Smart Shopping Trolley with Automated Billing System

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***Abstract*— The goal of the Smart Shopping project presented in this study is to automate the shopping process. Modern technology has allowed humans to live at a higher quality. Retail centers were consequently overcrowded. The billing procedure needs to be shortened to serve the massive population. This is accomplished with a smart shopping system based on RFID. A clever shopping cart generates and displays a bill when each item is read individually. The consumer uses the pre-charged cards that the mall has given them to pay the bill after it has been created**

The objective is to reduce the time needed for the billing system. Artificial intelligence, machine learning, virtual reality, touch commerce, the internet of things, and many other fields are among the many areas in which technology is developing daily in our modern society. The main objective of the project is to focus on the client's objectives and goals because time is more valuable to everyone in the real world. Nonetheless, they spend more time at the supermarket.

Keywords—Alternating current, Direct current, light dependent resistor, Revolution per minute, Battery operated motor, Integrated development environment.

I .INTRODUCTION

The goal of the Smart Shopping project presented in this study is to automate the shopping process. Thanks to modern technology, people now enjoy a higher standard of living.As a result, retail malls were packed. We must shorten the billing process in order to accommodate the enormous population. An RFID-based smart shopping system is used for this. A smart shopping cart generates and displays a bill when each item is read individually. The consumer uses the pre-charged cards that the mall has given them to pay the bill after it has been generated. The goal is to cut down on the amount of time required for the billing system. In our live world technology is expanding day by day in numerous domains like artificial intelligent, machine learning, virtual reality, touch commerce, internet of things and so on. Since everyone in the real-world values time more, the project's primary goal is to concentrate on the objectives and goals of the client. However, consumers spend more time at the grocery store. Because the entire billing process is automated, there is a far lower chance of human error. The system also has a feature that lets the user remove the scanned products, which further enhances the customer's shopping experience.

II. LITERATURE REVIEW

To carry out any project work, it is very essential to understand the current scenario and the technology merits and demerits. In this context literature survey has been carried out thoroughly to formulate and to choose the objectives of the project work. Following is some of its literature that has contributed in the area chose for the study.

Adarsh Borkar, Madhura Ansingkar, Monali Khobragade, Pooja Nashikkar, ArtiRaut.., “Smart Shopping-An Android Based Shopping Application” directly addresses This work expands the usefulness scope by addressing item manipulation, which presents additional issues relating to robotic control, object recognition, and spatial navigation in dynamic retail situations. Traditional smart carts primarily focus on data processing and invoicing automation. These difficulties are consistent with more general concerns in autonomous robotics literature, like avoiding obstacles and making decisions in real time. [1]

Rhythm Mehta, Dhruva Ashok, Anshul Ahluwalia, Prof. Siva Rama Krishnan S. “Smart Shopping using QR codes for Bill Calculation and RFID system”, This method underscores a key shift in smart shopping systems**:** moving the point of sale directly into the customer’s hands. By using a mobile app interface, the system not only improves checkout speed and user convenience, but also facilitates digital payments, aligning with the global trend toward cashless retail. Moreover, this approach enhances inventory and finance management, as each scanned product is instantly reflected in backend databases, streamlining stock monitoring and purchase analytics. [2]

.D, S. S. Guddad, A. S, K. Yanamala and S. S, "Smart Shopping Cart using IOT and robotic arm," It is anticipated that the paper's literature analysis would examine current smart cart technologies, highlighting their drawbacks and pointing out how integrating robotic arms with IoT platforms might improve functionality. Technical issues

including item detection, obstacle avoidance, in-store navigation, and deployment cost-effectiveness might also be covered. The authors present their system as a possible advancement over current models by integrating various technologies, with the goal of increasing automation, ease, and engagement in retail settings.[3]

Hubert, M. blut, C. Brock,C. Backhaus and T.Eberhardt ―Acceptance of smart phone based mobile. The study "Acceptance of Smartphone-Based Mobile Shopping: Mobile Benefits, Customer Characteristics, Perceived Risks, and the Impact of Application Context" explores the various aspects that affect consumers' decision to use smartphones for mobile shopping. A wide range of topics are covered in the larger body of literature on mobile commerce, or m-commerce, such as the factors that encourage and hinder the adoption of mobile shopping, the behavioral impacts of mobile technology, and the crucial roles that perceived risk and trust play in online transactions. [4]

