IOT BASED SMART CART WITH INVENTORY MANAGEMENT

ECS1002-Engineering Clinics

REVIEW-3

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IDENTIFICATION OF PROBLEM

The traditional shopping experience often faces challenges such as inefficient inventory management, manual product scanning, and long checkout queues. These limitations result in a time-consuming and frustrating process for both customers and retailers.

Key problems to be addressed include:

1. **Inefficient Inventory Management:** This inefficient process can result in out-of-stock situations, unsatisfied customers, and revenue loss for retailers.

2. **Time-consuming Product Scanning:** The conventional method of scanning products at the checkout counter requires individual item scanning, which can be time-consuming and prone to errors. This process often leads to long queues and customer dissatisfaction.

3. **Limited Customer Engagement**: Traditional shopping experiences lack personalized interactions and tailored recommendations. Customers are often unaware of product details, special offers, or complementary items that may enhance their shopping experience and meet their preferences.

4. **Ineffective Supply Chain Optimization:** Retailers face challenges in optimizing their supply chain processes, including restocking, inventory forecasting, and waste reduction. The lack of real-time data on product availability and customer preferences hinders their ability to streamline operations and minimize stockouts.

KEY OBJECTIVES OF THE PROJECT :

1. **Real-time Inventory Management:**
    1. Enable automatic tracking of inventory levels in real-time by utilizing RFID technology.
    2. Provide instant updates on product availability and stock levels to both customers and retailers.
    3. Reduce instances of out-of-stock situations, ensuring customer satisfaction and minimizing revenue loss for retailers.
2. **Efficient and Quick Checkout Process:**
    1. Implement a streamlined checkout process by utilizing RFID tags for automatic product identification.
    2. Eliminate the need for manual scanning at the checkout counter, reducing waiting times for customers.
    3. Improve the overall shopping experience by minimizing queues and enhancing operational efficiency for retailers.
3. **Enhanced Customer Engagement:**
    1. Utilize the Web interface to provide customers with personalized interactions and tailored recommendations.
    2. Display product details, prices, and additional information on the LCD display for customer awareness.
    3. Enhance the overall shopping experience by informing customers of special offers, complementary items, and relevant product information.
4. **Optimized Supply Chain Processes:**
    1. Facilitate effective supply chain optimization by providing real-time data on product availability and customer preferences.
    2. Support retailers in making informed decisions related to restocking, inventory forecasting, and waste reduction.
    3. Improve overall supply chain efficiency by leveraging IoT technology to gather and analyze data for better decision-making.

5.User-friendly Interface:

1. Develop a user-friendly interface on the LCD display for easy interaction with the Smart Basket.
2. Ensure clear and concise presentation of scanned product details, including name, price, and any additional information.
3. Enhance the overall usability of the Smart Basket, making it accessible and intuitive for a wide range of users.

6.Integration of Payment System:

1. Incorporate the integrated payment system to allow users to make payments directly through the Smart Basket.
2. Eliminate the need for waiting in line at the checkout counter, providing a convenient and time-saving payment experience for customers.

7.Implementation of IoT Technology:

1. Utilize Arduino as the central control unit, managing communication between various components.
2. Leverage RFID technology to enable seamless product identification and data retrieval.
3. Ensure the integration of Wi-Fi capabilities (esp 8266) for data exchange and connectivity with external databases and the Website.

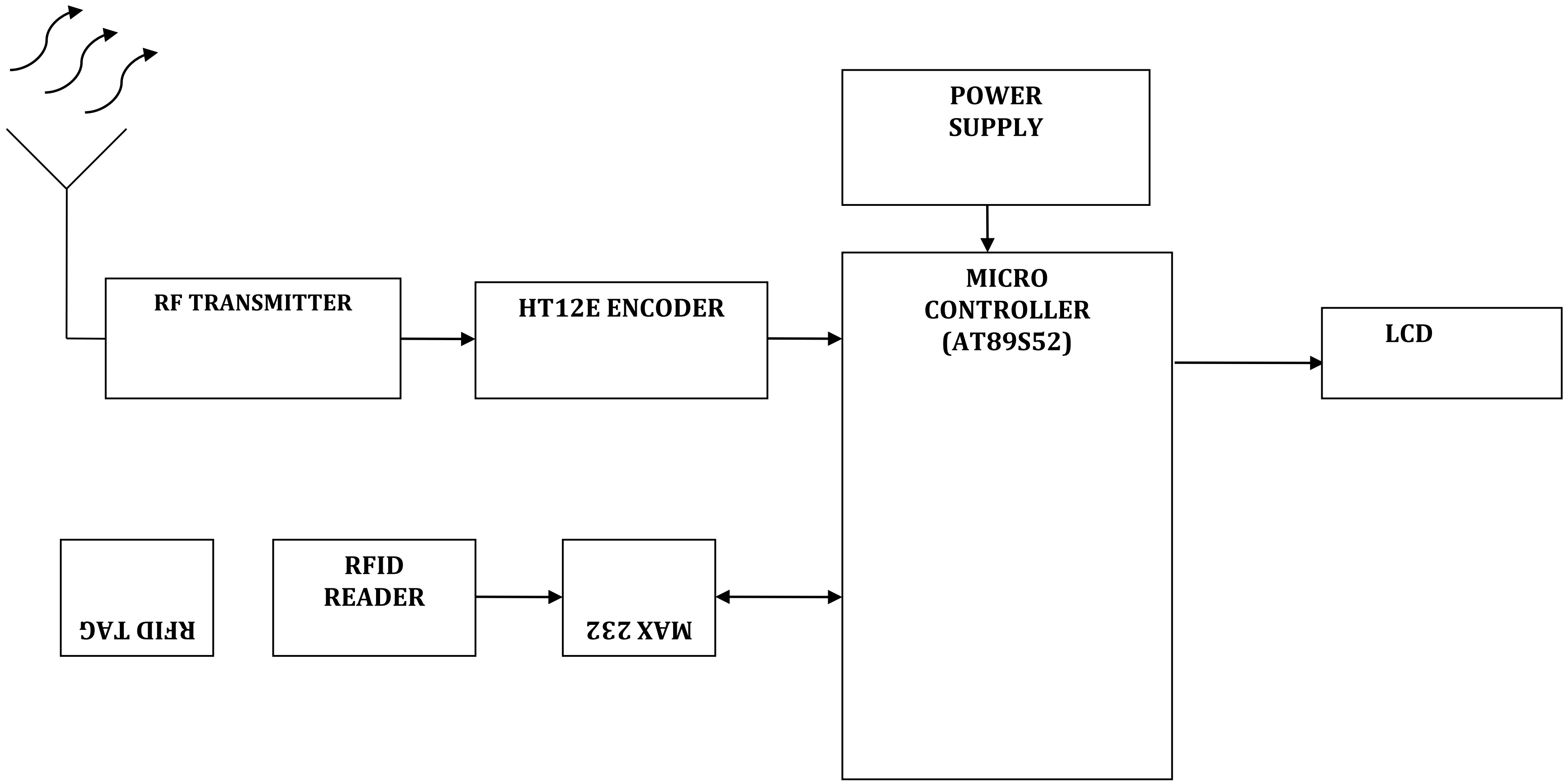
8.Error Reduction and Accuracy:

1. Minimize errors associated with manual scanning by implementing RFID technology for automatic product identification.
2. Enhance the accuracy of inventory management and checkout processes, reducing instances of miscounts and data discrepancies.

- By addressing these key objectives, **IOT BASED SMART CART WITH INVENTORY MANAGEMENT** aims to revolutionize the traditional shopping experience, providing a more efficient, engaging, and technology-driven approach for both customers and retailers.

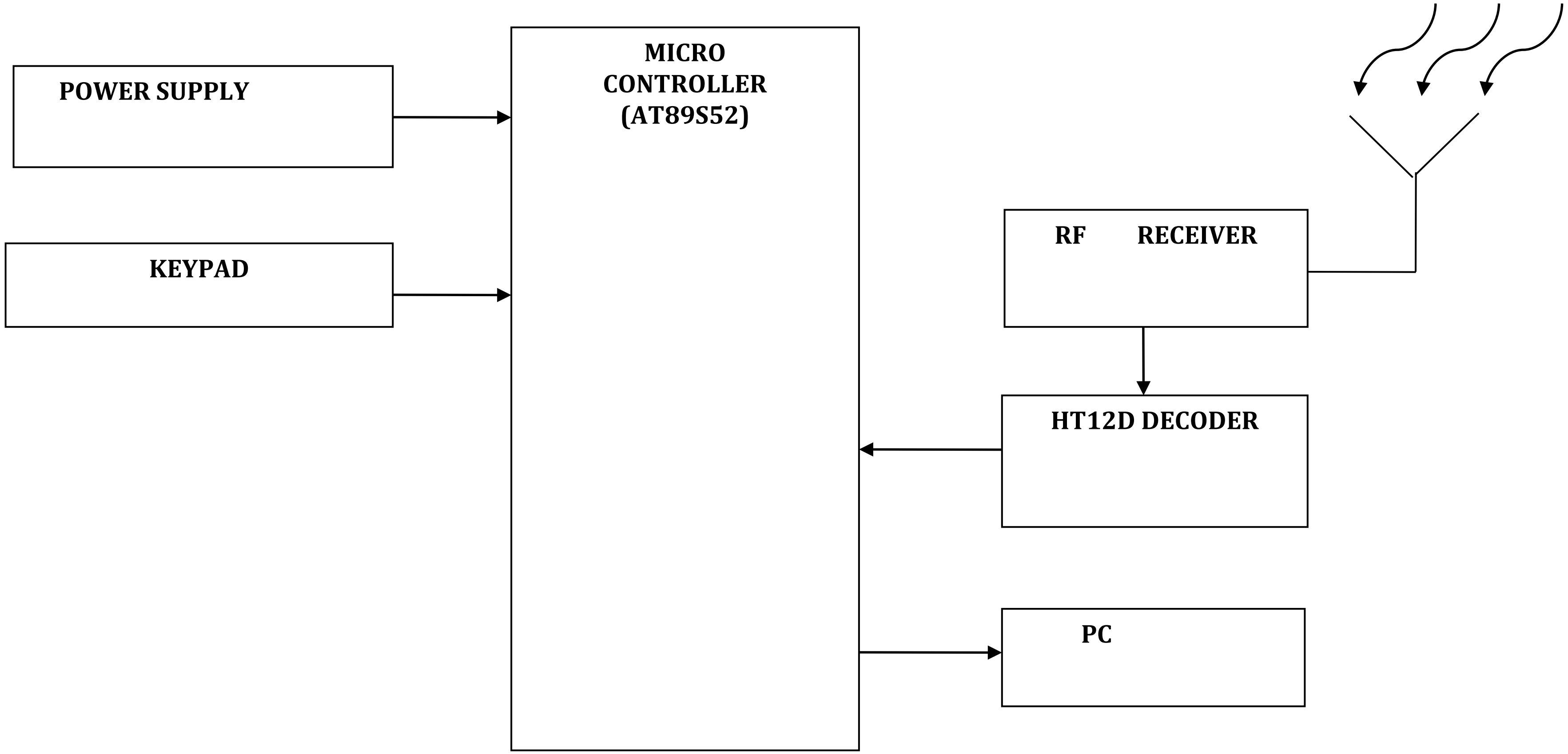
BLOCK DIAGRAM :

