Smart Shopping Billing Cart

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Abstract*: Nowadays, on weekends and holidays, there is a huge rush at the malls. The rush is even more when we have special offers and discounts. People buy a variety of completely unrelated items and put them in a trolley. One must proceed to the cashier to make payments after making the entire purchase. The cashier sets up the bar code scanner for the bill, which could be a time-consuming process and cause long lines at the charge counters. In a retail center, this study sought to reduce the line at the billing counter. Smart Trolley does the same by displaying the total price of the product kept inside the cart. In this manner, the consumer can pay the total amount due at the cash register and then leave with the goods they have purchased. The Node MCU, RFID Reader Module, and RFID Card form the basis of the hardware. It eliminates the customary product scanning at the counter, which speeds up the entire shopping experience. Additionally, with this method, the consumer will know the complete amount due and can plan his shopping appropriately, only purchasing necessities and increasing savings. Since the entire invoicing process is computerized, there is significantly less chance of human error. To further improve the shopping experience, the system also contains a function that allows customers to erase the products they have scanned.*

Keywords: Shopping Billing Cart

I. INTRODUCTION

A smart shopping billing cart is an advanced version of a traditional shopping cart that utilizes technology to make shopping more convenient and efficient. It is designed to streamline the shopping experience by automating many aspects of the process. Smart shopping billing carts typically incorporate features such as RFID scanners, sensors, cameras, and touchscreens to enable shoppers to easily locate products, scan them, and add them to their cart. The carts also often include built-in scales to accurately weigh items, and may even suggest recipes or meal plans based on the products that the shopper has added to their cart. One of the key benefits of a smart shopping billing cart is that it eliminates the need for shoppers to queue up at the checkout counter. The cart keeps track of the items that the shopper has added to it, and automatically tallies up the total cost of the items as the shopper continues to shop. Once the shopping is complete, the shopper simply pays for the items using a digital payment method, such as a mobile wallet or credit card. In addition to improving the shopping experience for consumers, smart shopping billing carts can also benefit retailers by reducing the need for human cashiers and improving inventory management. Overall, smart shopping billing carts are an exciting development in the world of retail and have the potential to revolutionize the way we shop. Regenerate response

Today, millions of people utilize large grocery stores to buy an ever-increasing variety of goods. Product acquisition is a multi-step process that includes waiting in checkout lines, searching for products, and time spent in queues. On the other hand, it is becoming very difficult for retailers to keep their customers loyal and to predict their needs due to the influence of competition and the lack of tools that discriminate consumption patterns. As a result, a system has been created that will help to replace the current billing system. So, by using an RFID reader and Bar-code scanner this project has been developed. This system uses an RFID system, Node MCU, and Blynk server.

NodeMCU is an IoT Module based on ESP8266 wifi Module. NodeMCU uses Lua Scripting language and is an open-source Internet of Things (IoT) platform NodeMCU also uses Arduino code. This module has CH340g USB to TTL IC. NodeMCU is an open-source platform. It is also easily programmable with low cost and simple to Implement Wi-Fi enabled.By developing these projects we can reduce the time complexity in the shopping malls and can help the customer to do their shopping easily without any tension of standing in queue for billing.

