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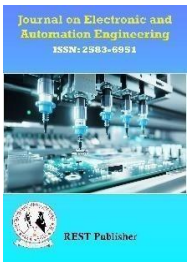

E-Cart using RFID Technology and Automated Checkout

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Abstract: *In this progressive technological era where automation is the norm it is a drawback that most of the customers in supermarkets wait in long queues because of the barcode-billing process. We want to introduce, our IOT-based project which consists of RFID sensors, microcontroller, communication module, and a Web application for inventory management which has reduced power needs. The main objective for designing this prototype is to reduce human efforts by introducing a low cost, easily scalable system for assisting the customers in shopping. The proposed system can easily be implemented and tested at a commercial scale under the real scenario in the future.*

Keywords: *RFID, IOT, NodeMCU, database, bluetooth*

1. INTRODUCTION

The fast-pacing urbanization and industrialization has brought a drastic development within the global market. Supermarkets play a pivotal role in the global economy, establishing a significant presence as indispensable and versatile enterprises across the world. It has become customary to frequent large shopping centers in metropolitan areas, particularly during holidays and weekends. Supermarkets are where people from all walks of life buy their daily essentials [1]. People spend a lot of time in finding the right product, and then further spend even more time in queues for billing their purchases. In most cases, supermarkets employ a barcode system to recognize products and compute the total for the final receipt. Each product is distinctly marked with these codes for identification purposes. When a customer completes their item selection and proceeds to the payment counter, each product is individually scanned using a barcode scanner. This manual scanning process, however, is inefficient and time-consuming. The scanning and the billing time increases if there is a lot purchased by the consumer. In this regard, our IOT based RIFD system comes handy. RFID based systems will be faster than the existing barcode-based system. Products available for purchase can be showcased in the customer's existing shopping list, aiding them in managing their list based on their requirements or budget. The project aims to develop a shopping system in a very small area and by reducing the load of the customers. The customers need not carry all the products they want to buy; they just need to scan the unique code assigned to every product using the reader provided to them. The product that they will scan will be automatically added to their cart in the billing software in the server. When they are done with their shopping, they just need to go to the billing counter and pay the generated amount of bill and collect their products. In this way the area in which shopping centres are made will be reduced and the customer need not carry heavy products or carts with them.

2. LITERATURE REVIEW

The suggested system uses an approach that combines RFID technology and the barcode system. M2M communication in embedded systems is used for implementation. Making use of this approach helps to simplify and improve the purchasing experience. Sensors used in this project have wireless interfaces that enable them to connect to one another and build a network. The design of a WSN is heavily influenced by the application and must take into account a variety of elements, including the environment, the design goals of the application, cost, hardware, and system constraints [2]. Barcodes solely facilitate data reading and lack the capability to store or write

information, making them susceptible to third-party interference since they do not incorporate encrypted data formats. Recognizing the superior efficiency of RFID, it was adopted in the development of this system. The system allows for the presentation of shopping products in the customer's ongoing list, aiding in the organization of purchases based on individual needs or budgetary considerations. The incorporation of a well-structured searching module further simplifies the process of locating products within the shopping mall [3].

