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IoT Based Smart Shopping Cart Using RFID

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Abstract: ***The standard of living for people has improved with the help of contemporary technology. As a result, large crowds gathered in supermarkets and shopping malls. Due to barcode-based billing system, it is difficult to avoid standing in long lines during weekends or when there is a large crowd in supermarkets and shopping centers. IoT Based Smart Shopping Cart using RFID technology seems to be a promising solution to address the issue of long queues at the billing counters in crowded shopping malls and supermarkets. This system can save a lot of time for customers as the bill is generated automatically at the cart itself. The use of RFID tags for each product and a recharge card with a certain amount in it for each store is an innovative approach that can simplify the billing process. The display of the remaining balance after deducting the price of each product on the LCD of the cart and the real-time update of the total bill on an IoT application such as ThingSpeak can provide customers with a convenient and transparent shopping experience. It can also reduce the need for manual labor, as the system can manage the billing process without the intervention of a cashier. Overall, the IoT Based Smart Shopping Cart using RFID technology has the potential to revolutionize the way people buy by making it faster, more convenient, and more efficient. It can also contribute to reducing the waiting time in long queues and improving the overall shopping experience for customers.***
Index Terms: RFID Technology, RFID Reader and Tags, IoT application, ThingSpeak.

I. INTRODUCTION

IoT achieves data management and data processing by tightly connecting communication networks with sensor networks, either directly or indirectly. The Internet of Things (IoT) relies heavily on sensors and actuators to connect us to the real world. It describes how cleverly physical objects like actuators that connect wirelessly or wired to other electronic devices can manage information. This includes sensors, microcontrollers, microprocessors, and physical devices.

Electronic tags that are connected to certain things are now used. RFID technology reads the object's stored information wirelessly when these tags come within range of the reader. In the IoT's applications, RFID is essential. It is made up of three parts, including RFID tags that are connected to the object and hold information about it, an RFID reader that reads the information from the tags, and a central processing system that facilitates communication between the RFID system and other electronic equipment.

Barcode scanning systems are typically used in retail centres. which has a huge queue of consumers waiting to be billed. An IoT-Based Smart Shopping Cart Using RFID is designed as a solution to this problem. Every product has an RFID tag attached to it, and an RFID reader mounted to the cart is used to scan each product. Customers fill the cart with various products they have purchased. The LCD shows the balance of the recharge card following each purchase. Rescanning the item will remove it from the total cost and put back the amount subtracted if the customer wants to remove some goods. Using this, the amount of time consumers must wait at shopping malls is reduced.

II. LITERATURE SURVEY

An IoT-based smart shopping cart makes it simple to shop in malls and supermarkets by automatically creating a bill in the cart and using the IoT application ThingSpeak, which reduces wait times at the cash registers. [1].

The automation of shopping carts using RFID and ZigBee modules is an innovative way to streamline the shopping experience for customers. The use of RFID tags instead of barcodes enables the system to identify products quickly and accurately, reducing the time customers spend at checkout. The trolley's ZigBee transmitter transmits data to the system's main computer, allowing the system to track inventory levels and sales in real-time. This makes it easy to restock items that are running low and to identify popular products that may need to be reordered [2].

The proposed automated and time-saving retail system is a great illustration of how technology may be used to enhance the customer shopping experience. By designing a smart cart that is customer-friendly and secure, retailers can enhance the overall shopping experience for their customers. One of the key features of the proposed smart cart is its ability to generate a bill from the cart itself. This means that customers can keep track of their purchases as they shop, making it easy for them to stick to their budget.

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Additionally, customers can make payments through a credit card, which helps maintain a database of their transactions. Using this information, retailers can launch promotions and schemes that are appropriate for their customers and offer those customers more discounts. [3-4].

The smart cart is made possible by the use of RFID technology for payments and shopping, as well as the AVR microcontroller for peripheral interfacing and inventory management. The RFID technology ensures that the system can accurately identify products, while the AVR microcontroller allows the system to manage inventory levels and interface with peripherals such as the LCD display and credit card reader [5].