II. LITERATURE SURVEY

In this project, the components used are an Arduino UNO board, LCD display, ESP8266 NodeMcu, RFID Reader, and RFID tags. When the customer starts shopping, each product we are attached to a unique code RFID tag. The unique code of the RFID tag scanned by the EM-18 Reader and the amount of the product displayed on the LCD display. A smart shopping billing cart is an advanced version of a traditional shopping cart that utilizes technology to make shopping more convenient and efficient. It is designed to streamline the shopping experience by automating many aspects of the process. Smart shopping billing carts typically incorporate features such as RFID scanners, sensors, cameras, and touchscreens to enable shoppers to easily locate products, scan them, and add them to their cart. The carts also often include built-in scales to accurately weigh items, and may even suggest recipes or meal plans based on the products that the shopper has added to their cart. One of the key benefits of a smart shopping billing cart is that it eliminates the need for shoppers to queue up at the checkout counter. The cart keeps track of the items that the shopper has added to it and automatically tallies up the total cost of the items as the shopper continues to shop. Once the shopping is complete, the shopper simply pays for the items using a digital payment method, such as a mobile wallet or credit card. In addition to improving the shopping experience for consumers, smart shopping billing carts can also benefit retailers by reducing the need for human cashiers and improving inventory management. Overall, smart shopping billing carts are an exciting development in the world of retail and have the potential to revolutionize the way we shop. Regenerate responses have gone through the covid-19 phase we know that it's important to maintain distance in public places is very necessary but it is not going practically. To overcome this challenge, a smart trolley using a "barcode scanner and RFID-reader" based on the IOT with an advanced billing system that makes shopping easy and fast. Customers can also avoid standing in the long queue.

Raju Kuma, k. Gopalakrishnan, k. Ramesh, [1] proposed a system that is helpful to both users and mall managers. The system is developed considering all issues related to all users included. A variety of customers can use this system if they know how to operate Android smartphones. The product is user-friendly, low-cost, and doesn't need any special training. Our scheme would prove time-saving and ease the shopping process for many people using the system. The advantages of the system make it more robust.

Manan Rao [2] proposed a system based on RFID technology that could replace the traditional barcode system was successfully established. The barcode system had various drawbacks including the strict requirements on the line of sight and its need to be placed in one particular boundary while scanning, not to mention the issues concerning its durability and inability to update information.The only constraint is that RFID scanning is known to have distance and range coverage. RFID tags are durable and allow constant updates of information as well as a rewrite of data to account for changes. They can also operate in extreme temperature conditions and are not susceptible to physical wear and tear or damage underwater.This makes the process reliable, flexible, and adaptive. The door fixed along with the servo motor ensures that until the payment is done, no unscanned product is placed inside the trolley. The availability of multiple modes of payment through digital wallets or bank accounts ensures that every single penny is paid for and prevents the occurrence of penny scams.

Yathisha, L [3] proposed by implement simplifying the billing process, making it swift & increase security using RFID techniques.In this, the author used the recharged card to deduct the money from the customer. As the customer buys of anything in the shopping malls, the amount will be deducted from the precharged card and sent to the authorized account. Which will make the customer get a good and comfortable experience while shopping. If the customer wants to remove the item, then he/she should scan the item once again which will cancel the item from the bill. Which will not cost an extra amount.Automatic billing of products by using the RFID technique will be a more viable option in the future.

Rong Chen, et.al., [4] proposed in this paper, a scheme of a smart supermarket shopping guide system (SSSGS) based on the technology of the Internet of Things is proposed. The most critical issue of SSSGS is product identification and information acquisition. This system combines electronic tags with identification techniques in the Internet of Things. The electronic tags are applied to the product identification. The wireless technique and identification methods are employed to transfer and determine the product information automatically. The function and properties of SSSGS are analyzed. The combination of the RFID network system and Zigbee network applications is investigated. Some middleware in communication tasks and the system of the SSSGS are proposed.

PT Sivagurunath, et.al., [5] proposed developed system using a smart shopping trolley using RFID value. Current retail systems use barcode scanners at malls. Barcodes are included on every product in this project. The bill is produced by manually scanning each item using the barcode scanner. The wait time is prolonged by this procedure. Customers spend more time there buying.

.J. D. Jadhav et.al., [6] proposed the items can be detected irrespective of their tag orientation, size, and shape.These were the drawbacks addressed in previous shopping trolley applications which were overcome in this application.The development of the antenna and hybrid coupler is based on the original work which has been carried out by MonashMicrowave, Antennas, RFID, and Sensor laboratories. Finally, this particular application may bring novel experiences for shoppers when they benefit from coordinated collaboration among technologies.Thus, shoppers will have the capacity to encounter a scope of new portable associated gadgets more qualified for variable innovation applications.