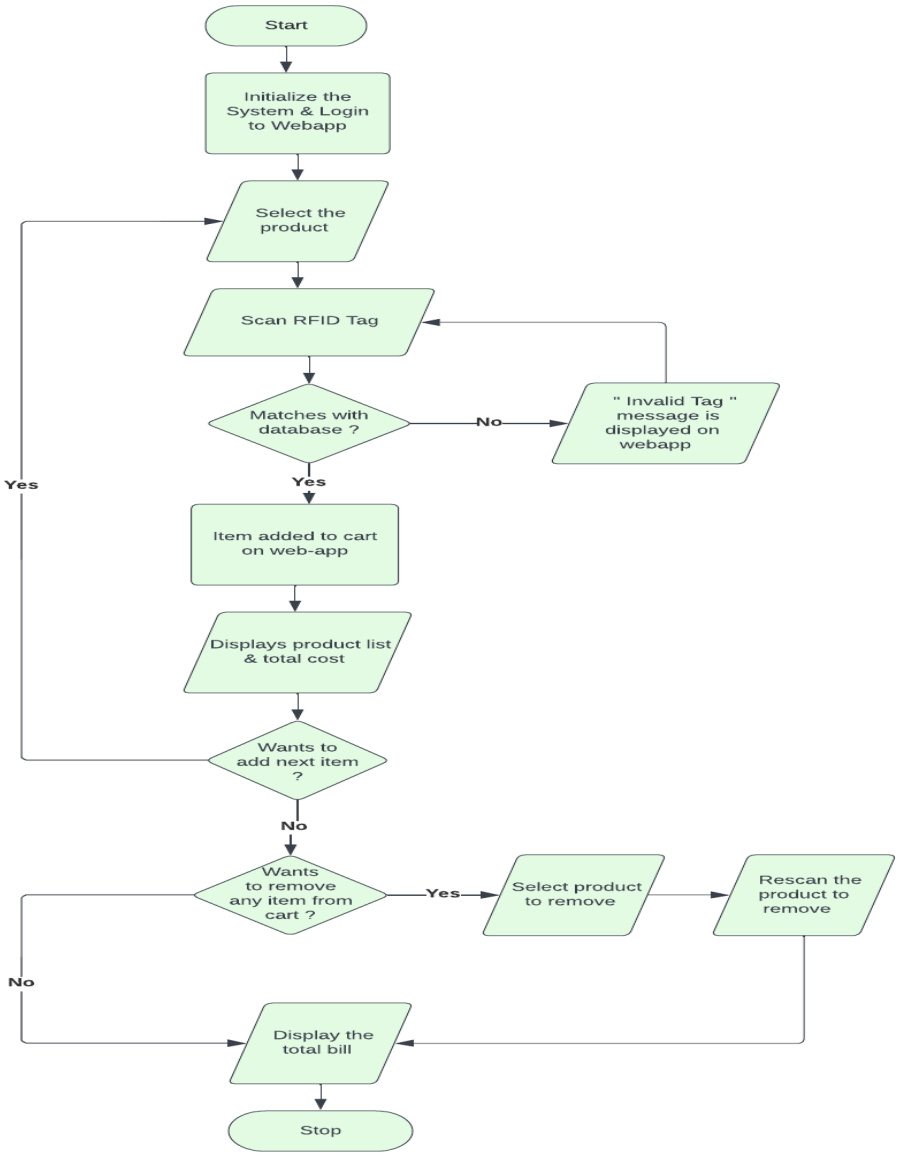

FIGURE 1. RFID technology

A procedure for locating an RFID reader is disclosed. The system consists of a processor, an RFID reader, and at least one additional RFID reader. The RFID readers communicates associate information through RFID tag with any one antenna that decodes the information. The processor establishes a connection between distinctive RFID tag details and a minimum of one antenna from at least two readers. This connection is utilized to ascertain the positioning of the initial RFID reader concerning the aforementioned at least one other RFID reader. This determination is made subsequent to the reception of RFID data from both the initial RFID reader and the minimum of one other RFID reader [6]. The use of radio frequency identification (RFID) technology has been expanded into a variety of high-security and high-integrity fields, including the identification of citizens and national defence. A mobile object is equipped with a tiny RFID tag that can be read by a reader and recognized after being scanned. Real-time inventory tracking and item identification are made possible by RFID. However, there are a number of concerns that could endanger the ability of apps using mobile hand-held readers and resource-constrained RFID tags to offer users important services [8].

3. METHODOLOGY

Customer scans the RFID tag on the product on display. Product is then displayed on the Web application which contains the details of the product. User then adds this item to the cart where customer is provided with the total bill amount. It is then redirected to a payment gateway. Customer can check out after the payment is successfully carried out. All this information is stored in a database to check the availability of the product and keep a track of count of each item. Usage of barcode had many concerns over its security, it can be easily hacked. Thus RFID tags, highly efficient, have been used where every product has a tag attached to it. Thus making it a customer friendly experience.

4. IMPLEMENTATION

Configuring the RFID setup: To configure the RFID tags we first need to write a code for NodeMCU in arduino IDE, in which we will use the RFID reader to input the product information into the RFID tags. The serial numbers for the tags are stored in a database to be used in the inventory. Another code is written in arduino IDE for the RFID reading process. In this code, we specify the WiFi SSID and password to connect the RFID reader with the database wirelessly. RFID then scans the unique serial number from the RFID tag along with the information about the products stored on it and sends it forward to the MySQL database in PHP.