1. **TROLLEY SECTION:**



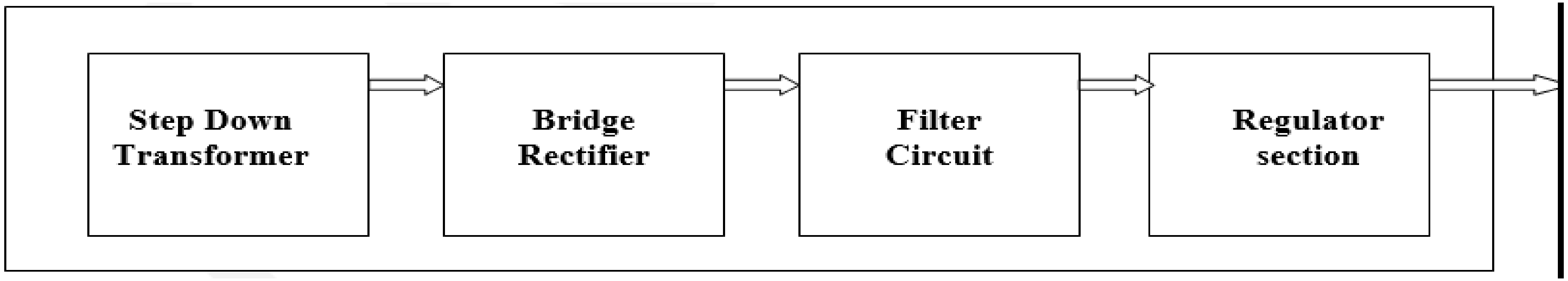
BLOCK DIAGRAM :

2. BILLING SECTION:



BLOCK DIAGRAM :

3. **POWER SUPPLY:**



IDENTIFICATION OF REQUIRED COMPONENTS AND BUDGET ESTIMATIOM

HARDWARE REQUIRED

Serial Number	Components	Quantity	Price(₹)
1	NodeMCU ESP8266 Wi-Fi	1	500
2	RFID card	5	200
3	RFID Reader EM-18 Board	1	1200
4	LM2596S DC to DC Step Down Module	1	200
5	IM900A GSM Modem with SMA Antenna (GSM Module)	1	1200
6	RF transmitter	1	300
7	RF receiver	1	300
8	LCD 16x2	1	500
9	3.7v 2000mah 18650 lithium(Li) ion cells	4	1000
10	Battery charger	1	500
	Total		**5900**

SOFTWARE REQUIRED

1. Arduino IDE

PLAN OF ACTION

1. Project Initiation:
2. Hardware Procurement:.
3. Software Setup:.
4. Arduino Programming:
5. RFID Integration:
6. User Interface Design:
7. Web Development
8. Testing and Debugging:
9. Maintenance and Updates
10. Documentation

TIMELINE OF THE UPDATES

❑ 1st FEBRUARY,2024 to 3rd FEBRUARY,2024

➢ Review I

➢ Presentation

❑ 19th MARCH,2024 to 23rd March,2024

➢ Review II

➢ Submission of prototype

❑ 23rd APRIL,2024 to 27th APRIL,2024

➢ Review III

➢ Submission of final model

CONCLUSION

- In conclusion, **Smart cart : Arduino-driven Checkout Efficiency Enhancement System** represents a transformative solution leveraging the power of the Internet of Things (IoT) and RFID technology to revolutionize the traditional shopping experience. By addressing key challenges in inventory management, checkout processes, customer engagement, and supply chain optimization, the Smart Basket aims to bring efficiency, convenience, and innovation to both customers and retailers.

- The integration of RFID technology allows for real-time inventory management, reducing the likelihood of out-of-stock situations and enhancing customer satisfaction. The streamlined checkout process, facilitated by automatic product identification, minimizes waiting times and improves overall operational efficiency for retailers.

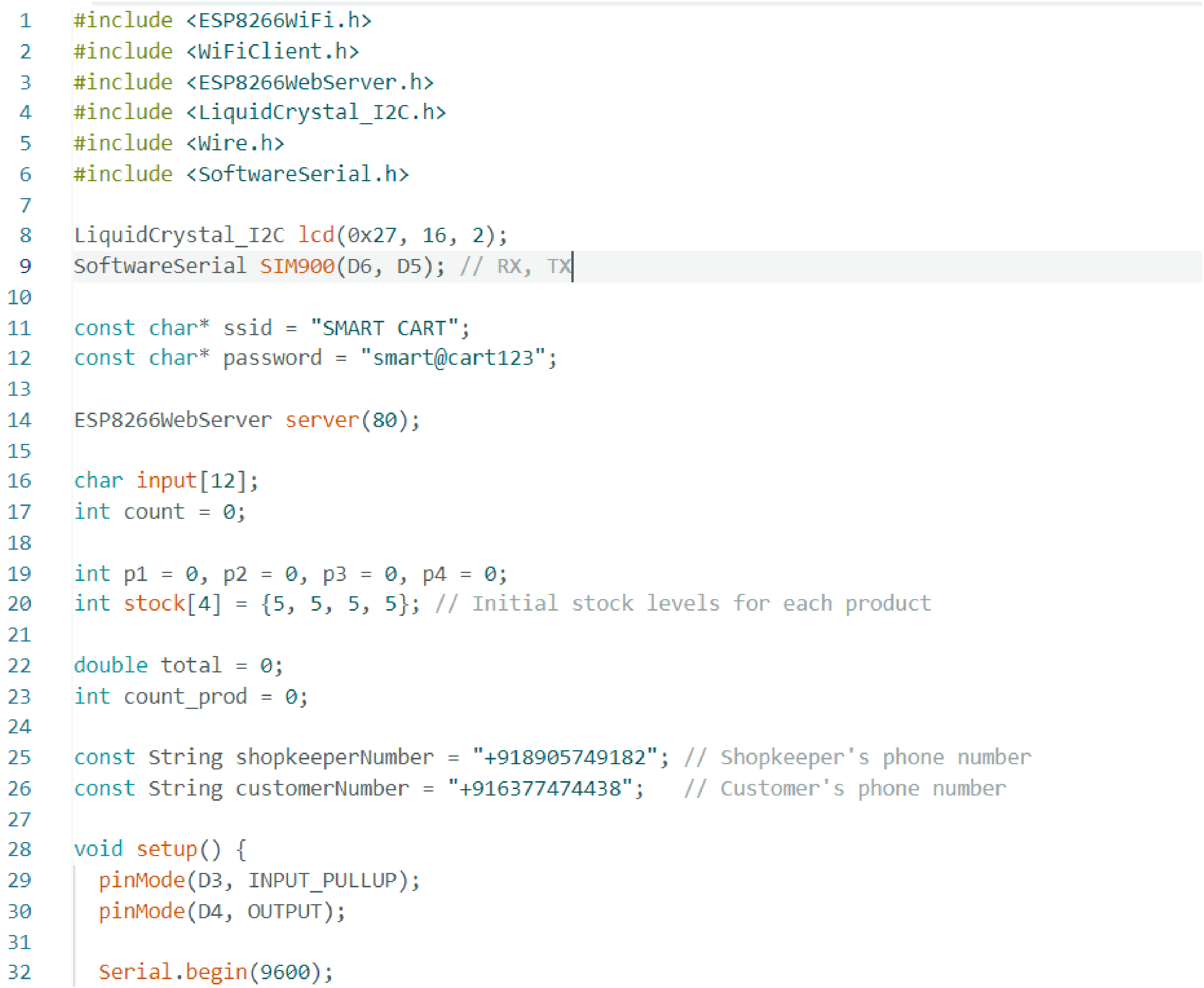
- Furthermore, the project focuses on enhancing customer engagement through a user-friendly interface and website. This enables personalized interactions, tailored recommendations, and access to relevant product information, fostering a more enjoyable and informative shopping experience.

- The Smart Shopping Basket's contribution to supply chain optimization is notable, providing retailers with valuable real-time data for informed decision-making related to restocking, inventory forecasting, and waste reduction.

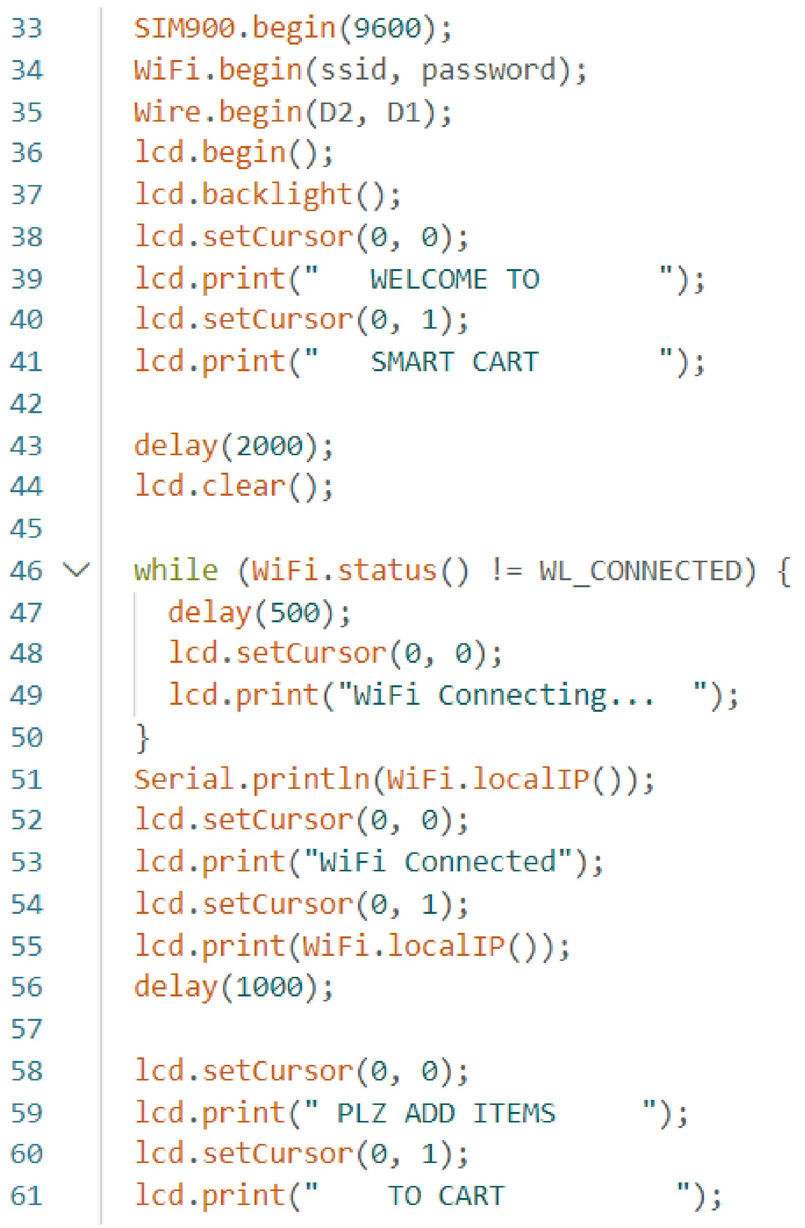
- The successful implementation of this project involves a meticulous plan of action, from hardware procurement to deployment, user training, and ongoing maintenance. The development of a secure and efficient integrated payment system adds an extra layer of convenience for users, allowing them to make transactions directly through the Smart Basket.

- In essence, the IoT Smart Shopping Basket project signifies a step forward in modernizing retail operations, showcasing the potential of IoT technology to bring about positive changes in how businesses manage inventory, engage with customers, and optimize supply chain processes. As the retail landscape continues to evolve, such innovative solutions hold the promise of creating a more seamless, efficient, and satisfying shopping experience for consumers while empowering retailers with enhanced operational capabilities.