Chandrashekhar, [7] proposed the work RFID System which is a good replacement for the barcode scanning system they have many disadvantages to the barcode system like the barcode scanning system can read data a certain distance.

Vishwas B, Swathi V Raidurg, Apoorva S, Anand Rao Pawar, H Laxmi B Rananavare,[8] proposed a system to secure a shopping cart in shopping malls. They developed the IOT-based application which secures the smart shopping cart. By using a raspberry pi 3, they developed the system. As the first user should log in to the system (If he/she is a new user then they should register to the system) The user should provide the basic information to save in the database of the system. After the user has registered then the user will log in which will validate by the database. Then the item is added to the cart and the bill will be displayed on display. After verifying the bill, the customer will pay the bill and take the exit.
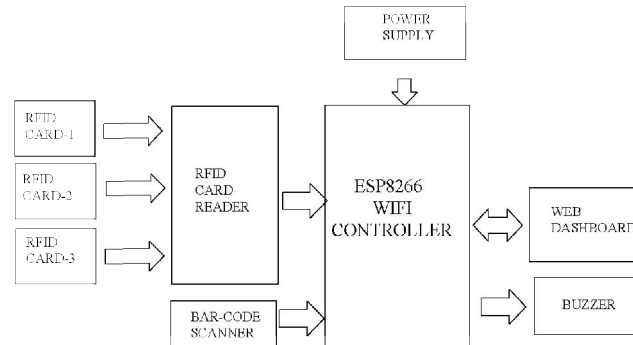
III. BLOCK DIAGRAM

Figure 1: Proposed block diagram of smart shopping billing cart

As shown in figure 1 Different RFID cards are can be scanned on the RFID card reader. Just like RFID, a bar code scanner is also installed to scan products with bar codes after a product has been scanned the information is sent to the ESP8266 WIFI controller. From the WIFI controller, the signal is sent to the WEB dashboard. The total amount gets added to the list and is shown on the dashboard. A buzzer is also added to the controller to alert.

3.1 Design Calculations

An ESP8266 WIFI controller is the brain of the design. Due to its inbuilt wifi, it helps to connect with the internet for IOT applications. RFID card reader and bar code scanner are connected to the controller. on the other hand web dashboard and a buzzer is also connected to ESP8266.

whenever an RFID or bar code is scanned on the RFID card reader and bar code scanner respectively the information about the product is processed in ESP8266 and then get displayed on the web dashboard.

- An RFID tag (of frequency 125khz) is attached to every product in the mall and the reader (EM-18) is attached to the trolley. At the time of purchase, the tag attached to the product is scanned by the reader. Each tag has a unique EPC.

- Based on the EPC received by the Arduino, the information of the product is displayed on the LCD along with the updated cost. This information is also sent to the central PC with the help of the HC-12 transmitter at the trolley and the HC-12 receiver at the PC.
- If the customer wants to remove the added product, the product should be scanned again. Then the cost of the corresponding product will be deducted from the bill.
- The push button is provided at the trolley to indicate the end of the shopping. On pressing of push button, the final bill is displayed on the LCD, and the payment through recharged card can be done. Recharged cards are unique RFID tags provided for each customer.
- These cards contain information such as the customer identification number and the balance available on the card. By scanning recharged cards, payment is done at the trolley itself.Finally, LCD shows the balance available on their card. This whole information is available on the serial monitor of the central PC.

3.2 Components

Choosing potential components was a vital part of the process. The first thing to keep in mind while choosing the components was that they should be budget-friendly. A high-quality product at an affordable price makes its place in the market. secondly, mechanical parameters like dimension, package, weight, etc were of concern because the final model must be easy to handle and carry from one place to another. third thing was that after the completion of the project when it will be used by the customers the at that time the maintenance cost should be low these will increase the long-term availability and durability.