Creating a Database: We create a database for PHP code using MyPHPAdmin application. It creates a MySQL database with various parameters such as Product name, Price, Quantity. Another database stores the RFID tags serial numbers and the corresponding information stored on them. The final database is used to store Customer details such as name, phone number and email address

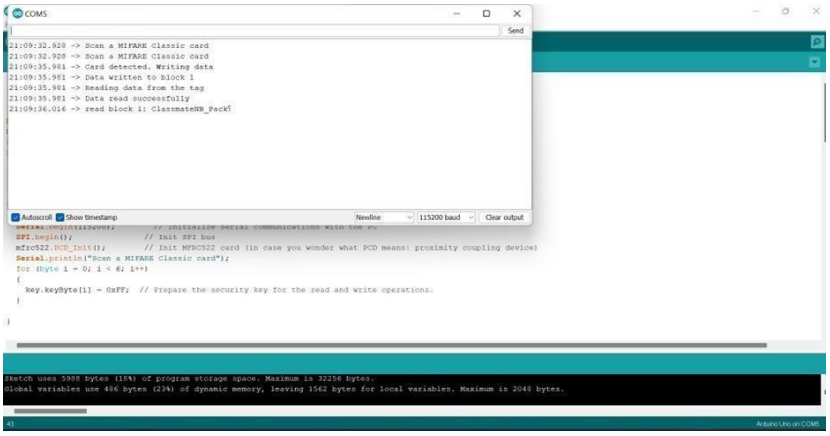

FIGURE 1. Writing data in RFID tags

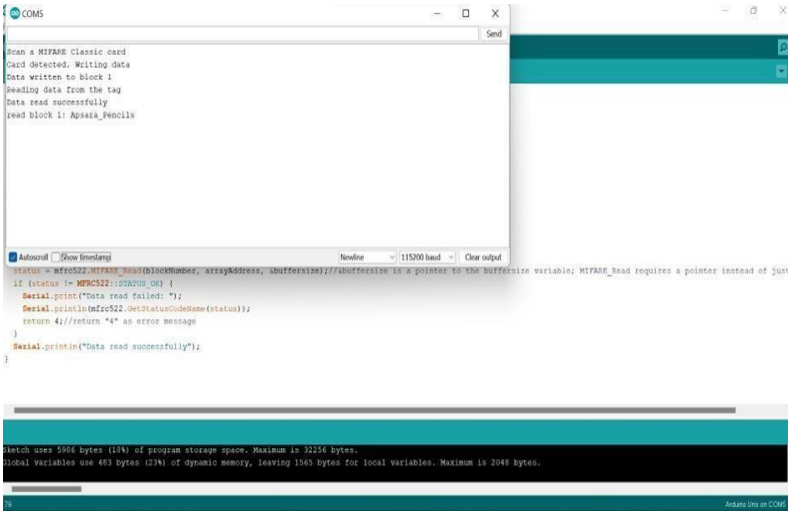

FIGURE 3. RFID scanner reading data from the tag

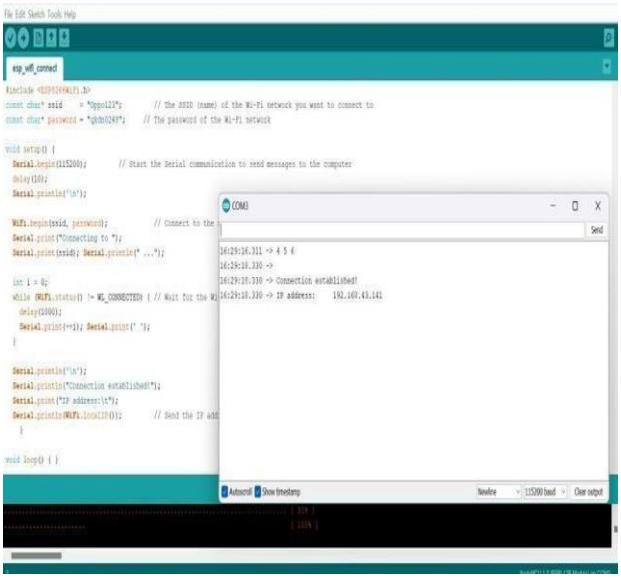

FIGURE 4. Connection established between Node MCU and Database

Creating a Database: We create a database for PHP code using MyPHPAdmin application. It creates a MySQL database with various parameters such as Product name, Price, Quantity. Another database stores the RFID tags serial numbers and the corresponding information stored on them. The final database is used to store Customer details such as name, phone number and email address.