S. Kowshika, S. S. Madhumitha, G. Madhu Varshini, V. Megha and K. Lakshmi, "IoT based Smart Shopping Trolley with Mobile Cart Application". By fusing IoT infrastructure with a mobile app interface, the paper "IoT-Based Smart Shopping Trolley with Mobile Cart Application" advances intelligent retail systems. As smart trolleys have evolved in literature, IoT modules with features like real-time inventory updates, store navigation, and customized promotions have been included, along with technology like RFID, barcode scanning, and weight sensors for automatic billing. [5]

III. Proposed System

The proposed system uses a Multiplexing and demultiplexing algorithm to recognize QR code images on smartphones, allowing users to verify product authenticity and access a variety of applications. When a user scans a product's QR code using the app's built-in scanner, the system decodes the data and launches a web service that establishes a secure connection to the store database. Once linked, the system obtains and presents extensive product information to the user in real time. This seamless procedure minimizes manual work and scanning time for specific items, considerably improving the purchasing experience. By automating item recognition and database synchronization, the system provides speedy and accurate transactions while increasing user convenience and confidence in product authenticity.

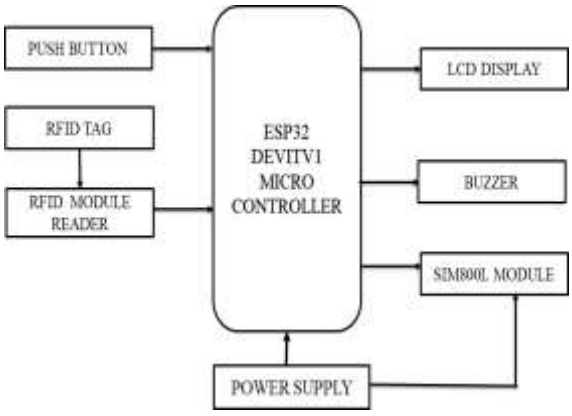


Fig 1: Block diagram of a system

This clever shopping cart technology speeds up transactions and payments. It incorporates an LCD display, RFID reader, and ESP32 microprocessor right into the cart. Each product has an RFID tag, which is scanned before being added to the cart. The LCD shows the product pricing, item count, and total cost in real time. If a customer wants to delete an item, they can press the remove button and rescan it, which will immediately update the total. At checkout, a QR code with the final bill is created, allowing customers to pay immediately from their basket. This method not only streamlines the shopping and billing process for clients, but it also removes the need for traditional billing counters, allowing shopping mall owners to decrease operational costs.

ESP32 microcontroller v1: The microcontroller controls the system's brains. It adjusts output after analyzing sensor data.

16x2 LCD Display with I2C: With the items added to the basket, their pricing, and the running total displayed, this display offers a straightforward and simple result.

SIM800L GSM Module: In order to provide order confirmations or billing information, the SIM800L GSM Module manages communication with external systems. Sending SMS messages is made possible via this module, which can also be used to link to more sophisticated functionalities.

RFID Reader Module: It is a wireless composition made up of readers and tags. The component with one or more antennas that send out radio waves and receive signals from the RFID tag is called the reader.

Toggle Switch: An electrical switch that may be opened or closed by sliding a handle or lever forward and backward is called a toggle switch

Jumper Wires & Connecting Wires: A longer cable called a connecting wire is used to join devices or other circuit components. It is employed to establish a long-term link between two locations.

Arduino IDE: The integrated development environment (IDE) is open-sourceFrom this we can write, compile and upload the code to the Arduino board.

IV. DESIGN AND IMPLEMENTATION

To assemble the components, follow the steps:

The microcontroller (blue board with the antenna) appears to be powered via a USB cable connected to its micro-USB port. This likely provides the 5V and ground needed for its operation. Several wires connect the microcontroller to the blue RFID-RC522 module. These wires likely carry the SPI (Serial Peripheral Interface) signals (MOSI, MISO, SCK) along with power (VCC) and ground (GND) necessary for communication. A bundle of wires connects the microcontroller to the green LCD module with a black display. These connections would include data lines (likely in 4-bit or 8-bit parallel mode), control signals (like RS, EN), and power (VCC) and ground (GND) for displaying information.