III. EXISTING SYSTEM

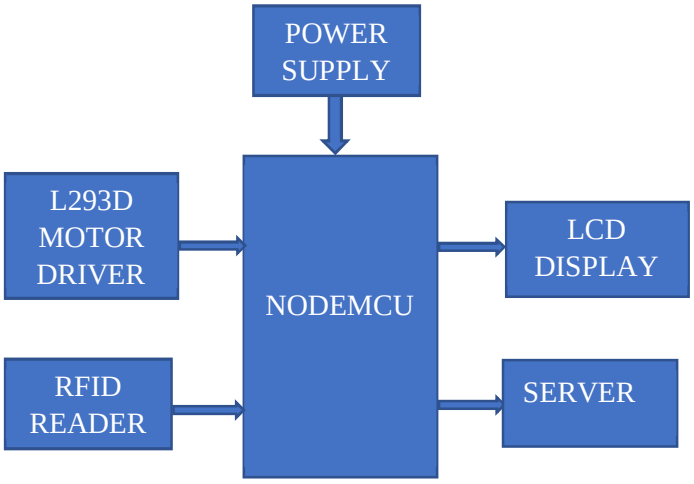
In a barcode scanning system, customers must carry their purchased goods to the billing counter where they must wait in queue. A barcode scanner is used to scan each item individually after which the total cost of the purchase is determined.

A. Drawbacks Included with Barcode Scanning Are

This can be a time-consuming process, especially during peak hours when there are a large number of customers. Furthermore, customers may not be aware of the total amount of their purchase until they reach the counter, which can lead to unexpected surprises and inconvenience.

IV. IOT BASED SMART SHOPPING CART USING RFID

A. Block Diagram



B. Hardware Description

1) NodeMCU

The open-source NodeMCU (Node MicroController Unit) is built on a low-cost System-on-a-Chip (SoC) called the ESP8266. It has an operating voltage of 3.3V and input voltage of 4.5-10V.

2) L293D Motor Driver

The L293D integrated circuit (IC) is a dual H-bridge motor driver. Motor drivers act as current amplifiers because they change a low-current control signal into a higher-current signal. This signal has a greater current level, which is used to operate the motors. Two integrated H-bridge driver circuits are present in L293D. In its typical mode of operation, two DC motors can run simultaneously in both forward and reverse directions. From 4.5V to 36V, the output supply (VCC2) has a wide range.

3) RFID Technology

The two components of the wireless Radio Frequency Identification (RFID) technology are tags and readers. An electronic device called a reader transmits radio waves and utilizes one or more antennas to pick up signals from RFID tags. Both passive and active tags use radio waves to transmit their identity and other data to nearby readers. Considering that the reader supplies power, passive

RFID tags don't need batteries. Batteries are used to power active RFID tags. RFID tags can hold a variety of data, ranging from one serial number to many pages of specifics. RFID tags can read from up to 12 meters away with a passive RFID tag, whereas active RFID tags can read from up to 100 meters away.

4) LCD

Liquid crystal display is referred to as LCD. Since their interface serial/parallel pins are defined so it is easy to interface them with many microcontrollers. A lot of the products we use every day come with LCDs. They are used to show status of the product or provide interface for inputting or selecting some process.

C. Software Description

1) Arduino IDE

An application for processing language and wiring projects that is cross-platform and written in Java is called the Arduino Integrated Development Environment (IDE). It has a code editor that makes compiling and uploading programmes to your board straightforward. Programmes for the Arduino are written in C++ or C. Many basic input/output functions are made exceedingly efficient by the "Wiring" software library, which is included with the Arduino IDE and is taken from the original Wiring project.

2) ThingSpeak

Users can speak with gadgets linked to the internet using ThingSpeak, which is open-source software that is free. Ruby was used to write it. It facilitates data access, retrieval, and logging by offering an API to social network websites and mobile devices. The MathWorks program MATLAB for numerical computing is integrated support for ThingSpeak.

D. Working

1) Set up the NodeMCU to communicate with the RFID reader, the L293D board, and the LCD display.
2) Write code to read the RFID tags of the products and deduct the amount from the RFID tag with the corresponding product.
3) Control the motor connected to the L293D board to open and close the cart based on the products being added or removed.
4) When a recharge card is scanned by the RFID reader, the value is displayed on the LCD.
5) Then, scan the product tags and the corresponding amount will be deducted from the total amount and the remaining balance will be displayed on the LCD.
6) If at all one has to remove a product that is already in the cart, rescan the product tag and the amount will be re-added to the recharge card.