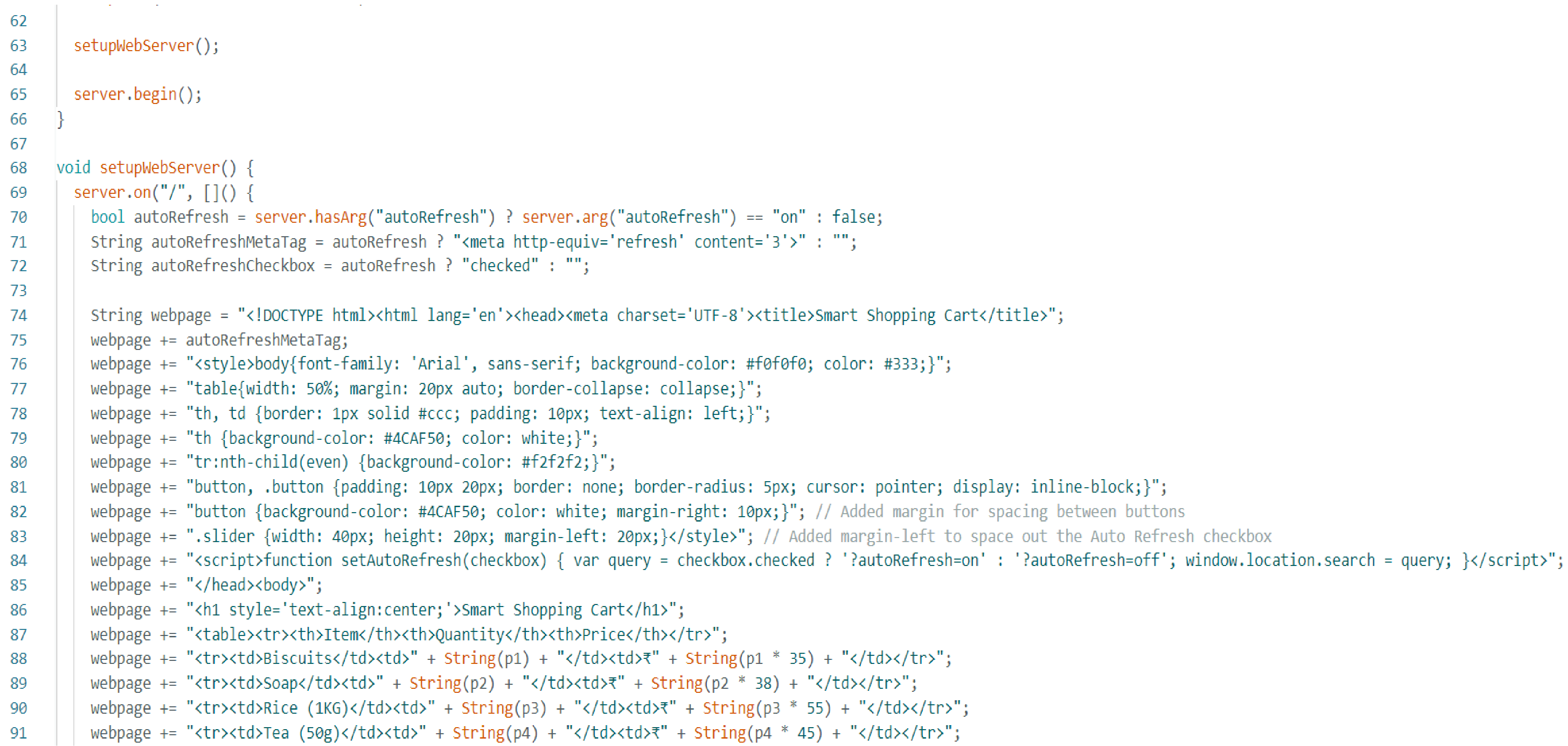
WORKING CODE



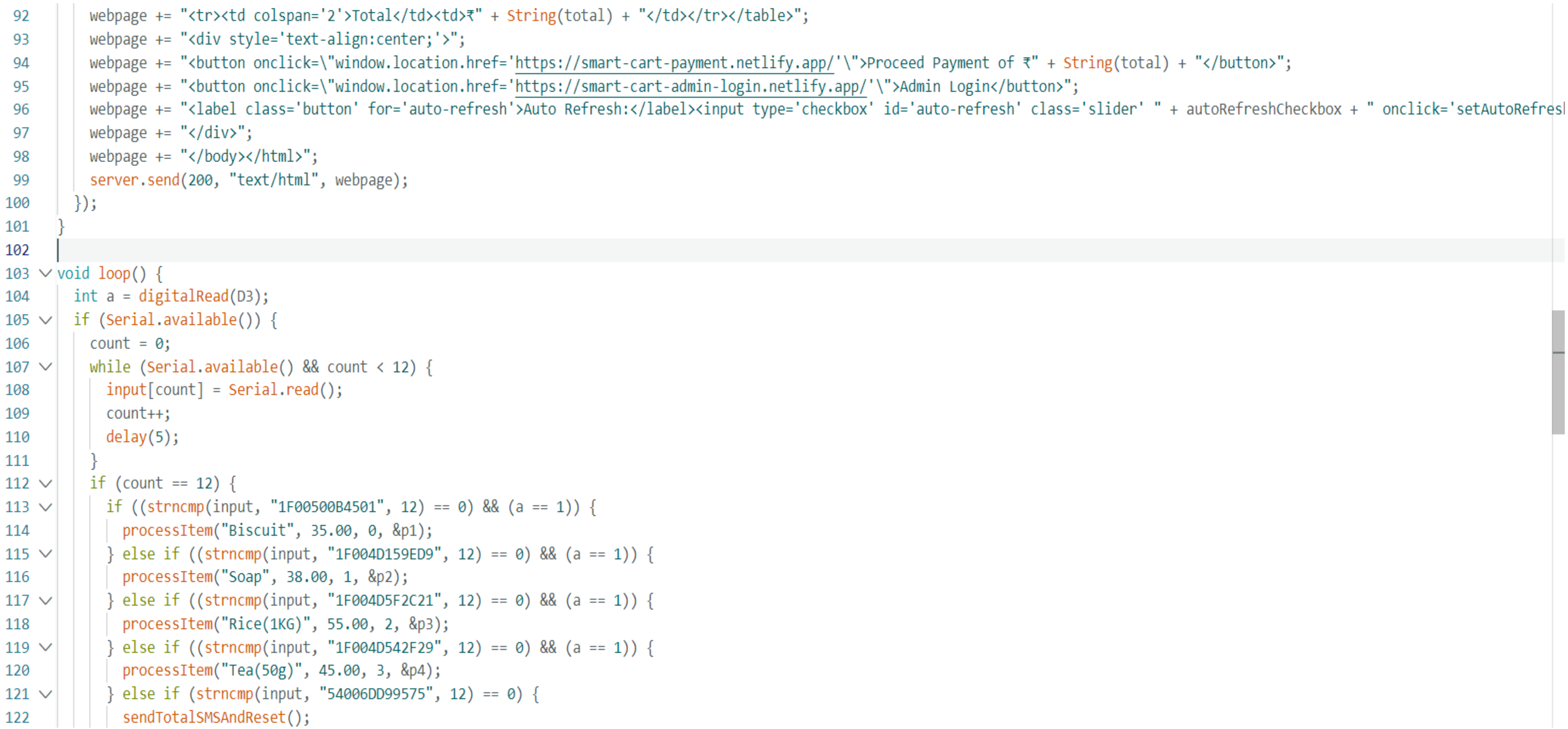
```
#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ESP8266WebServer.h>
#include <LiquidCrystal_I2C.h>
#include <Wire.h>
#include <SoftwareSerial.h>

LiquidCrystal_I2C lcd(0x27, 16, 2);
SoftwareSerial SIM900(D6, D5); // RX, TX

const char* ssid = "SMART CART";
const char* password = "smart@cart123";

ESP8266WebServer server(80);

char input[12];
int count = 0;

int p1 = 0, p2 = 0, p3 = 0, p4 = 0;
int stock[4] = {5, 5, 5, 5}; // Initial stock levels for each product

double total = 0;
int count_prod = 0;

const String shopkeeperNumber = "+918905749182"; // Shopkeeper's phone number
const String customerNumber = "+916377474438";   // Customer's phone number

void setup() {
  pinMode(D3, INPUT_PULLUP);
  pinMode(D4, OUTPUT);

  Serial.begin(9600);
```



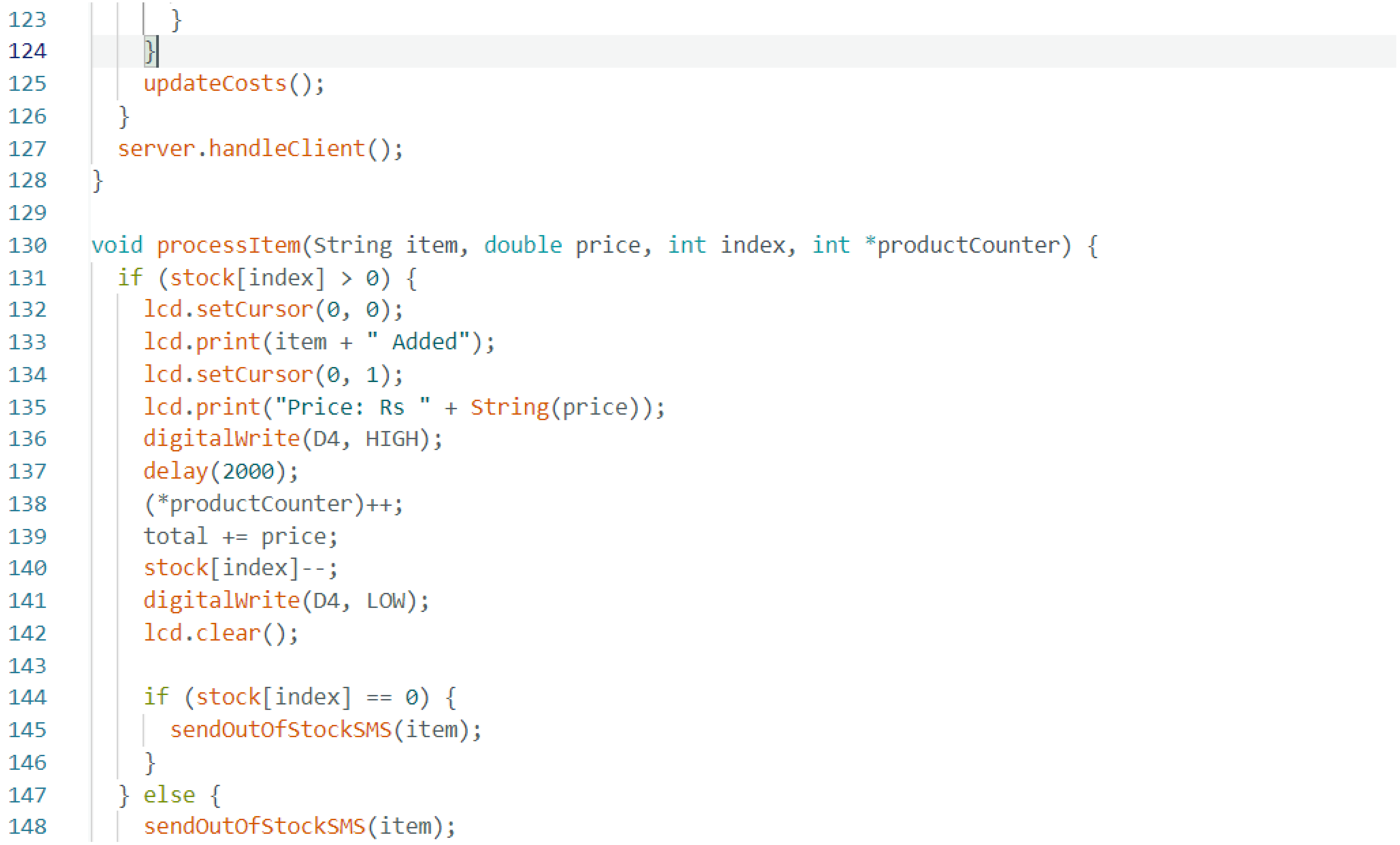
```
SIM900.begin(9600);
WiFi.begin(ssid, password);
Wire.begin(D2, D1);
lcd.begin();
lcd.backlight();
lcd.setCursor(0, 0);
lcd.print("   WELCOME TO       ");
lcd.setCursor(0, 1);
lcd.print("   SMART CART       ");

delay(2000);
lcd.clear();

while (WiFi.status() != WL_CONNECTED) {
  delay(500);
  lcd.setCursor(0, 0);
  lcd.print("WiFi Connecting...  ");
}
Serial.println(WiFi.localIP());
lcd.setCursor(0, 0);
lcd.print("WiFi Connected");
lcd.setCursor(0, 1);
lcd.print(WiFi.localIP());
delay(1000);

lcd.setCursor(0, 0);
lcd.print(" PLZ ADD ITEMS     ");
lcd.setCursor(0, 1);
lcd.print("    TO CART          ");
```