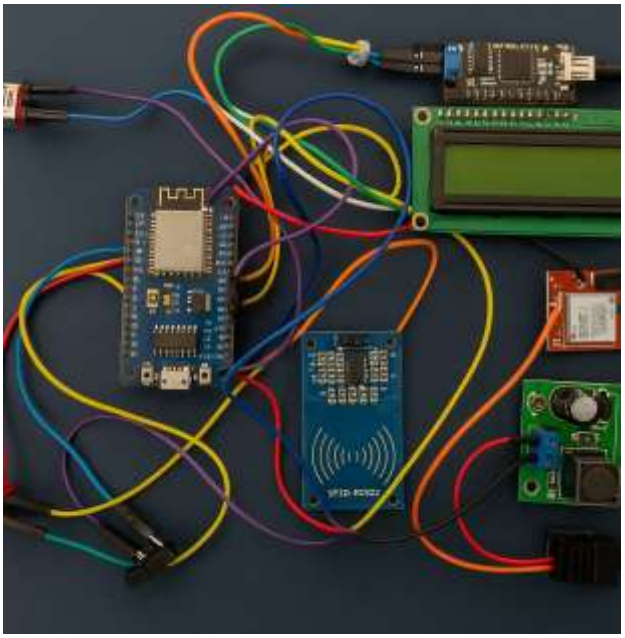
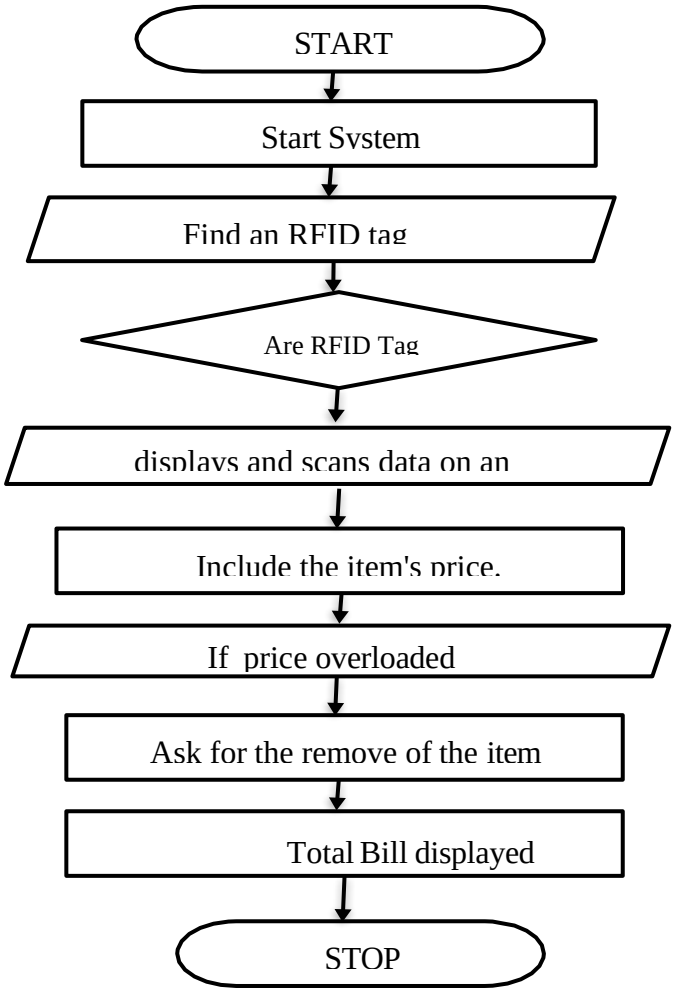


Fig 2: Circuit Diagram

Wires are seen connecting the microcontroller to the small red board, which appears to be a SIM800L or similar GSM module. These connections would include serial communication pins (TX, RX) for sending AT commands and receiving data, as well as power (VCC) and ground (GND).The Motor enable is connected to the Arduino pin 10,11, Turn 12,13 The black and red wires connected to the green terminal block seem to be distributing power to some of the modules. It's difficult to trace the exact source of this power from the image alone, but it's likely connected to the overall power supply of the system. There are other colored wires emanating from the microcontroller that led to other components partially visible in the frame (like the black module with the heats ink and the breadboard-like strip). The exact nature of these connections and the function of these components cannot be definitively determined from this single image. It's possible that some of the modules (like the LCD or another unseen sensor) are communicating using the I2C protocol, which would typically involve two wires (SDA and SCL) connected to the microcontroller. However, this cannot be confirmed with certainty from the visible wiring.