Based on the above criteria we chose the following Components:

1. ESP8266
2. RFID Module
3. RFID Cards
4. Bar code Scanner
5. 5.RFID keychain

A. ESP8266 Wi-Fi Controller:

ESP8266 is a microcontroller unit. Mostly it is part of an integrated system. Due to the built WIFI, it can also be used for IOT applications. It is self-contained, and independent and yet runs as a small, dedicated system.

B. RFID Card:

Radio Frequency Identification is a rectangular card that is used for wirelessly transmitting a receiving signal. They send and receive radio wave frequencies. Each product will have a unique RFID. whenever any product is scanned the RFID card reader the product.

C. RFID Card reader:

RFID card reader is an electronic device that is used to identify the RFID card.After identifying an RFID card the information is sent to the main system, and the details appear on the screen. It can be wireless or portable.

D. RFID Module:

RFID or Radio Frequency Identification system consists of two main components, a transponder/tag attached to an object to be identified, and a Transceiver also known as an interrogator/Reader. A Reader consists of a Radio Frequency module and an antenna that generates a high-frequency electromagnetic field. Below Table 1 shows the specifications of the RFID module.

Parameters	Value
Frequency Range	13.56 MHz ISM Band
Host Interface	SPI / I2C / UART
OperatingSupply Voltage	2.5 V to 3.3 V

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Max. Operating Current	13-26mA
Min. Current (Power down)	10μA
Logic Inputs	5V Tolerant
Read Range	5 cm

Table 1. Specifications of RFID module

E. Bar Code Scanner:

1d Barcode Scanner:

In the same way, an RFID scanner is used to read RFID cards; a Bar code scanner is used to identify Bar codes. It is called 1D because only one-dimensional bar codes can be identified by this scanner. After scanning the barcode, the information about the product will appear on the screen. Some characteristics of bar code scanners are:

Quick & Accurate Billing:

As we don't have to wait at the counter for a long time for billing it reduces the overall period and makes shopping easier. and also, all the products will be calculated accurately without any error.

Works In Harsh Conditions:

Even if the barcode is slightly scratched or not in proper condition still it will get scanned.Also dimmed light and environmental conditions will not have any effect on the overall billing.

Handy & Sturdy Design:

Easy to handle and does not require any particular skills to operate. its tiny size makes it easy to hold in your hands.

Compatibility & Scan Rate:

This barcode scanner with an IP54 waterproof rating is compatible with Mac, Linux, Windows, and other common software. It is a superb performer as it can scan 300 times/second.

Easy To Operate:

The scanner has only a two-meter-long cable which makes it easy to use and handle. To start we only have to plug in the USB and use it. Red color LED light appears on the scanner once it has been started.

Wide Range Of Usage:

With powerful decoding capabilities, this barcode scanner is ideal for use in supermarkets, department stores, libraries, bookstores, inventory tracking, POS, etc. The 1D Laser Barcode Scanner 3005 makes your daily work much easier with simple accounting. This is a 1D code scanner and supports USB 2.0 interface. Its accuracy is amazing and its fast and convenient scanning makes you more relaxed. The ergonomic ABS design is strong, and sturdy and won't break even after a hard drop. It is an excellent performance that can be held comfortably for a long time. High-precision scanning without errors is possible. Just plug in and scan on different operating systems. The scanner has many features. It can scan 300 codes per minute. Product breakage, water damage and wear and tear are not covered by warranty. The warranty covers product manufacturing defects. The customer must send the product to our service center for in-warranty repair.

Circuit design (Circuit schematic):

A smart shopping billing cart is a modern technology that allows customers to scan items as they shop and receive a running total of their purchases. figure 2 shows the circuit diagram of smart shopping billing cart.

Here circuit diagram description of a smart shopping billing cart:

Power Supply: The power supply provides electrical power to the entire system. It can be a battery or a wall outlet, depending on the design. Microcontroller: The microcontroller is the brain of the system, responsible for controlling and managing all the components. It processes the input data from the sensors and sends the output data to the display and speaker.

