

Smart Cart using RFID (Radio Frequency Identification)

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Abstract - In terms of simplifying shopping and reducing crowd at supermarkets, there is need for the advanced technology that simplifies the shopping and reduces queue at billing counter. By automatically identifying the products being added to the cart and providing the information on the user interface, the smart cart can make the shopping experience easier. This project presents a simplified basic version of shopping cart that can recognize products by RFID Cards. The primary objective of this project is to reduce waiting times at long queue in markets and other shopping centers using an basic innovative cart system that makes use of RFID technology to provide an intelligent approach to the billing process. The project's primary focus is the smart cart . It consists of NODEMCU, LCD Display, RFID Reader Module, RFID Cards, Buzzer, Arduino UNO etc. Every item that is put into the cart will be able to have a total bill generated by the system. It will be simpler to skip billing counters in shopping malls. This project will able to simplify the shopping experience by reducing human interference with accuracy.

Key Words: RFID, Smart Cart, NODEMCU, LCD Display, RFID Cards, Arduino

1. INTRODUCTION

The main aim of the project is to satisfy the customer requirements and to reduce the time spent on the Billing counter which is to complete the billing process in the cart rather than waiting in a queue even for one or two products. The customers must add the products after a short RFID scan in cart and when the shopping is done the finalized amount will be displayed on the LCD screen. Finally customers can pay their total bill at the counter.

Mainly this proposed system includes hardware resources such as NODEMCU, RFID Reader Module, RFID cards, Buzzer, Connecting wires and Software resources such as Arduino IDE which uses Embedded C programming language.

The Customer has to scan the products by RFID reader and after scanning they can place it in the Smart Cart . After

shopping is done by customer as per his/her requirement, they can pay bill at the billing counter as the total price is displayed on the LCD screen display.

As Cashier at the billing counter has to scan each and every products purchased by the customer, it becomes more time consuming in terms of customer and as well as customer point of view. By this reason human error is also reduced.

2. LITERATURE SURVEY

In Literature Survey here, the number of research and implementation papers of existing projects are included. All of these projects features, and other parameters are taken into consideration and after this we have designed our project.

[1] Tanmay Shukla, Poorvi Shrivastava, Prachi Takke, Prof. Madhuri Ghuge "RFID based Smart Trolley" March 2019: This paper emphasizes on the avoidance of the hustle like pushing trolley, waiting in billing queue. They developed IoT based Trolley which is totally automatic. Customer will be purchasing products and they are kept in trolley by them. RFID will automatically scan them by detecting it from local database. LCD display is there for showing product shopping details.

[2] Udit Gangwal, Sanchita Roy, Jyotsana Bapat "Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks" 2013: In this paper, the proposed project uses Wireless Sensor Networks (WSN) technology. It reduces manpower and avoid crowd at billing counter. It ensures detection of unauthorized customers which increases smart system fair attractive for both buyers and sellers.

[3] Bhumika R., Harshitha G. Bhat, Chandana K., Meghashree R. T., Dr. Sangappa S. B. "Automated Shopping Trolley for Billing System" 2019: This paper emphasizes on the quick and easy shopping experience. It reduces the long waiting line at Billing counter and as well as reduces the efforts of the cashier to scan each and every product as it will reduce time also.

[4] Om Ravi Mhaskar, Aditya Sandip Benichatake, Arjun Amar Dalvi, Shrivardhan Rajesh Chavan, D. V. Patil “Automatic Human Follower Shopping Trolley” March 2022: This proposed project is based on the RFID sensors, Arduino and Mechanical Trolley. This smart Shopping Trolley also reduced the time for shopping and also reduces the crowd at billing counter.

[5] Apeksha Jagtap, Rohit Pagar, Gopika Nair “Smart Shopping Trolley with Automated Billing” May 2023: The main motive of this paper is to focus on customer needs. It eliminates the process of usual product scanning by cashier at counter. It reduces time and also reduces human error.

3. COMPONENTS USED

1. NODEMCU / ESP8266
2. RFID Reader Module (RC522)
3. RFID Cards

1. NODEMCU:



It provides easy-to-use open-source platform for Internet of Things (IoT) development which is based on the ESP8266 WIFI (Wireless Fidelity) module. NODEMCU supports programming with Arduino IDE. It is of low cost making it cheaper in cost and providing better functionality.

2. RFID Reader Module (RC522):



The RFID Reader Module (RC522) is a low cost RFID reader and writer module. It operates at 13.56 MHz and which used to allow communication using Radio-waves with RFID cards or tags or key chains etc.

It can be interfaced with Arduino IDE, NODEMCU etc. which supports SPI (Serial Peripheral Interface) communication.

3. RFID Cards:



RFID cards are small and portable cards which contains a micro RFID chip which stores information electronically in it. It also contains antenna which is used to recognize the radio frequency waves and communicates through the radio frequency waves.