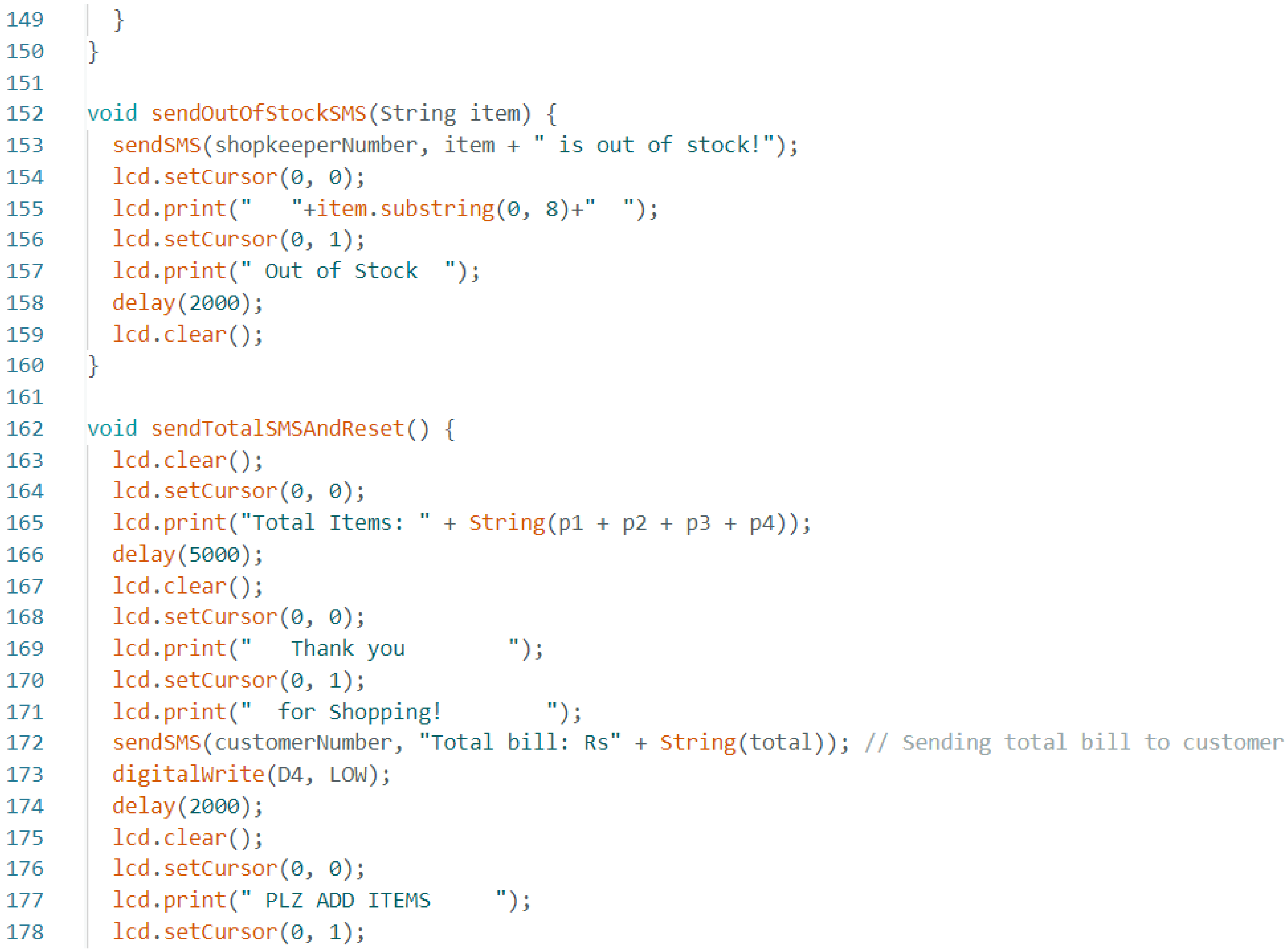
```

  setupWebServer();

  server.begin();
}

void setupWebServer() {
  server.on("/", []() {
    bool autoRefresh = server.hasArg("autoRefresh") ? server.arg("autoRefresh") == "on" : false;
    String autoRefreshMetaTag = autoRefresh ? "<meta http-equiv='refresh' content='3'>" : "";
    String autoRefreshCheckbox = autoRefresh ? "checked" : "";

    String webpage = "<!DOCTYPE html><html lang='en'><head><meta charset='UTF-8'><title>Smart Shopping Cart</title>";
    webpage += autoRefreshMetaTag;
    webpage += "<style>body{font-family: 'Arial', sans-serif; background-color: #f0f0f0; color: #333;}";
    webpage += "table{width: 50%; margin: 20px auto; border-collapse: collapse;}";
    webpage += "th, td {border: 1px solid #ccc; padding: 10px; text-align: left;}";
    webpage += "th {background-color: #4CAF50; color: white;}";
    webpage += "tr:nth-child(even) {background-color: #f2f2f2;}";
    webpage += "button, .button {padding: 10px 20px; border: none; border-radius: 5px; cursor: pointer; display: inline-block;}";
    webpage += "button {background-color: #4CAF50; color: white; margin-right: 10px;}"; // Added margin for spacing between buttons
    webpage += ".slider {width: 40px; height: 20px; margin-left: 20px;}</style>"; // Added margin-left to space out the Auto Refresh checkbox
    webpage += "<script>function setAutoRefresh(checkbox) { var query = checkbox.checked ? '?autoRefresh=on' : '?autoRefresh=off'; window.location.search = query; }</script>";
    webpage += "</head><body>";
    webpage += "<h1 style='text-align:center;'>Smart Shopping Cart</h1>";
    webpage += "<table><tr><th>Item</th><th>Quantity</th><th>Price</th></tr>";
    webpage += "<tr><td>Biscuits</td><td>" + String(p1) + "</td><td>₹" + String(p1 * 35) + "</td></tr>";
    webpage += "<tr><td>Soap</td><td>" + String(p2) + "</td><td>₹" + String(p2 * 38) + "</td></tr>";
    webpage += "<tr><td>Rice (1KG)</td><td>" + String(p3) + "</td><td>₹" + String(p3 * 55) + "</td></tr>";
    webpage += "<tr><td>Tea (50g)</td><td>" + String(p4) + "</td><td>₹" + String(p4 * 45) + "</td></tr>";
```



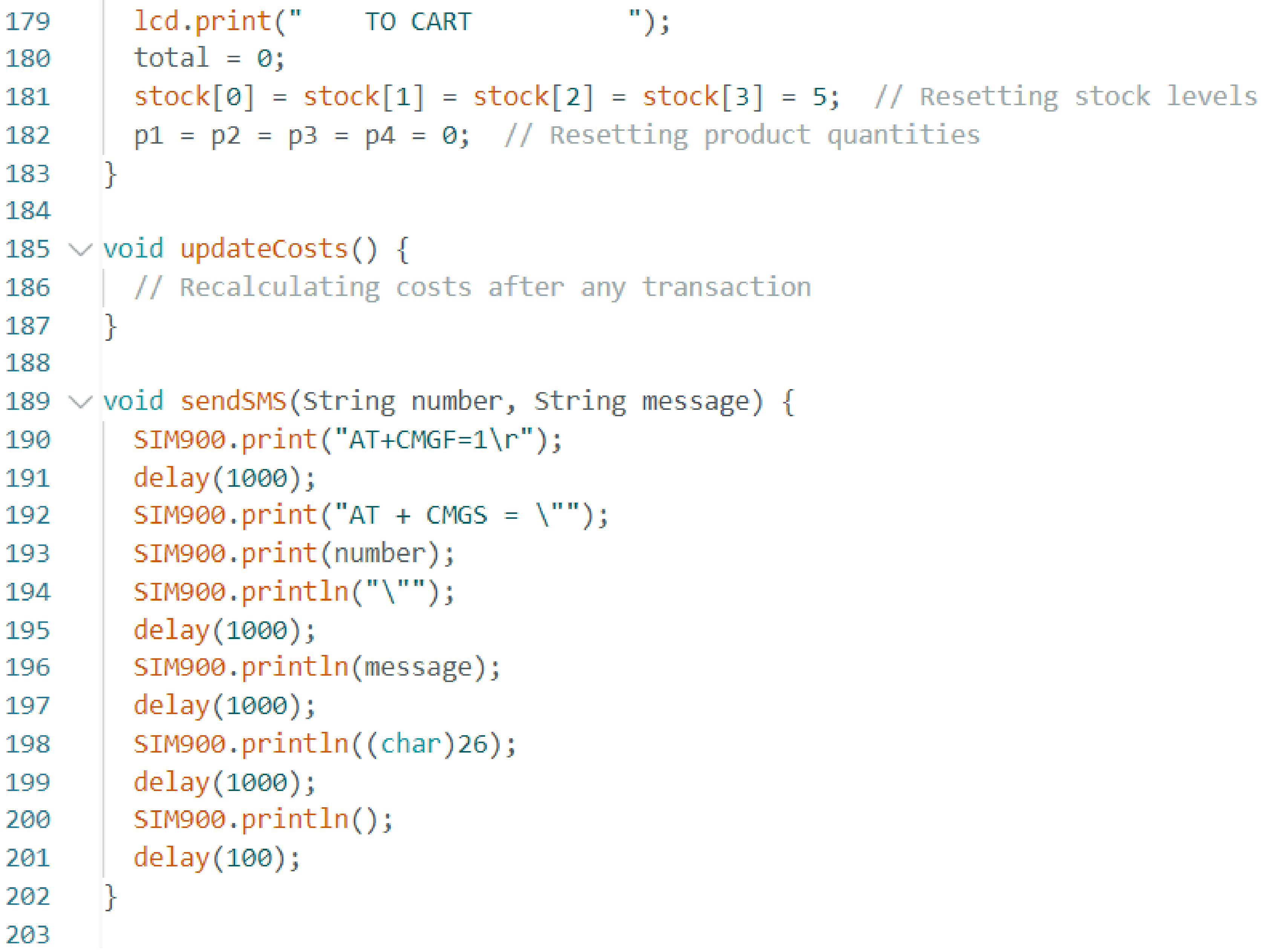
```
    webpage += "<tr><td colspan='2'>Total</td><td>₹" + String(total) + "</td></tr></table>";
    webpage += "<div style='text-align:center;'>";
    webpage += "<button onclick=\"window.location.href='https://smart-cart-payment.netlify.app/'\">Proceed Payment of ₹" + String(total) + "</button>";
    webpage += "<button onclick=\"window.location.href='https://smart-cart-admin-login.netlify.app/'\">Admin Login</button>";
    webpage += "<label class='button' for='auto-refresh'>Auto Refresh:</label><input type='checkbox' id='auto-refresh' class='slider' " + autoRefreshCheckbox + " onclick='setAutoRefres
    webpage += "</div>";
    webpage += "</body></html>";
    server.send(200, "text/html", webpage);
  });
}

void loop() {
  int a = digitalRead(D3);
  if (Serial.available()) {
    count = 0;
    while (Serial.available() && count < 12) {
      input[count] = Serial.read();
      count++;
      delay(5);
    }
    if (count == 12) {
      if ((strncmp(input, "1F00500B4501", 12) == 0) && (a == 1)) {
        processItem("Biscuit", 35.00, 0, &p1);
      } else if ((strncmp(input, "1F004D159ED9", 12) == 0) && (a == 1)) {
        processItem("Soap", 38.00, 1, &p2);
      } else if ((strncmp(input, "1F004D5F2C21", 12) == 0) && (a == 1)) {
        processItem("Rice(1KG)", 55.00, 2, &p3);
      } else if ((strncmp(input, "1F004D542F29", 12) == 0) && (a == 1)) {
        processItem("Tea(50g)", 45.00, 3, &p4);
      } else if (strncmp(input, "54006DD99575", 12) == 0) {
        sendTotalSMSAndReset();
```



```
      }
    }
    updateCosts();
  }
  server.handleClient();
}

void processItem(String item, double price, int index, int *productCounter) {
  if (stock[index] > 0) {
    lcd.setCursor(0, 0);
    lcd.print(item + " Added");
    lcd.setCursor(0, 1);
    lcd.print("Price: Rs " + String(price));
    digitalWrite(D4, HIGH);
    delay(2000);
    (*productCounter)++;
    total += price;
    stock[index]--;
    digitalWrite(D4, LOW);
    lcd.clear();

    if (stock[index] == 0) {
      sendOutOfStockSMS(item);
    }
  } else {
    sendOutOfStockSMS(item);
```

