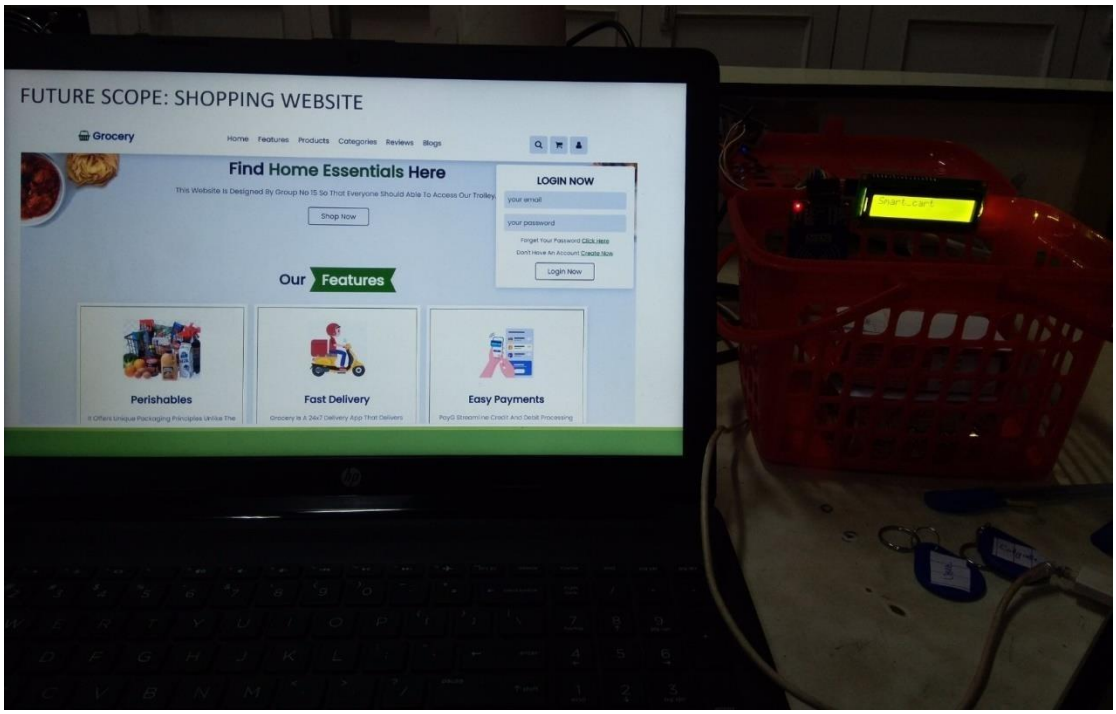
Improved hardware and connectivity: As hardware technology advances, smart shopping carts could become more accurate, reliable, and affordable. Improved connectivity could also help to overcome some of the current technical limitations of the technology.

Integration with other technologies: Smart shopping carts could be integrated with other technologies, such as augmented reality, to provide even more engaging and interactive shopping experiences.

Overall, the future of smart shopping carts is bright, and the technology has the potential to transform the retail industry in exciting ways. As the technology continues to develop and evolve, we can expect to see even more innovative and sophisticated implementations in the years to come.

Final view of smart shopping cart:


SMART SHOPPING CART
Product Data Table


FUTURE SCOPE: SHOPPING WEBSITE
Grocery
Home
Features
Products
Categories
Reviews
Blogs
Find Home Essentials Here
Shop Now
LOGIN NOW
your email
your password
Login Now
Our Features
Perishables
Fast Delivery
Easy Payments

Chapter 6

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