Scanner: The scanner is a sensor that reads the barcodes on the products. It can be either a laser scanner or a camera-based scanner. The scanner sends the barcode data to the microcontroller.

Display: The display is an output device that shows the customer the items they have scanned and the running total of their purchases. It can be an LCD screen or an LED display.

Speaker: The speaker is an output device that provides audio feedback to the customer, such as a beep sound when an item is scanned or a voice message.

Memory: The memory stores the barcode data and the prices of the products. It can be a flash memory or an SD card.

Communication Module: The communication module allows the system to communicate with other devices, such as a central server or a mobile app. It can be a Wi-Fi module, a Bluetooth module, or a cellular module.

Billing Module: The billing module calculates the final bill based on the items scanned and the prices stored in the memory. It can be a simple calculation algorithm or a complex billing system.

Payment Module: The payment module allows customer to pay for their purchases using various methods, such as cash, credit card, or mobile payment. It can be a card reader, a cash dispenser, or a QR code scanner. Overall, a smart shopping billing cart is a sophisticated system that combines various components to provide a seamless and convenient shopping experience for customers.
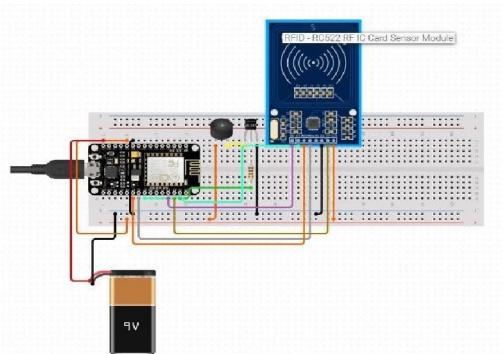

Figure 2: Circuit diagram of Smart Shopping Billing Cart
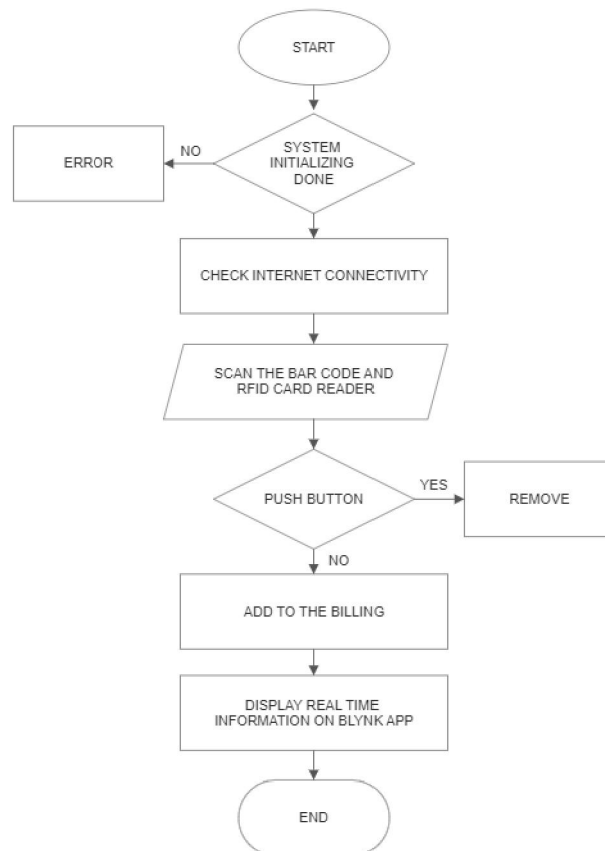
Design (Flowchart)

Figure 3: Flow chart of smart shopping billing cart

In the above figure 3 the mechanism of a smart shopping billing cart is shown in a flow chart. At first, the machine is started then everything is checked about the connectivity and installation for the working of the system. if something is not working properly an error is shown on the display otherwise system gets started for further process. then we need to scan the product on an RFID reader or barcode scanner as needed. the total price is added to the list one by one and the billing is created.