Creating Frontend for the Web Application: We use HTML and Javascript/CSS to create a frontend for the Web Application. The front page of the web app will have a Navigation bar on the top which will be used by the customers to open different pages in the web app. We will use HTML buttons to create the menus on the navigation bar. HTML is also used to create a basic layout of the online shop showing various products on a showcase. Javascript and CSS is used to make the web app presentable.

Creating Backend for the Web Application: The backend program for this web application was written in PHP. In the php code we link all the frontend pages created using HTML so that they are accessed correctly once a customer clicks on a button. Every button created using HTML is then given a backend command. Another PHP code is made to link the MySQL database with Razorpay using the Razorpay API key.

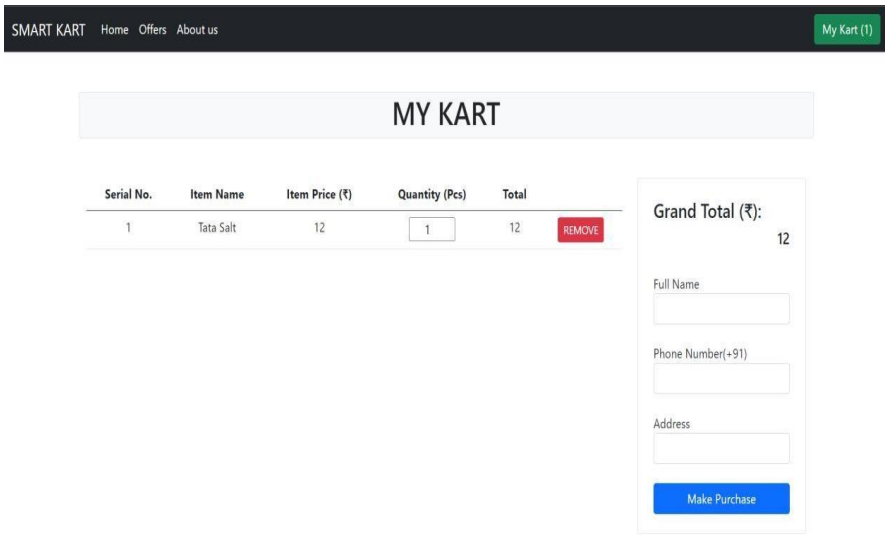

FIGURE 5. Cart on the web application

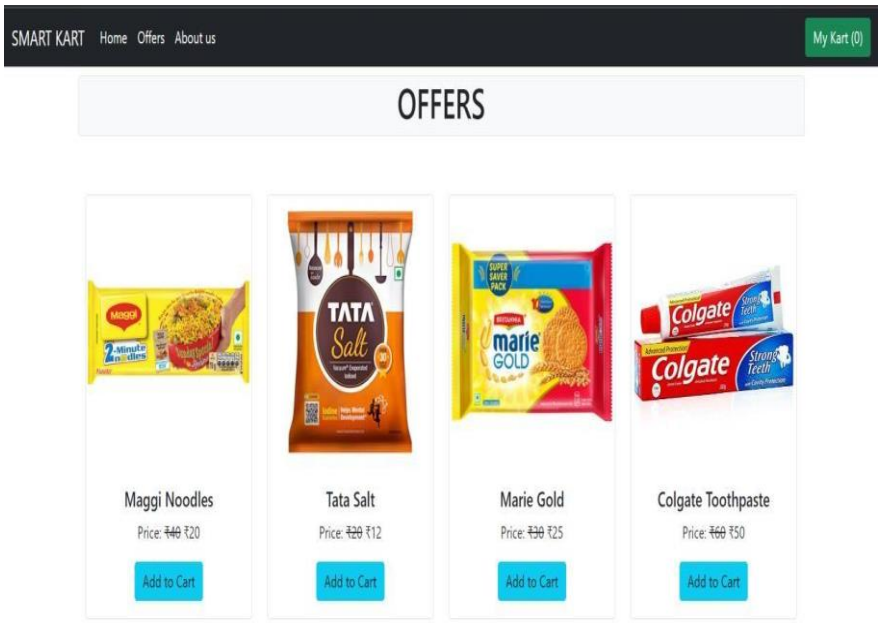

FIGURE 6. Offers page

Creating Backend for the Web Application: The backend program for this web application was written in PHP. In the php code we link all the frontend pages created using HTML so that they are accessed correctly once a customer clicks on a button. Every button created using HTML is then given a backend command. Another PHP code is made to link the MySQL database with Razorpay using the Razorpay API key.