V. RESULT

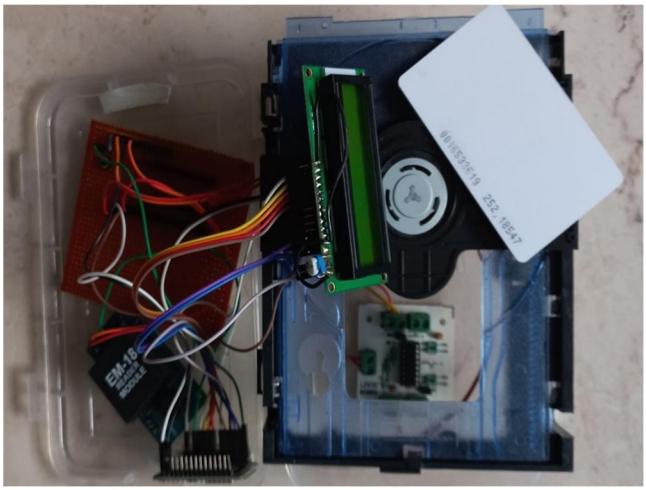


Fig.1 Circuit Connection.

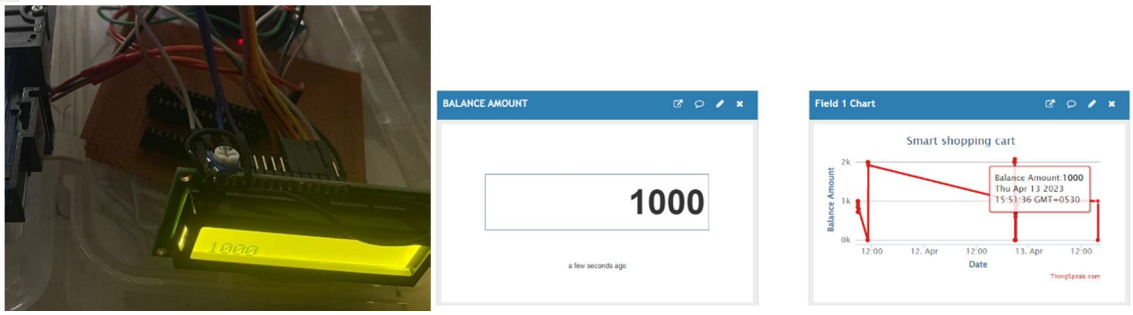


Fig.2 Scanning of the recharge card and the amount is displayed on the LCD as well as on ThingSpeak.

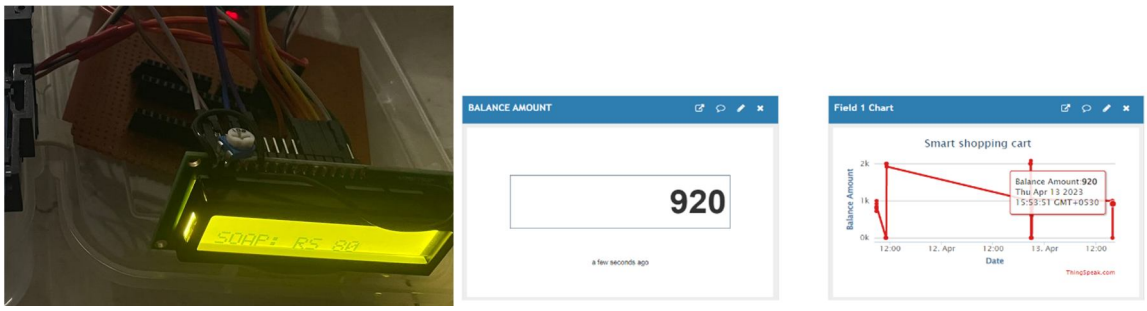


Fig.3 Scanning of soap product tag and the amount 80(in rupees) is deducted from the total amount on LCD displayed and its corresponding result on ThingSpeak.

