B.SC. ENGG. PROJECT

Project Report on

RFID SMART SHOPPING CART

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***Abstract*—In the age of modern technology, most customers have to wait at the supermarket to shop because it is a time-consuming process. Due to the barcode-based billing process, supermarkets are crowded during discount periods or weekends, and it is difficult for to queue. In this regard, a smart shopping cart based on the Internet of Things (IoT) is proposed, consisting of a Radio Frequency Identification (RFID) sensor, a NODE MCU and a website . One part is the RFID tag attached to each product, and the other part is the RFID reader, which can read the information of the product effectively. Each product list after is displayed under on the website. Customers can easily manage shopping lists on the website according to their preferences. The then wirelessly sends the purchase information to the server, and the automatically generates an invoice. This experimental prototype was designed to eliminate 's time-consuming provisioning process and quality of service issues. The proposed system can be easily implemented on a commercial scale and tested in future real scenarios. This is the reason why the proposed model is more competitive against the other models.**

***Index Terms*—IoT, RFID,NODEMCU,Wire,Smart shopping cart,RFID Tag**

I. INTRODUCTION

- **Overview:** With the growing economy, urbanization, industrial growth in recent years, there has been a significant change in the global market.Now a day,shopping at big malls is becoming daily activity in metro cities.Smart shopping cart system which is based on RFID technology.The best ways to help the customers is to reduce the time spent in shopping,reduce cost of items and automated billing.
  In shopping malls various technologies are used like Barcode system, Mobile technology (using Android App), etc. In these system customers have to wait in long queue for billing. Hence, we proposed the new idea using IOT (Internet of Things).
  In this system RFID (Radio Frequency Identification) Technology is used. Every item or product is attached with a RFID tag and this product is scanned using RFID reader which is attached with a trolley. Customer purchase different items and put them in the trolley. Price of that total items and also names will be displayed on LCD (Liquid Crystal Display) screen which is also attached with a trolley. If a customer wants to remove some items, they have to rescan the item which will delete it from the total bill. In this system, customer's time is reduced at the time of shopping in the malls.
- **Purpose:** The proposed project aims to eliminate this problem by introducing a novel alternative to traditional billing methods, speeding up the payment process. In proposed system every product has a unique RFID tag attached to it.Attached tag contains not only cost of the product but also additional information related with product like product name, manufacturing date, expiry date, etc. While customer put the product in the cart at that time the RFID reader reads that RFID tag attached to that product.
  The RFID reader will sends this information to the Arduino Board for further process. Arduino performs various operations on the information received by RFID reader by reading RFID tag attached to the product .With the help of Arduino, LCD Display will show the name and total cost of the product. If customer wants to remove any product from list of the purchased product which is already in cart, then customer can remove that product by rescanning that product's Tag.

II. LITERATURE SURVEY

- **Existing Problem:** Frequently, people encounter a problem of spending too much of their time waiting in queues for billing their purchases in different shopping centers or supermarkets. Waiting in queues negatively affects human morale and may cause misunderstandings or conflict amongst people, for instance, when someone breaks the line and stands in front of other people.
  Barcodes: The vast majority of modern supermarkets use barcode system to identify products and check-in customers waiting in queue .Barcodes represent a series of vertical black lines of different thickness and separation distance which can be coded into data information . All information describing a particular product such as full name, cost, weight, etc. are stored in primary software database, and this product is addressed by unique ID that is read from barcodes . This way, one can easily get all information about a particular product just by scanning barcode that is printed in some area on product packaging.

The main problem with the existing system of barcode billing is the fact that each product is scanned only one at a time so that total scanning time grows gradually when there are plenty of purchased products. The barcode scanner is limited by direct visual contact with barcodes . Thus, it cannot scan barcodes that stay out of its vision.

- **Proposed Solution:** One measure to reduce the waiting time of customers is to introduce an intelligent billing system using electronic Smart Cart as an alternative to existing barcode system. Smart cart allows a customer to manually perform billing without relying on cashier by means of swiping the RFID tags over RFID reader. Unlike barcode system, smart cart does not need any visual contact with barcodes which may get distorted in real life situations. All data about purchased products and user account data are stored in a cloud database in the Internet. Then, smart cart shows this information to customers on its display. A customer can delete an item from the list whenever he or she wishes. If the customer decides to finish purchasing, just a single button press is required to upload all purchased product data and their total cost to cloud database. Once all payment data is uploaded to the web, total cost is withdrawn from the registered account cash of the customer. All purchased products are deleted from the cloud database and the customer can freely pass the anti-theft gate with the purchased products.