V.FLOW CHART

Our suggested RFID-enabled IoT-based smart shopping cart automates and simplifies the in-store purchasing procedure. A distinct RFID tag with information like the product's name, category, and price is inserted in each one. An RFID scanner recognizes the item when a customer adds it to the cart and changes the customer's virtual cart accordingly. The product specifications, item count, and total cost are displayed in real time via the ESP32 microcontroller and LCD display. By clicking a button and rescanning, customers can remove products, updating the display and total cost in the process. All of the products in the cart are scanned by an RFID reader during checkout, and the backend computes the total cost, including taxes. After that, customers can pay in a variety of ways, cutting down on time spent at billing counters



and increasing the effectiveness of their purchasing..

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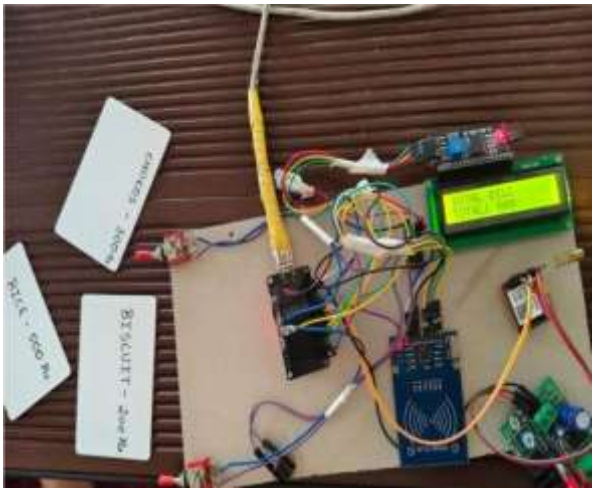
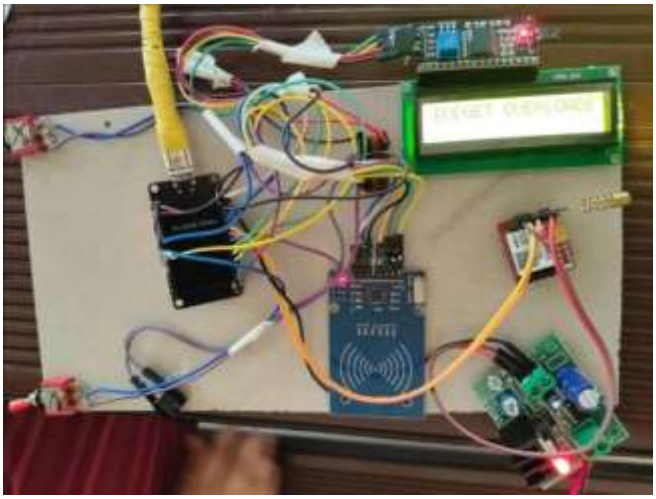
Fig 3: Flow chart

RESULT AND DISCUSSION

The following figure shows the result of the proposed



systems:



An RFID tag with a unique ID, price, and other information is attached to every item in the store. Customers actively scan items close to the RFID scanner as they are placed in the cart, as seen in the picture. An ESP32 module connects to the reader, which wirelessly sends the data to a server that pulls product information from a database. Rice, biscuits, and chocolates are scanned and added. The system notifies the user if the "BUDGET OVERLOADED" level is reached after tracking total spending and comparing them to a preset budget. Effective stock management is supported by real-time inventory updates. The entire item list and total pricing are displayed on the trolley display at checkout. The user receives a confirmation SMS after a simple payment process that may involve the use of an RFID card.

CONCLUSION

A notable development in contemporary retail technology is the smart shopping trolley system, which improves the shopping experience by fusing RFID with microcontroller-based automation. Real-time billing is enabled in the cart, which decreases reliance on checkout personnel and does away with the need to wait in lengthy lines. Accurate billing, quick updates shown on an LCD and web server, and effective product scanning are all made possible by the integration of technologies like Node MCU and Arduino. Along with saving time, this method reduces human error, which boosts customer happiness and shop productivity. Its smooth functioning and easy-to-use interface make it particularly useful in crowded metropolitan settings. As technology advances, the retail industry is expected to continue innovating and providing a more efficient, easy, and accessible shopping experience for everyone.

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