IV. METHODOLOGY

This model is called RFID and Barcode based "SMART BILLING SYSTEM". On some product RFID tags and some products, Barcode is used. In this project, we build a scanner that scans different tags. The reader is operated through a node MCU. When the tag is scanned according the cost of the cart increases and we can remove the product after the scan using the push button after that scan product it will decrease the cost of the product from the total amount. The tags will correspond to different prices and they will be updated in the cart amount. When the first switch is pressed, the System goes into the minus mode, and the amount is deducted according to the tag. The second switch is used to clear all the products in the cart and clear the cart amount.

Software tools –

1. Arduino IDE

2. Blynk IOT Platform

ARDUINO IDE –

The Arduino Software (IDE) is open-source software, a compiler to convert that code to machine code or binary files so that the microcontroller can understand, and also programming software to loads these firmware files onto the microcontroller.

When we combine all these with some additional features like debugging support, console support, etc, that's what we call an IDE (Integrated Development Environment) or in simple terms the Arduino Software. Arduino IDE, as the name states, is a development IDE for Arduino boards.

It consists of a feature-rich code editor, compiler, programmer, serial console, serial plotter, and many other features. It is simple and easy to use.

In the Arduino environment, we write sketches that can be uploaded to Arduino boards. In this tutorial, we will go through how to select a board connected to your computer, and how to upload a sketch to that board.

There are two main tools when uploading a sketch to a board: verify and upload. The verify tool simply goes through your sketch, checks for errors, and compiles it. The upload tool does the same, but when it finishes compiling the code, it also uploads it to the board.

With the board selected, we are good to go! Click on the upload button, and it will start uploading the sketch to the board.

Blynk IOT Platform:

Blynk is here to help all of those talented developers and entrepreneurs looking to prototype, deploy, and remotely manage connected electronic devices at any scale. Our new platform will let you connect hardware to the cloud and use pre-made app modules to build iOS, Android, and web applications ready for the end-users.blynk connects devices to the cloud, builds mobile apps to remotely control and monitor them, scales thousands of users, and deployed products from connected product prototypes to commercial launches and A low-code IoT software platform to manage further growth. Alongside all other typical IoT infrastructure with over 400 hardware models, a native mobile app allows customers to connect any device to the internet and run commercial projects using a suite of software products.

Simulation Results, Description (Snapshot)

For simulation, we use the proteus Arduino tool. Figure 4 shows the simulation of the smart shopping billing cart on Proteus software. Proteus software is used to create schematics and electronic prints for the manufacture of the circuit board. From the tool, we select Arduino UNO and two virtual terminals. One port of Arduino is connected to the receiver and one port is connected to the transmitter. After debugging and running it will give two virtual terminals. We

have two tag values valid or invalid. We have to paste the tag value in the second terminal then we get the result in the first terminal is that tag is valid or not.
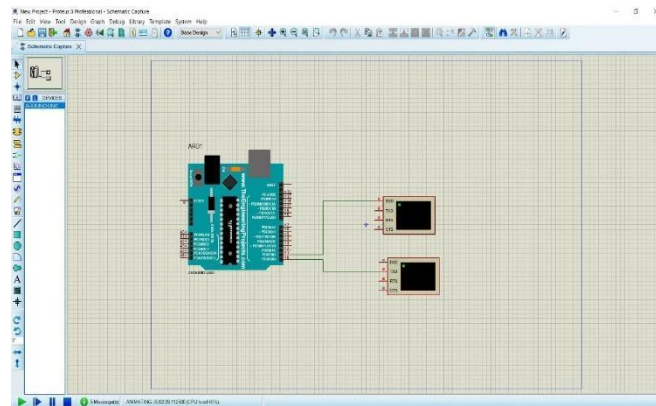

Figure 4: Simulation of Virtual terminal using Arduino on Proteus Software

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