III. THEORITICAL ANALYSIS

- **Block Diagram:**

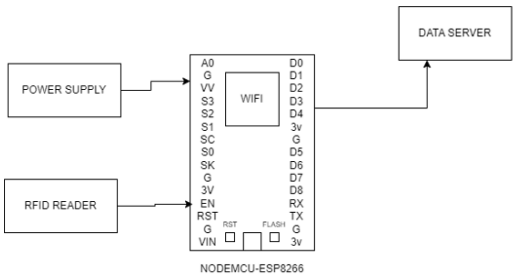

Fig. 1. System Block Diagram

- **Software Designing:**

XAMPP:

The goal of XAMPP is to build an easy to install distribution for developers to get into the world of Apache. To make it convenient for developers, XAMPP is configured with all features turned on.

Visual Studio Code:

Visual Studio Code is a streamlined code editor with support for development operations like debugging, task running, and version control. It aims to provide just the tools a developer needs for a quick code-build-debug cycle and leaves more complex workflows to fuller featured IDEs, such as Visual Studio IDE.

Arduino Sketch:

A sketch is the name that Arduino uses for a program. It's the unit of code that is uploaded to and run on an Arduino board. The Arduino programming language is based on Processing, which is aimed at visual artists. Hence a development version being a 'sketch'. Processing is a programming language, development environment, and online community that since 2001 has promoted software literacy within the visual arts.

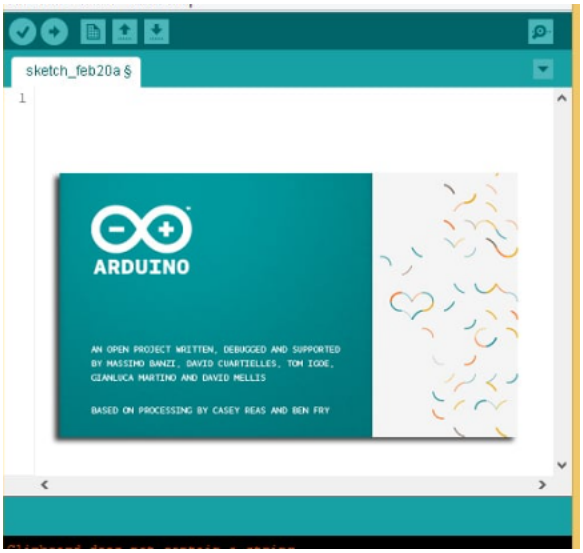

Fig: Arduino Sketch

- **Hardware Designing:**

RFID:

An RFID reader is a network device that can be carried or permanently connected. A signal is sent using radio waves to activate the tag. Once activated, the beacon sends waves back to the antenna where they are converted into data. The transponder is on an RFID tag. It is used in commercial and industrial applications to track items in supply chains and warehouses, such as library checkout systems. RFID is similar to a barcode in that a tag or data on a tag is intercepted by a device that stores the data in a database.

NodeMCU:

NodeMCU is an open source IoT platform.It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware, which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits.

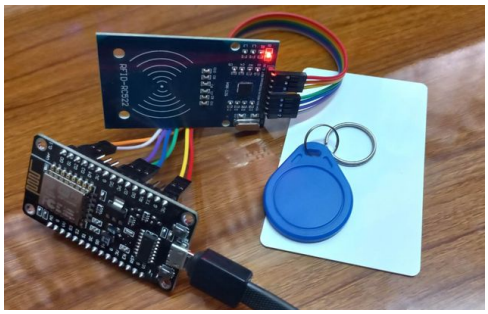

Fig: Hardware Designing

IV. RFID Reader:

Readers are devices with one or more antennas that emit radio waves and receive signals back from RFID tags. Tags that use radio waves to communicate their identity and other information to nearby readers can be passive or active. Passive RFID tags are powered by a reader and do not have a battery.