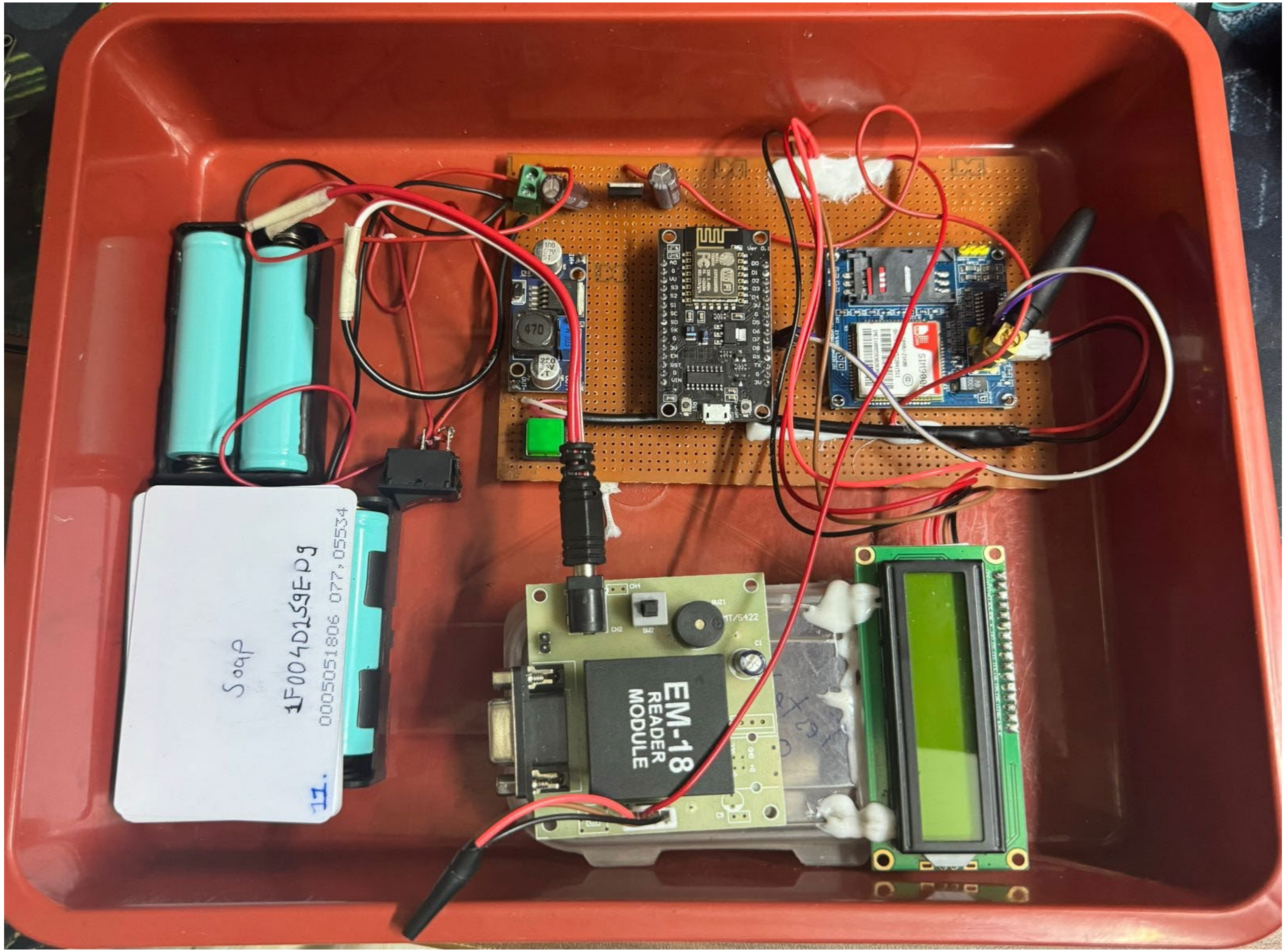


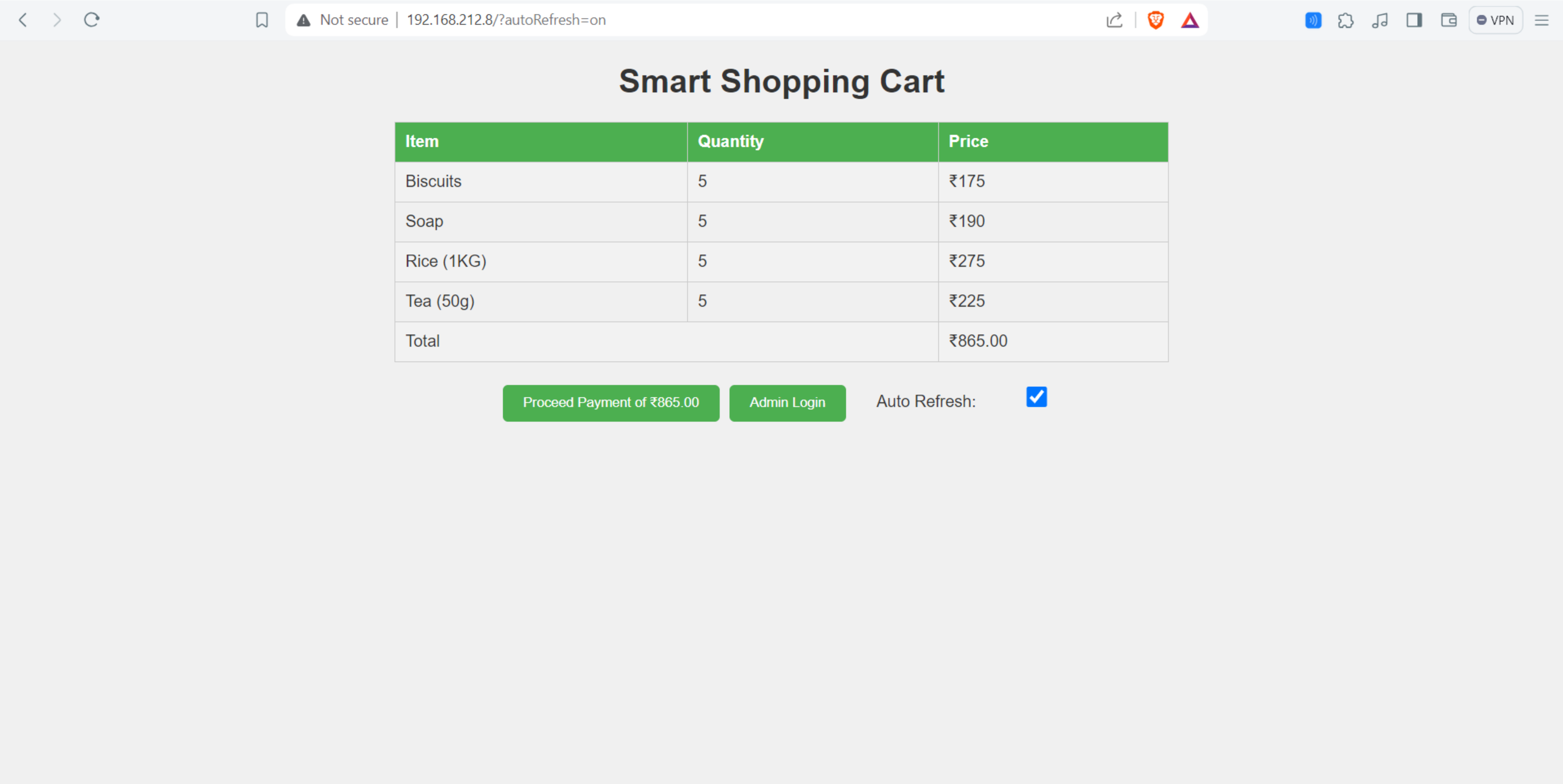
```
  }
}

void sendOutOfStockSMS(String item) {
  sendSMS(shopkeeperNumber, item + " is out of stock!");
  lcd.setCursor(0, 0);
  lcd.print("   "+item.substring(0, 8)+"  ");
  lcd.setCursor(0, 1);
  lcd.print(" Out of Stock  ");
  delay(2000);
  lcd.clear();
}

void sendTotalSMSAndReset() {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Total Items: " + String(p1 + p2 + p3 + p4));
  delay(5000);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("   Thank you        ");
  lcd.setCursor(0, 1);
  lcd.print("  for Shopping!        ");
  sendSMS(customerNumber, "Total bill: Rs" + String(total)); // Sending total bill to customer
  digitalWrite(D4, LOW);
  delay(2000);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(" PLZ ADD ITEMS     ");
  lcd.setCursor(0, 1);
```



```
  lcd.print("    TO CART          ");
  total = 0;
  stock[0] = stock[1] = stock[2] = stock[3] = 5;  // Resetting stock levels
  p1 = p2 = p3 = p4 = 0;  // Resetting product quantities
}

void updateCosts() {
  // Recalculating costs after any transaction
}

void sendSMS(String number, String message) {
  SIM900.print("AT+CMGF=1\r");
  delay(1000);
  SIM900.print("AT + CMGS = \"");
  SIM900.print(number);
  SIM900.println("\"");
  delay(1000);
  SIM900.println(message);
  delay(1000);
  SIM900.println((char)26);
  delay(1000);
  SIM900.println();
  delay(100);
}