Linking Razorpay to the Database: We use the razorpay API to link it to the MySQL database such that product information is sent to the razorpay database. We use an API key to authenticate the razorpay account. Each account's API key is unique. By default razorpay shows values in Paisa and not rupees so we have to multiply the total amount by 100 before showing the total amount on the webApp. We have to link the values from our MySQL database to their counterparts in razorpay database.

5. RESULTS AND CONCLUSION

In this paper, IOT based smart trolley is implemented using NodeMCU and from the above work we can say this method of shopping is time-efficient and hassle free. By using this type of system, people do not have to carry heavy items in crowded places and wait in long queues. It is faster as the user can plan his budget and accordingly reduce or increase the items he is buying. Customers can purchase the goods by availing any ongoing offers in the stores with an ease. This RFID system will give the customers will give the users ease of digital billing and sales promotion based on their product purchase. The implementation of an IoT-based smart trolley using NodeMCU has resulted in a highly efficient and convenient shopping experience. By allowing customers to scan RFID tags on products, the system significantly reduces the time spent on manual searches, enabling quick and informed decision-making. The technology offers benefits such as enhanced user convenience, improved budget planning through real-time billing information, and the seamless utilization of store promotions. The low-cost and robust nature of the system ensures real-time processing of goods, while a well-managed database provides valuable insights for inventory management and future strategic decisions. However, the system's limitation of requiring a line of sight for scanning should be considered. Overall, this innovative solution leverages IoT and RFID technologies to transform traditional shopping into a modern, user-friendly, and cost-effective retail experience.

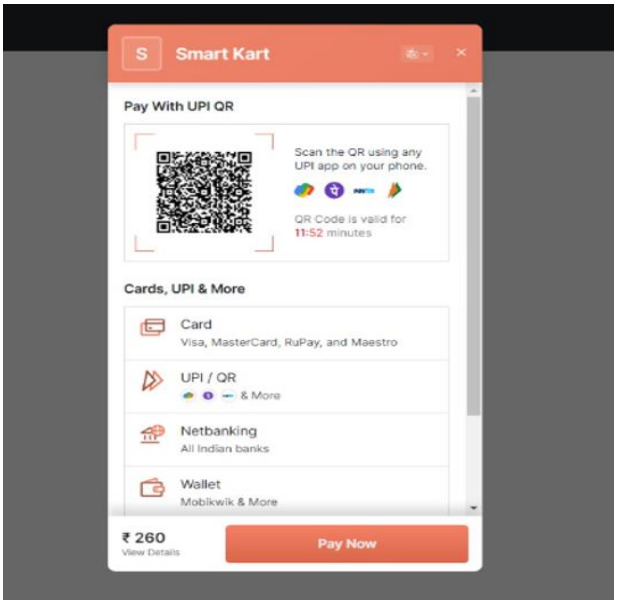

FIGURE 7. Payment modes displayed to pay the bill

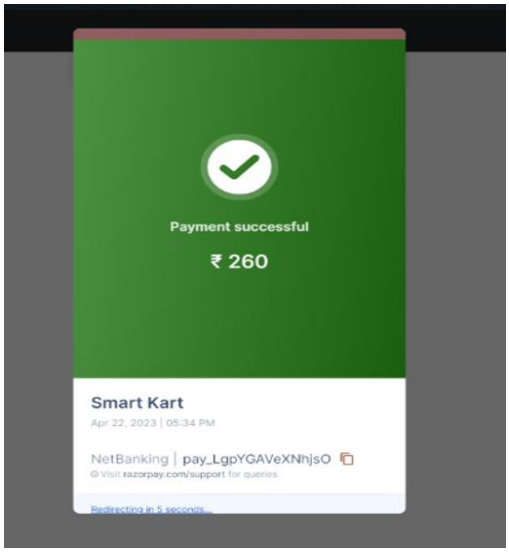

FIGURE 8. Payment success page

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