Fig: RFID Reader

V. FLOWCHART

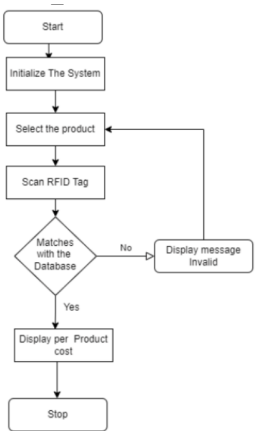

Fig: Flowchart

VI. RESULTS

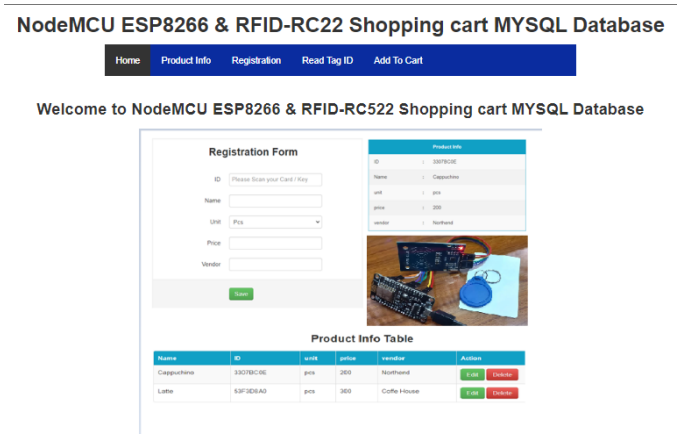

Fig: Heme Page

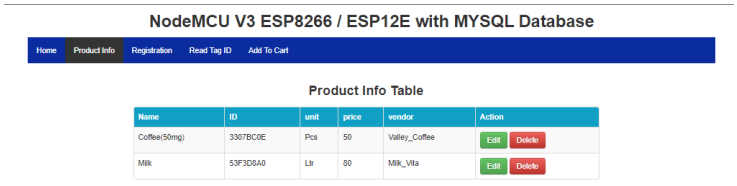

Fig: Product Information

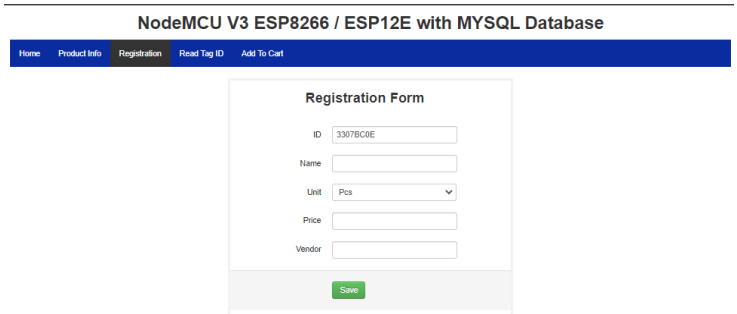

Fig: Registration Page

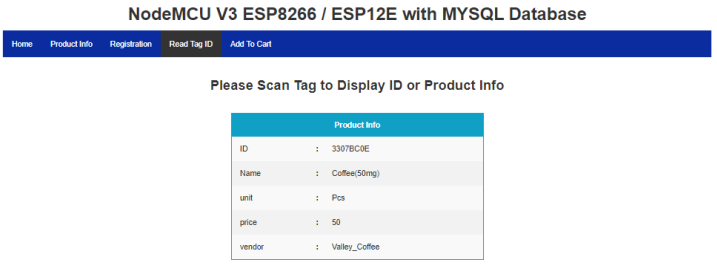

Fig: Read Tag Id Page

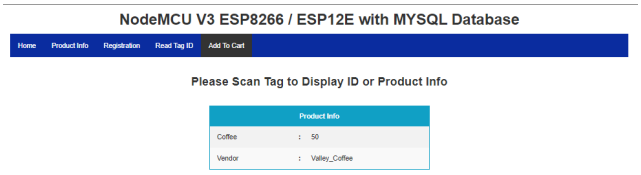

Fig: Add to Cart

VII. ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- It reduce shopping time.
- The rfid tags can be rewrite.
- Man power at billing counters can be reduced.
- Doesn't need line of sight.
- Improved read rates.
- It is trustworthy, highly consistent and reliable.

DISADVANTAGES

- Reader collision.
- Tag collision.
- RFID reader can read RFID tag in the few cm distance in this prototype.
- Can read only single item in this prototype.
- The Smart Cart cannot support infants or children.
- Smart shopping carts cost more.

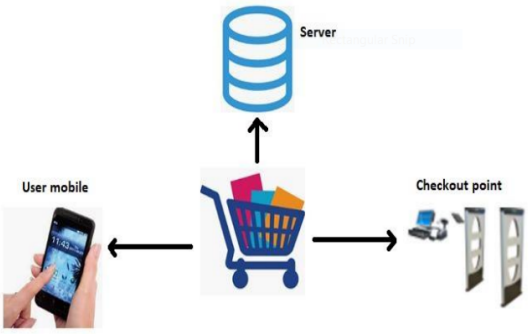

Fig. 2. Smart shopping using RFID Shopping Cart

VIII. APPLICATION

- Streamlined inventory management: With this web-based database, users can easily keep track of inventory levels, sales data.
- Enhanced customer experience: With this web-based database, retailers can quickly identify and respond to customer needs.
- Remote access and management: With this users can access and manage their inventory from anywhere with an internet connection.