```

PROTOTYPE

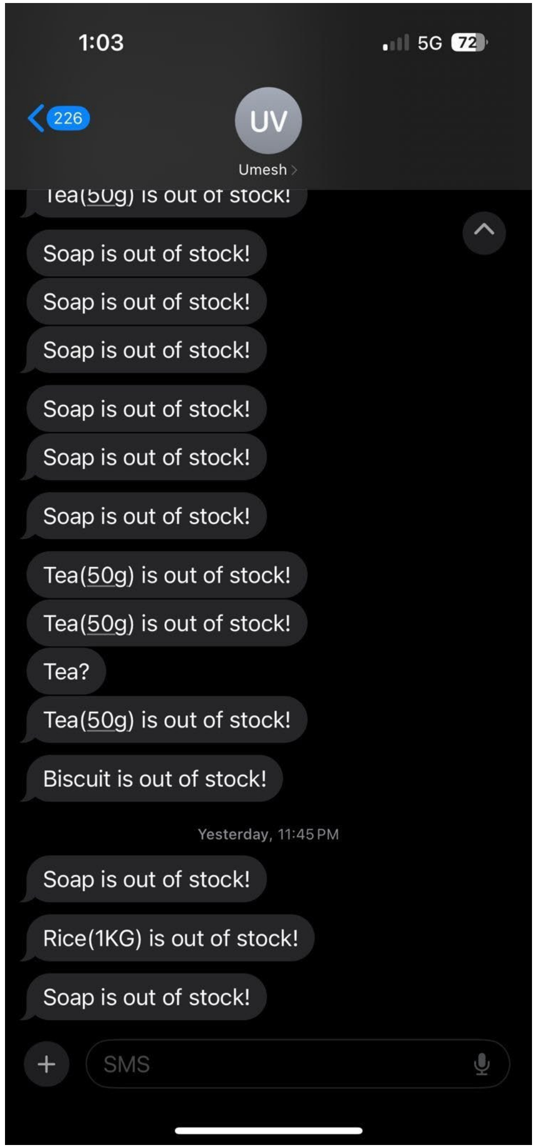

EM-18
READER
MODULE
Soap
1F004D159ED9
0005051806 077,05534
17.


Not secure | 192.168.212.8/?autoRefresh=on
VPN
Proceed Payment of ₹865.00
Admin Login

Smart Shopping Cart

Item	Quantity	Price
Biscuits	5	₹175
Soap	5	₹190
Rice (1KG)	5	₹275
Tea (50g)	5	₹225
Total		₹865.00

Auto Refresh: ☑



Tea(50g) is out of stock!

Soap is out of stock!

Soap is out of stock!

Soap is out of stock!

Soap is out of stock!

Soap is out of stock!

Soap is out of stock!

Tea(50g) is out of stock!

Tea(50g) is out of stock!

Tea?

Tea(50g) is out of stock!

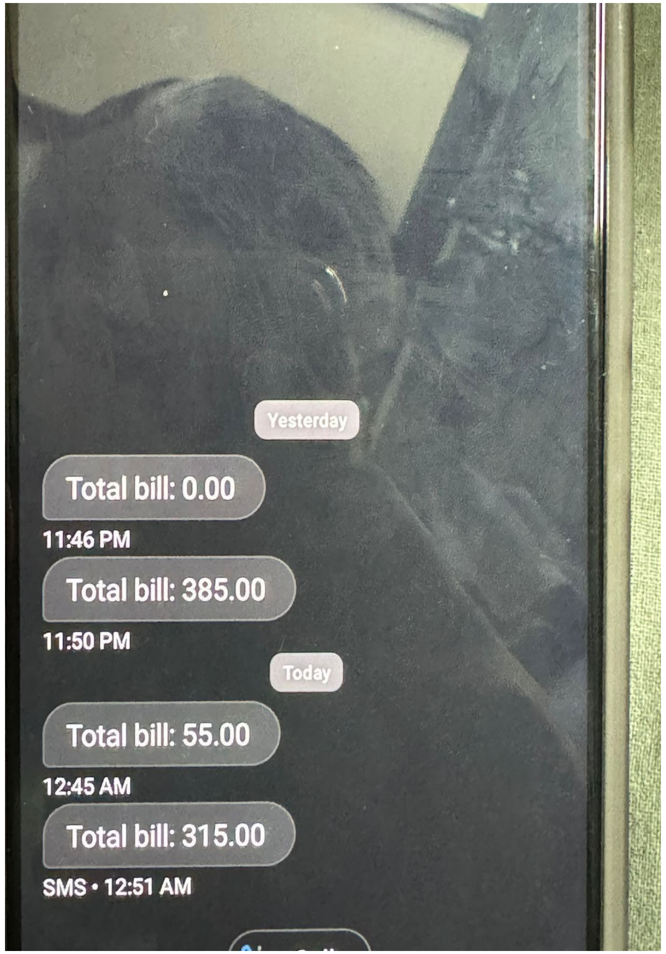
Biscuit is out of stock!

Yesterday, 11:45 PM

Soap is out of stock!

Rice(1KG) is out of stock!

Soap is out of stock!



Yesterday

Total bill: 0.00

11:46 PM

Total bill: 385.00

11:50 PM

Today

Total bill: 55.00

12:45 AM

Total bill: 315.00

SMS • 12:51 AM

CHANGES MADE:

1.Fixed frequent restart of setup

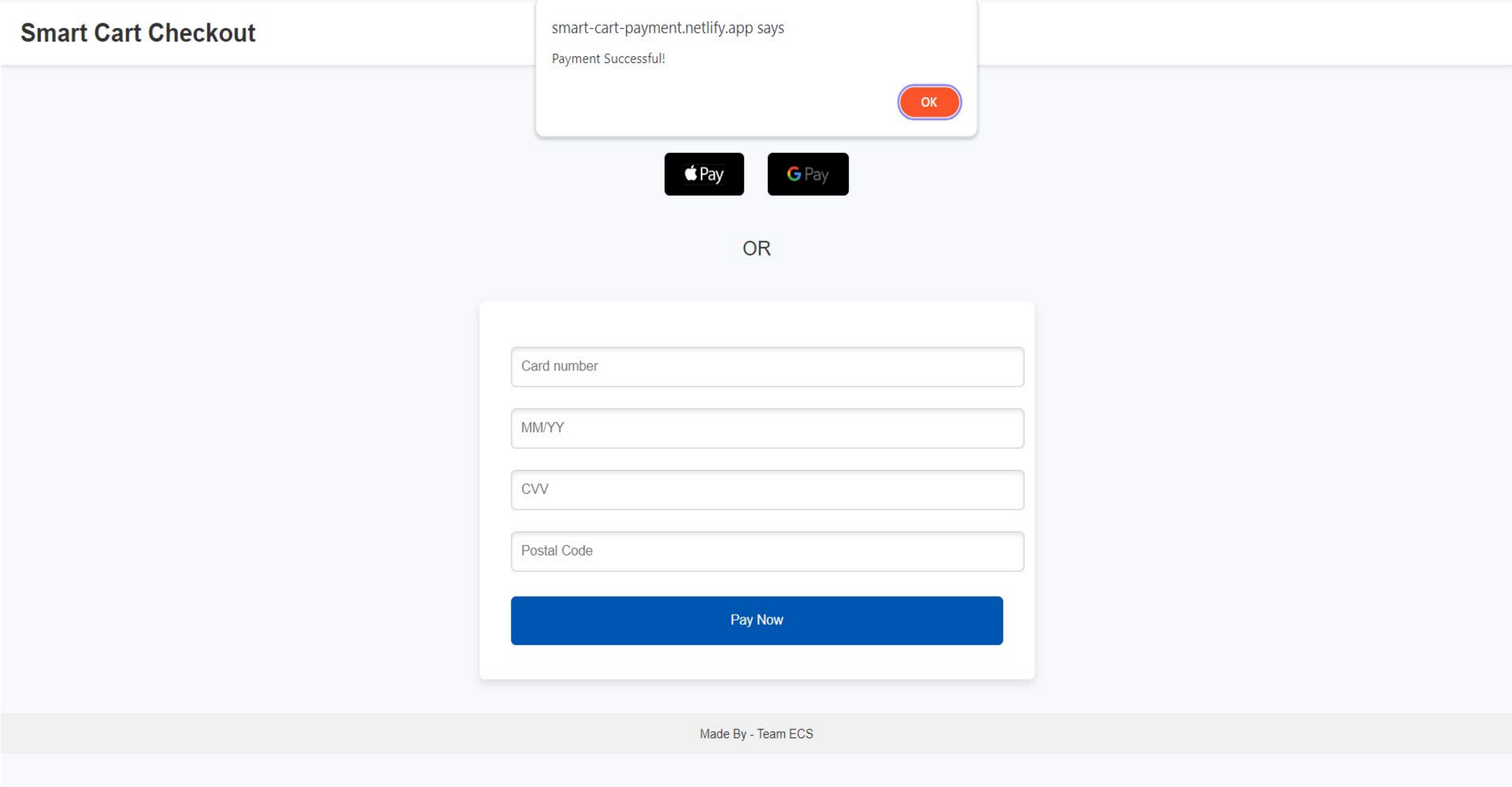
2. Fixed webpage(now optimized)

3. Fixed sms triggering issue

4. Added autorefresh button in webpage

5. Added Static payment page

https://smart-cart-payment.netlify.app/



Smart Cart Checkout

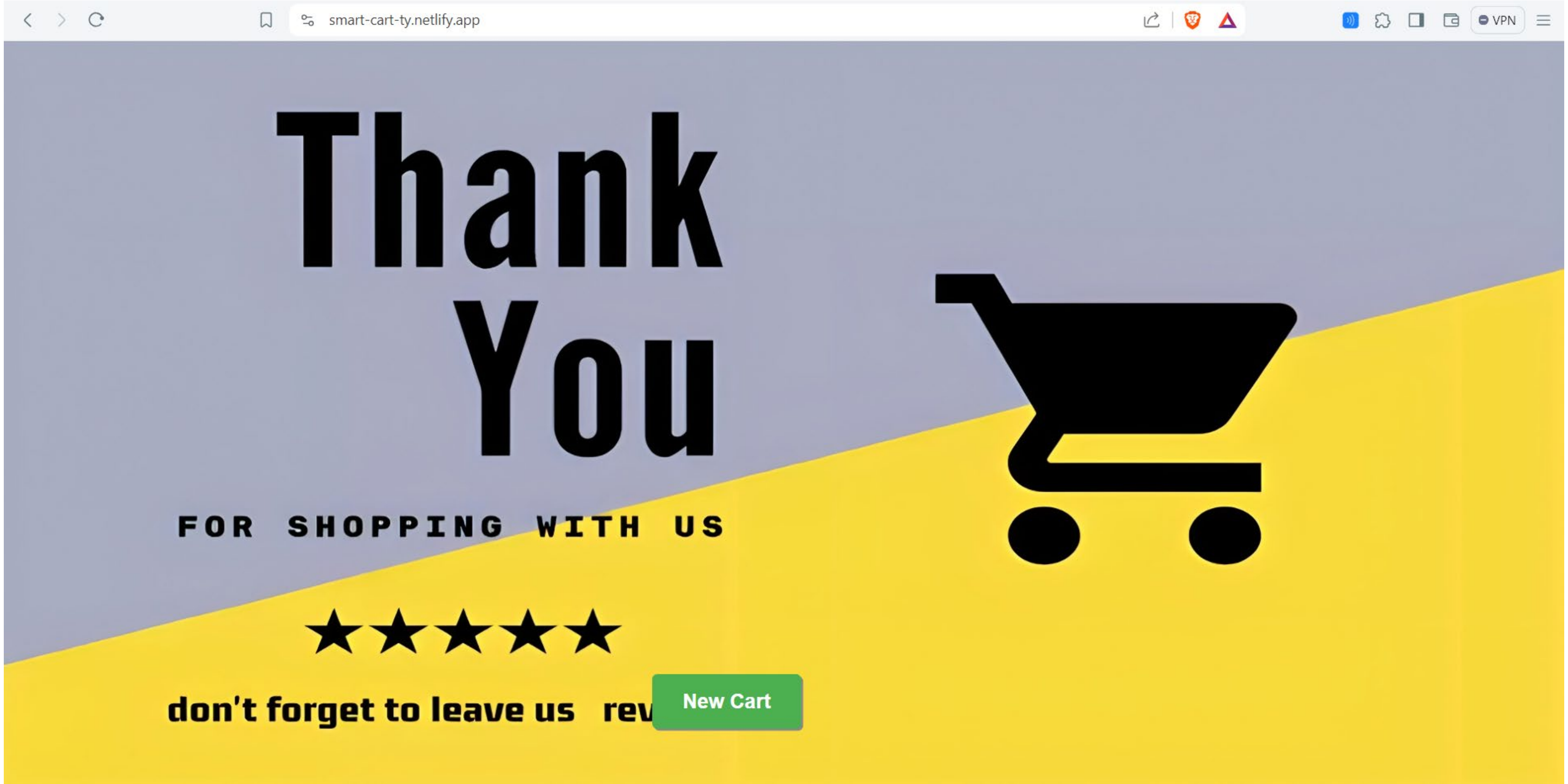
smart-cart-payment.netlify.app says

Payment Successful!