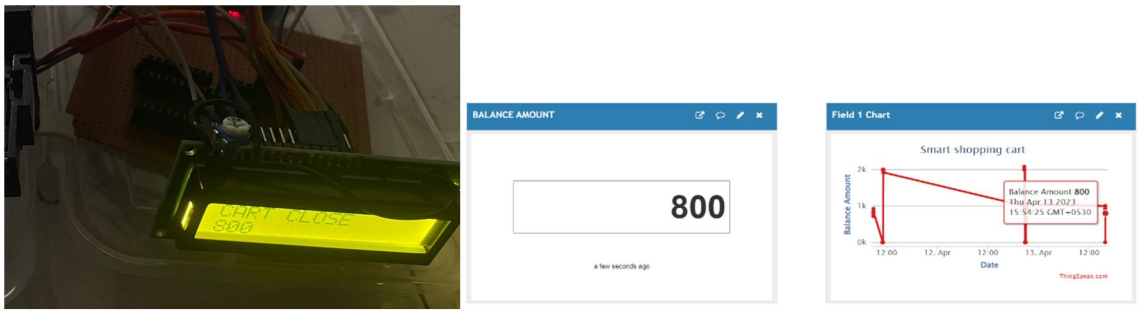


Fig.4 Scanning of rice product tag and the amount 120(in rupees) is deducted from the total amount on LCD display and its corresponding ThingSpeak result.

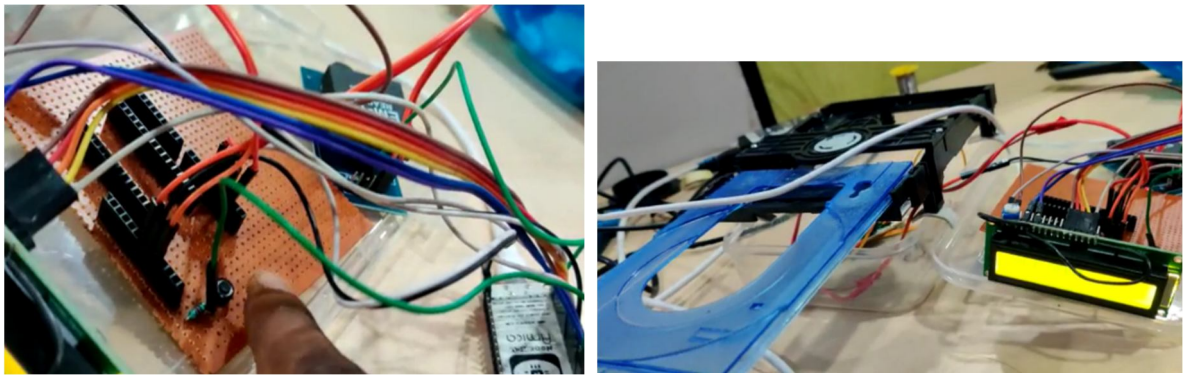


Fig.5 Manually pressing the push button to open the cart so as to remove a product that is already in the cart.

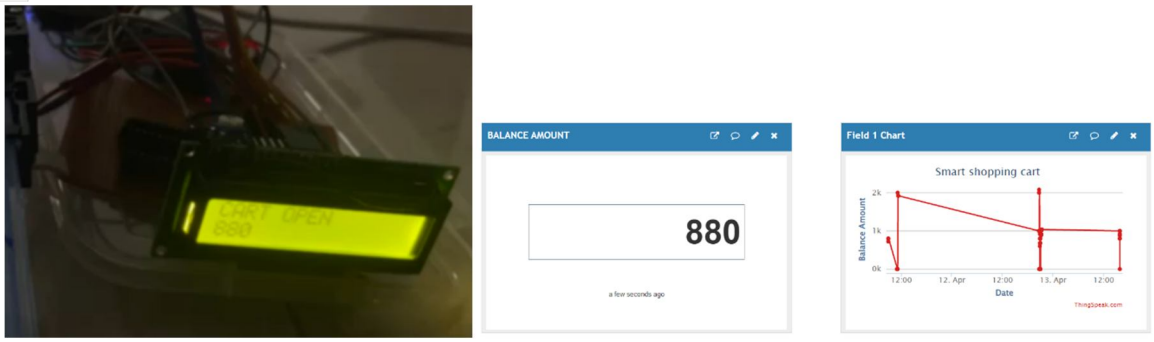


Fig.6 Rescanning the product tag that is to be removed from the cart. Soap here, and the amount 80 is added back to the total amount.