IX. CONCLUSION

In the article mentioned above, a system design is proposed to automate the shopping process by merging different technologies such as NODE MCU, RFID and Web Site. It can be divided into two major categories of electronic components and software components. Among the electronic components, the Arduino Uno acts as an intermediate microcontroller, controlling the RFID technology and the embedded communication between the RFID technology and software components such as web sites via WIFI.

This project, "Smart Cart Using RFID Technology" provides ease for shopping for customers. It also takes less times when compared to regular billing techniques. Customer need not want to wait in a long queue. Stock management can be monitored easily. Customers can purchase items with in their wallet balance as the total bill is displayed in the LCD display. This system is more reliable, and it doesn't require special training. This system reduces the number of salesmen. It accomplishes both customer and shopkeeper's demand.

X. FUTURE SCOPE

- Development of project can be done in many ways,where RFID tags can be replaced by RFID stikers which are samll in size and low cost.
- Security can be improved by counting the number of items or placing weight sensors within the cart tallying the weight and getting all the types of product names when cart is passed through a particular aisle using camera module.
- Multiple RFID tags can be read using single RFID reader for more number of products which are added in the cart.

XI. REFERANCES

- RFID Based on IoT; [https://www.researchgate.net/publication/340520982_IoT-Based_Smart_Shopping_Cart_Using_Radio_Frequency_Identification]
- SMART SHOPPING CART USING RFID ["SmartShoppingCartwithAutomaticCentralBillingSystem] through RFID and ZigBee", 2014 IEEE.] [https://www.shopify.com/retail/rfid-technology#:~:text=Radio%2Dfrequency%20identification%20technology%20is,tracking%20data%20of%20your%20inventory.]

XII. APENDIX

```
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>
#include <WiFiClient.h>
#include <SPI.h>
#include <MFRC522.h>
#define SS_PIN D2
#define RST_PIN D1
MFRC522 mfrc522(SS_PIN, RST_PIN);
#define ON_Board_LED 2
const char* ssid = "Flash";
const char* password = "nopassword@";
int readsuccess;
byte readcard[4];
char str[32] = "";
String StrUID;
```

```
HTTPClient http;
WiFiClient client;
void setup() {
  Serial.begin(9600);
  SPI.begin();
  mfrc522.PCD_Init();

  delay(500);

  WiFi.begin(ssid, password);

  pinMode(ON_Board_LED,OUTPUT);
  digitalWrite(ON_Board_LED, HIGH);
  Serial.print("Connecting");
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    digitalWrite(ON_Board_LED, LOW);
    delay(250);
    digitalWrite(ON_Board_LED, HIGH);
    delay(250);
  }
  digitalWrite(ON_Board_LED, HIGH);
  Serial.println("");
  Serial.print("Successfully connected to : ");
  Serial.println(ssid);
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());

  Serial.println("Please tag a card
  or keychain to see the UID !");
  Serial.println("");
}
void loop() {
  readsuccess = getid();

  if(readsuccess) {
  digitalWrite(ON_Board_LED, LOW);
    String UIDresultSend, postData;
    UIDresultSend = StrUID;

    postData = "UIDresult=" +
    UIDresultSend;

    http.begin(client, "http://
    192.168.0.112/ rifat/getUID.php");
    http.addHeader("Content-Type",
    "application/x-www-form-urlencoded");

    int httpCode = http.POST(postData);
    String payload = http.getString();
    Serial.println(UIDresultSend);
    Serial.println(httpCode);
    Serial.println(payload);

    http.end();
    delay(1000);
  digitalWrite(ON_Board_LED, HIGH);
  }
}
int getid() {
  if(!mfrc522.PICC_IsNewCardPresent()) {
    return 0;
  }
  if(!mfrc522.PICC_ReadCardSerial()) {
    return 0;
  }


  Serial.print("THE UID OF THE
  SCANNED CARD IS : ");

  for(int i=0;i<4;i++){
    readcard[i]=mfrc522.uid.uidByte[i];
    array_to_string(readcard, 4, str);
    StrUID = str;
  }
  mfrc522.PICC_HaltA();
  return 1;
}
void array_to_string(byte array[],
unsigned int len, char buffer[]) {
    for (unsigned int i = 0;
    i < len; i++)
    {
        byte nib1 = (array[i] >> 4) & 0x0F;
        byte nib2 = (array[i] >> 0) & 0x0F;
        buffer[i*2+0] = nib1  < 0xA ? '0' + nib1
        : 'A' + nib1  - 0xA;
        buffer[i*2+1] = nib2  < 0xA ? '0' + nib2
        : 'A' + nib2  - 0xA;
    }
    buffer[len*2] = '\0';
}
```