Made By - Team ECS

6. Added thank you page when payment completes

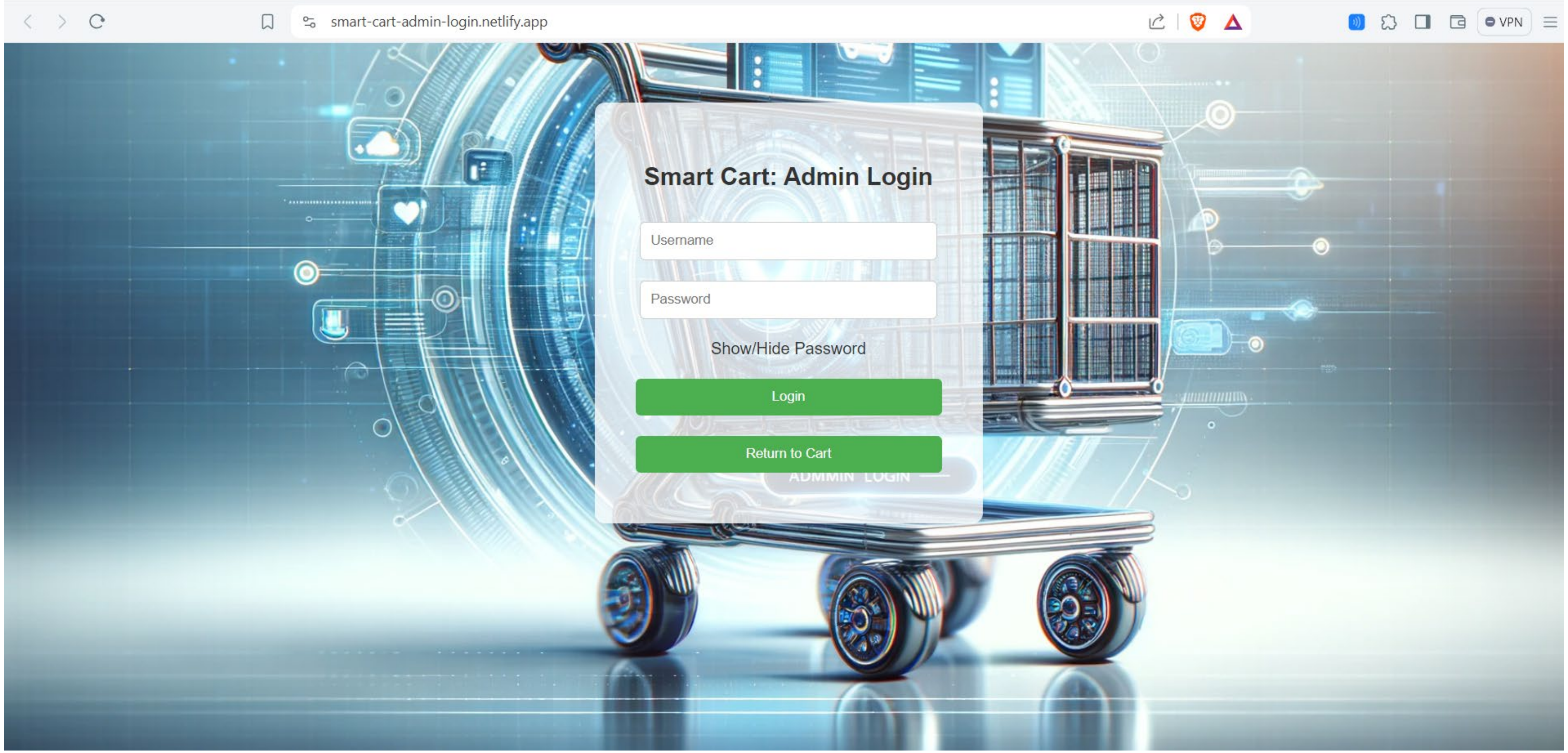
https://smart-cart-ty.netlify.app/



7. Added Admin(Owner) login to access Admin panel

Credentials to login*
Username- admin
Password - admin

Unable to login if entered wrong credentials
https://smart-cart-admin-login.netlify.app/