VI. CONCLUSION

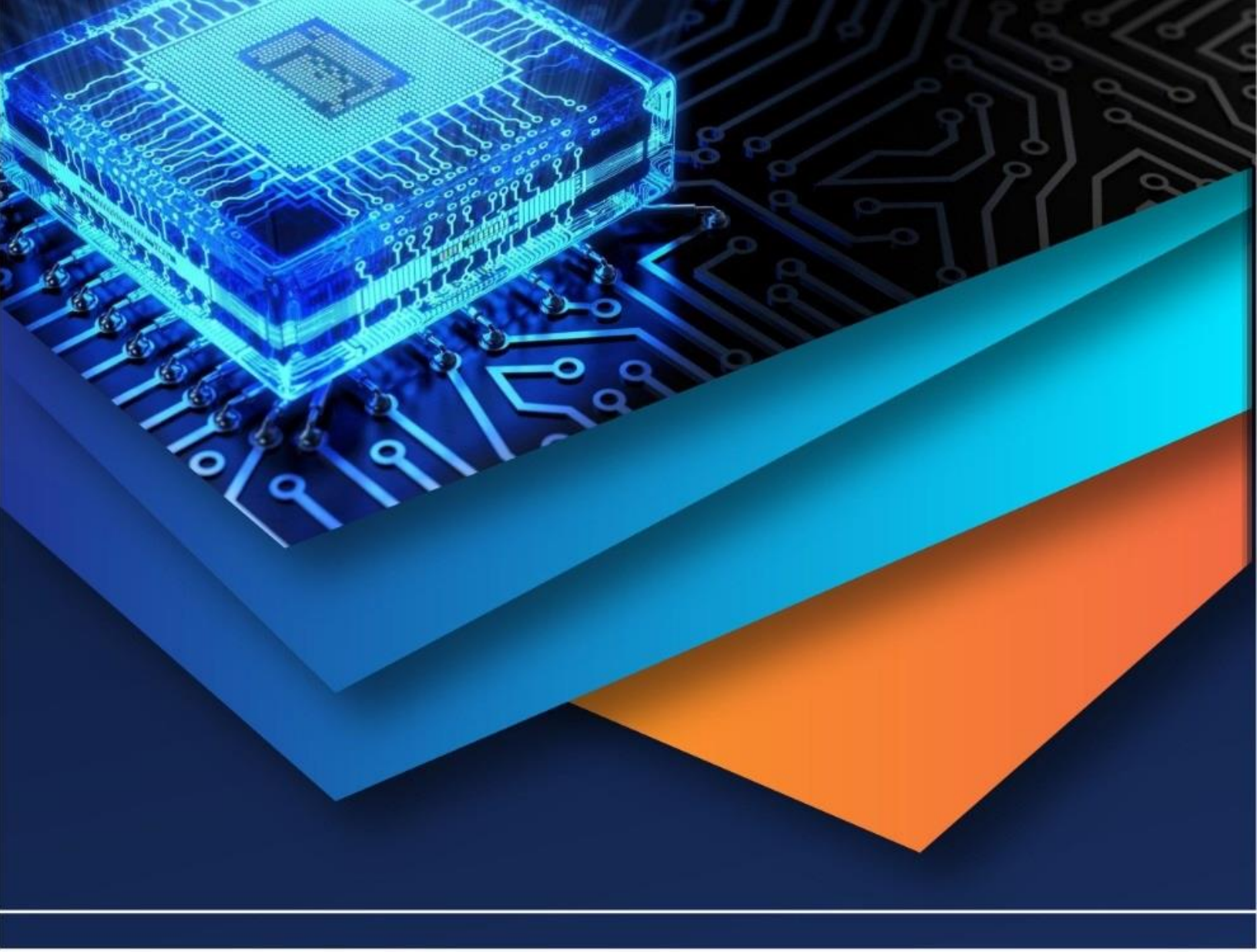
An IoT-based smart shopping cart makes it simple to shop in malls and supermarkets by automatically creating a bill in the cart and using the IoT application ThingSpeak, which reduces wait times at the cash registers. Standing in long and time-consuming queue will be eliminated. Customers scan their products with an RFID tag to an RFID reader on the shopping cart and then the cart gets opened whose amount is then deducted from the recharge card and the remaining amount is displayed on the LCD. So that customer can accordingly continue with his/her shopping without bothering about the total bill. This hence reduces the expenses incurred by the management by eliminating man power at the billing by barcode scanning.

VII. FUTURE SCOPE

Additionally, the system can be further enhanced by introducing weight tallying in the cart after selecting a particular product from the database. Another potential advancement is the integration of machine learning algorithms to analyze customer behavior and preferences. This can help the system to personalize the shopping experience for each customer, by suggesting relevant products or promotions based on their past purchases or browsing history.

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