RFID card is of two types:

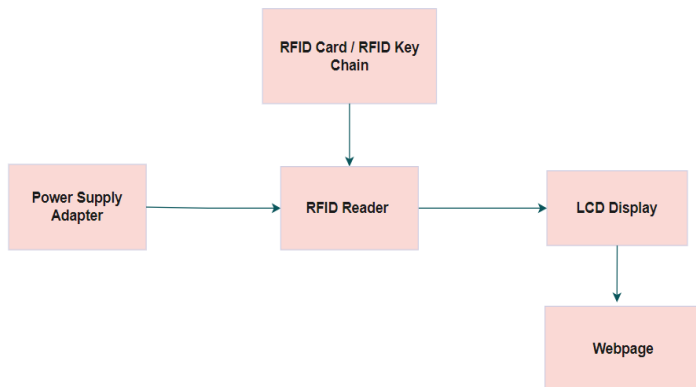
1. Passive RFID card - Don't have power source
2. Active RFID card - Have their own power source

4. PROPOSED METHODOLOGY

The Proposed methodology ‘Smart Cart using RFID (Radio Frequency Identification)’ emphasizes the points such as Reducing time for scanning products at billing counter as here the Customers themselves have to scan the products and by their choice they can purchase them and it will reduce the long queue at billing counter as previously the cashier scans products and gives us total shopping bill but in this project the customer have to scan the product by RFID reader, then they can add the products in the Cart. The Customer has to pay the bill at counter but the time is reduced by scanning products at shopping time by customer. The total bill appears on the LCD (Liquid Crystal Diode) display and the QR code for paying bill is available at the billing counter of the Supermarket or other public shopping areas.

This project includes main hardware components such as RFID reader module, RFID cards and key-chains, NODEMCU, LCD Display, Buzzer, etc and in Software components it includes the Arduino IDE which uses the Embedded C programming language.

5.SYSTEM ARCHITECTURE



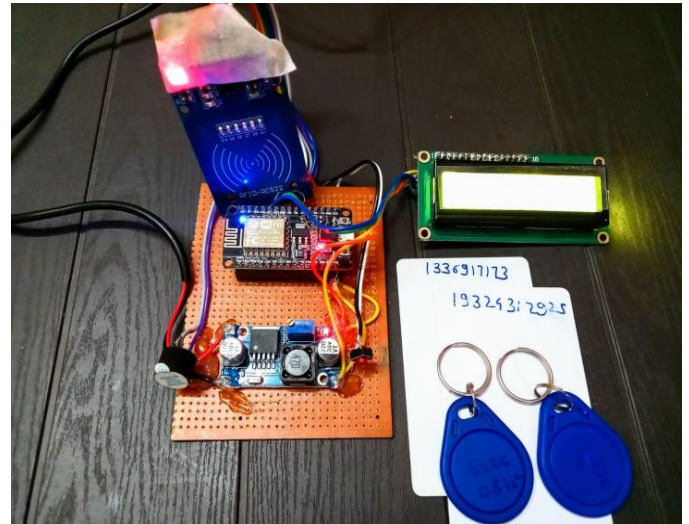
The System Architecture includes the Power Supply Adapter, RFID Card or RFID Key-Chain, RFID reader module, LCD display and a local webpage.

The Power Supply Adapter needs because RFID reader module RC522 need electronic power supply to activate itself without which it cannot operate. The RFID card or key-chain is required to scan the products which is attached to the products. It includes microchip and antenna which helps to scan the product by RFID reader. The LCD display is used to display the information of shopping for user convenience. It includes a local webpage which shows information on that page.

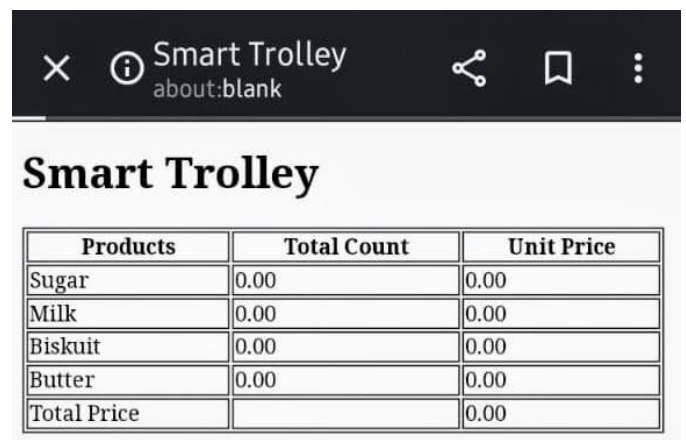
First of all, there is need to On the power supply to activate the RFID reader module. After this step,The RFID card or key-chain is ready to scan. The card will scanned by RFID reader, the reader detects the microchip inside it by using radio waves. After this, whichever product will be scanned it will display on the LCD screen and also simultaneously as transaction occurs webpage also updates. As well as per requirement we can remove the products also by scanning it again. When we scan the RFID card the reader will detect it by radio frequency waves and compares it with the stored database of product which has control of the Market’s main database administrator.

6. RESULTS

The Proposed Project designed is as follows:



Switch on the Power Supply, then IP address is displayed on the LCD screen. Enter that IP address in any internet browser.



Let's add Butter, Sugar and Biscuits in the Smart Cart



Smart Trolley

Products	Total Count	Unit Price
Sugar	1.00	50.00
Milk	0.00	0.00
Biskuit	1.00	30.00
Butter	1.00	60.00
Total Price		140.00

Let's remove Biscuits from the Cart



Smart Trolley

Products	Total Count	Unit Price
Sugar	1.00	50.00
Milk	0.00	0.00
Biskuit	0.00	0.00
Butter	1.00	60.00
Total Price		110.00

By these steps Customer can do further shopping as per their requirement.

7. CONCLUSIONS

The "Smart Cart using RFID (Radio Frequency Identification)" project has accomplished with advantages such as reduced time, reduced human error and customer friendly. This project can be implemented at small to medium Supermarket locations.

8.FUTURE SCOPE

This project can be developed a bit like providing a scanner for payment of shopping products on the cart itself or it can be display on the LCD screen also. The more powerful and high frequency RFID reader modules and RFID cards can be used.

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