smart-cart-admin-login.netlify.app

Smart Cart: Admin Login

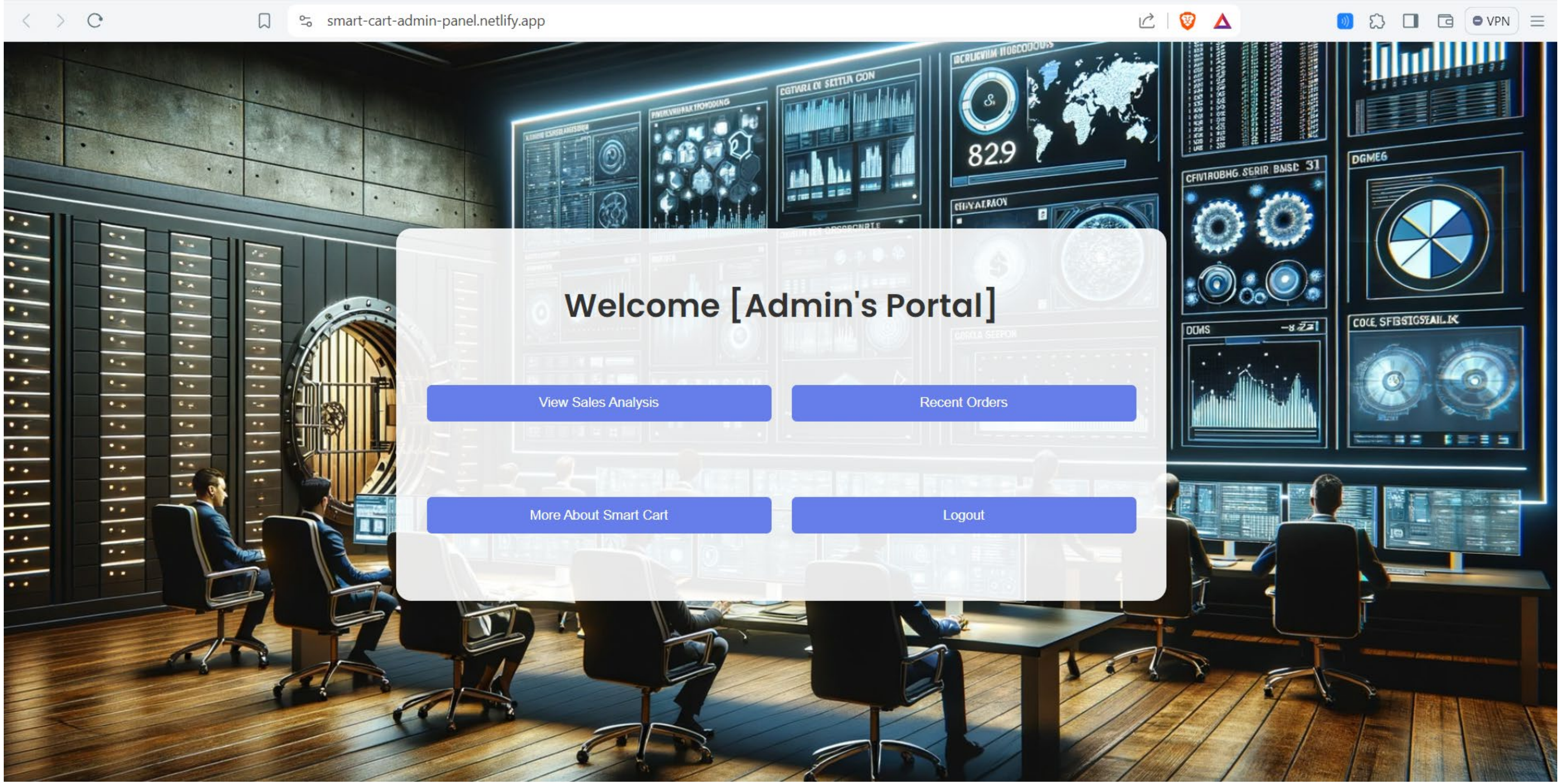
Username

Password

Show/Hide Password

8. Added Admin Panel with features

https://smart-cart-admin-panel.netlify.app/

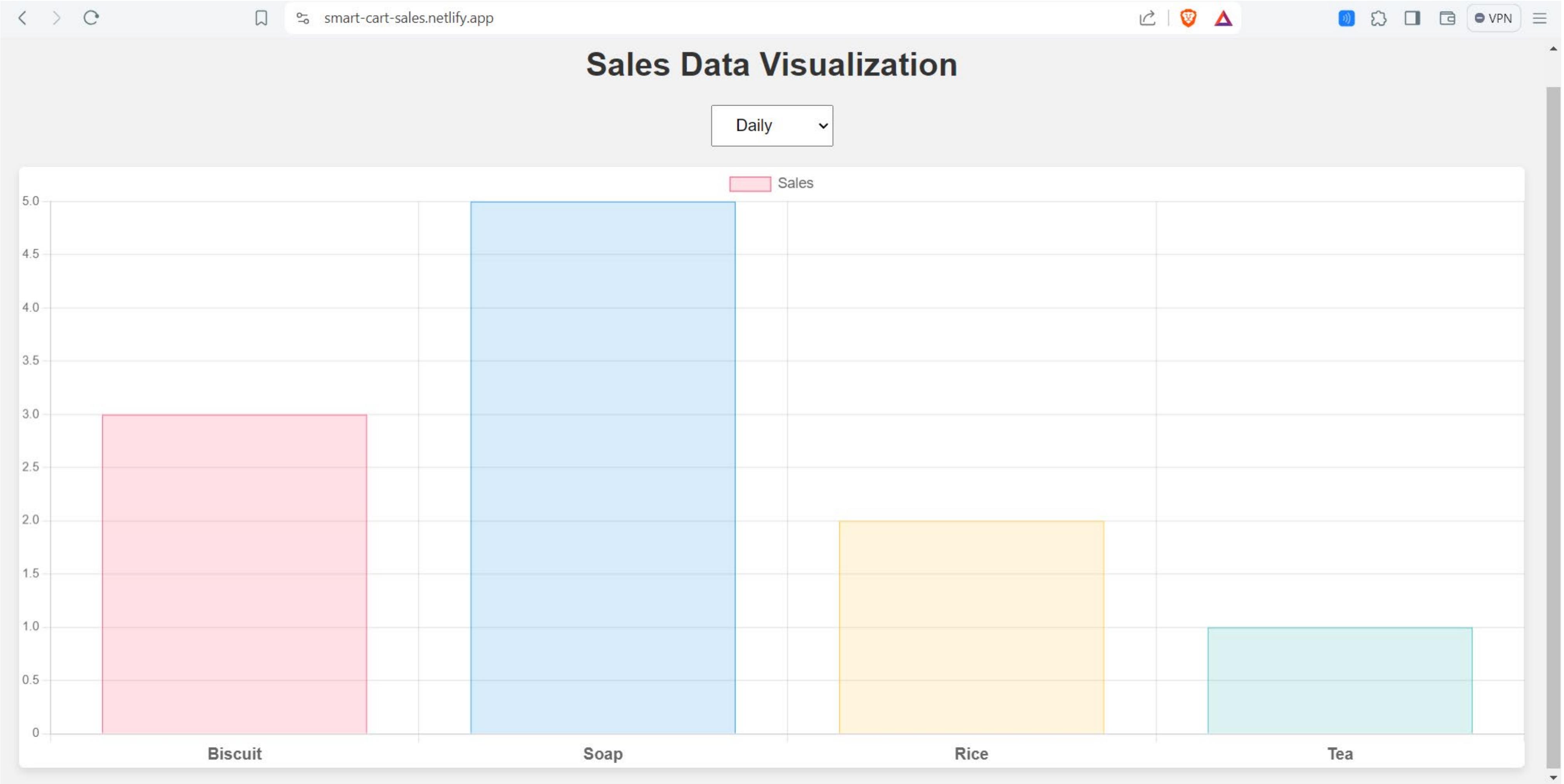


Welcome [Admin's Portal]

9.Added Sales Analysis with daily/monthly/yearly basis

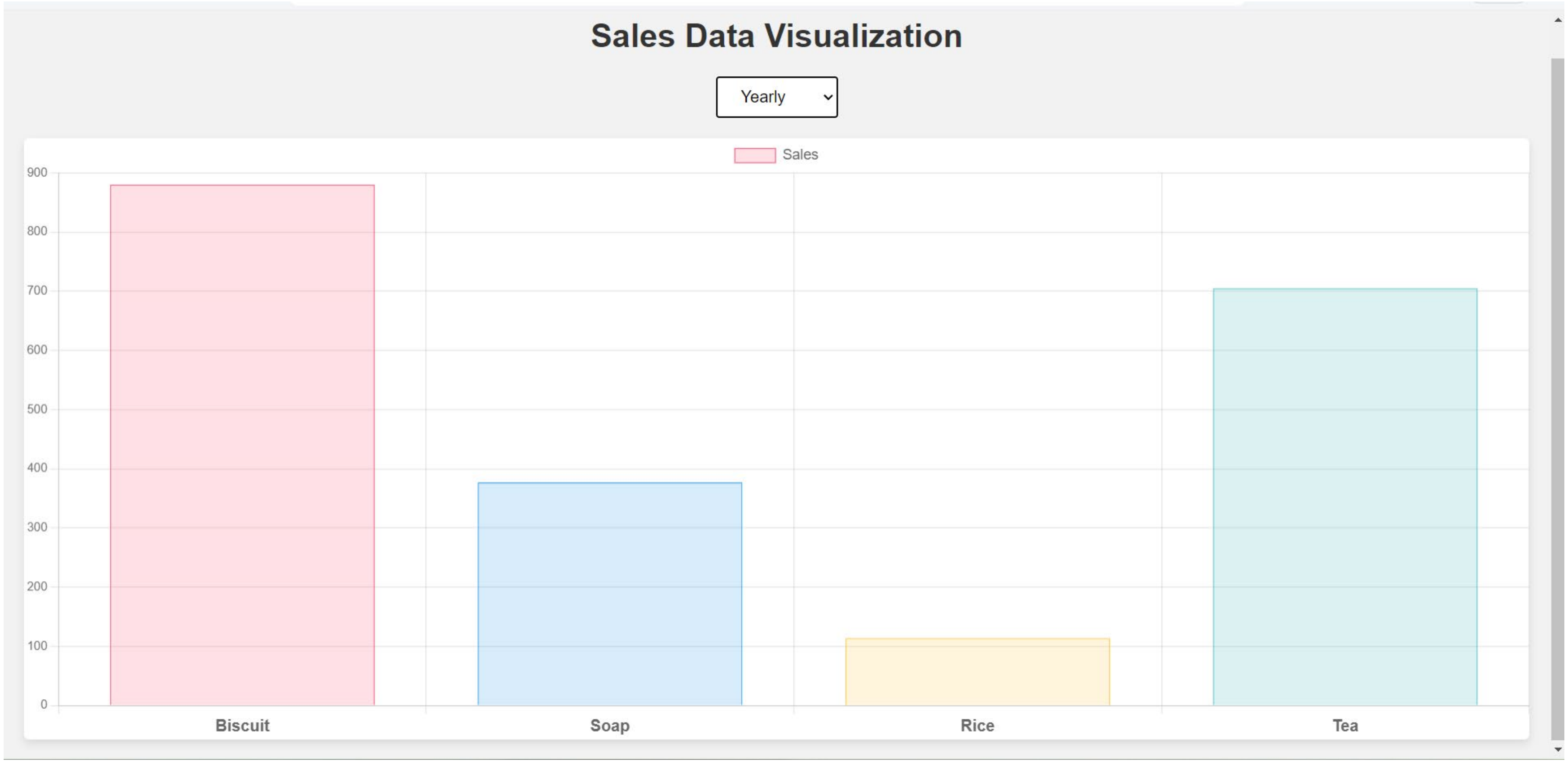
https://smart-cart-sales.netlify.app/

Daily mode:



Sales Data Visualization

Yearly mode:

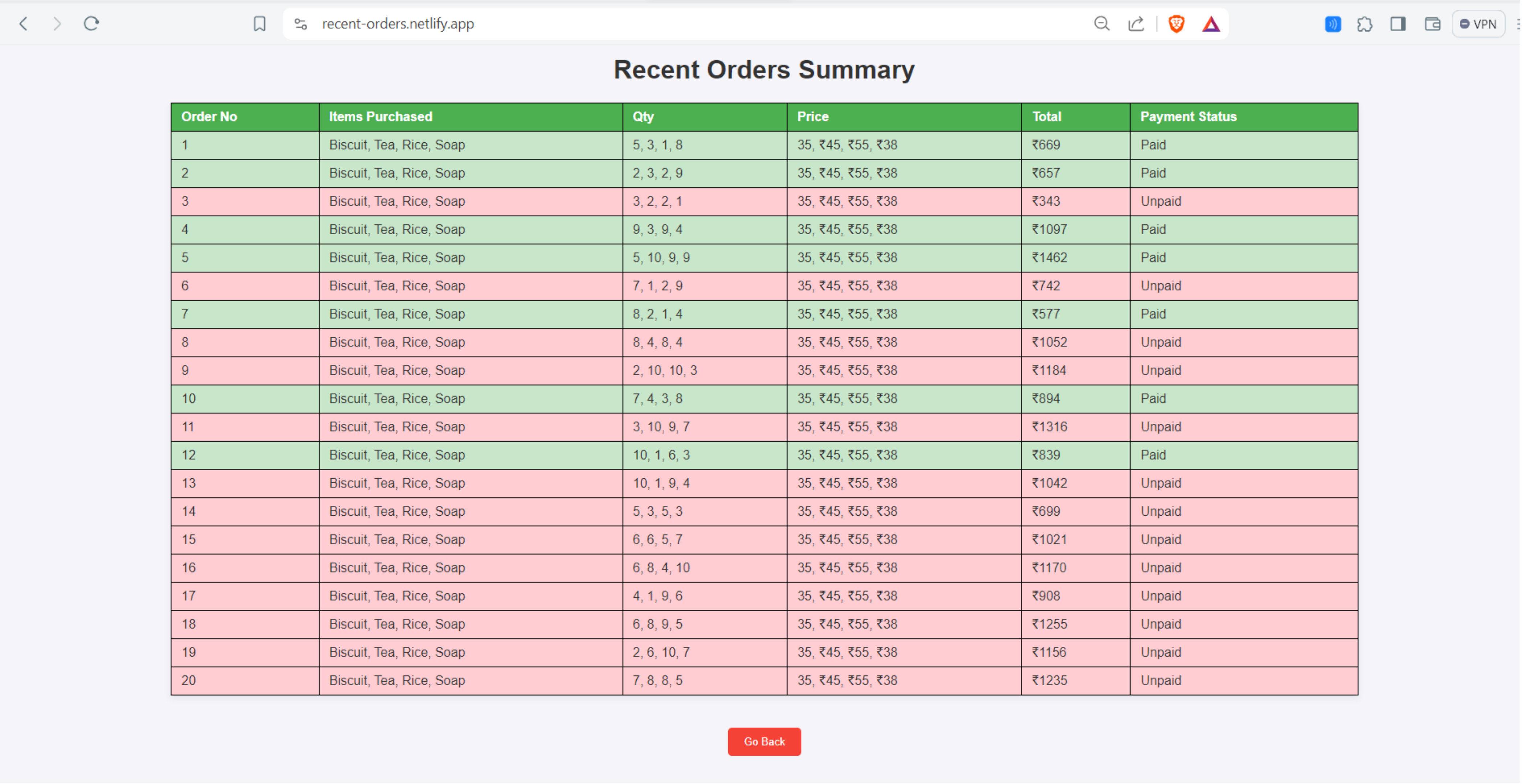


Sales Data Visualization

Yearly

10. Added static option to see recent orders

https://recent-orders.netlify.app/



Recent Orders Summary

Order No	Items Purchased	Qty	Price	Total	Payment Status
1	Biscuit, Tea, Rice, Soap	5, 3, 1, 8	35, ₹45, ₹55, ₹38	₹669	Paid
2	Biscuit, Tea, Rice, Soap	2, 3, 2, 9	35, ₹45, ₹55, ₹38	₹657	Paid
3	Biscuit, Tea, Rice, Soap	3, 2, 2, 1	35, ₹45, ₹55, ₹38	₹343	Unpaid
4	Biscuit, Tea, Rice, Soap	9, 3, 9, 4	35, ₹45, ₹55, ₹38	₹1097	Paid
5	Biscuit, Tea, Rice, Soap	5, 10, 9, 9	35, ₹45, ₹55, ₹38	₹1462	Paid
6	Biscuit, Tea, Rice, Soap	7, 1, 2, 9	35, ₹45, ₹55, ₹38	₹742	Unpaid
7	Biscuit, Tea, Rice, Soap	8, 2, 1, 4	35, ₹45, ₹55, ₹38	₹577	Paid
8	Biscuit, Tea, Rice, Soap	8, 4, 8, 4	35, ₹45, ₹55, ₹38	₹1052	Unpaid
9	Biscuit, Tea, Rice, Soap	2, 10, 10, 3	35, ₹45, ₹55, ₹38	₹1184	Unpaid
10	Biscuit, Tea, Rice, Soap	7, 4, 3, 8	35, ₹45, ₹55, ₹38	₹894	Paid
11	Biscuit, Tea, Rice, Soap	3, 10, 9, 7	35, ₹45, ₹55, ₹38	₹1316	Unpaid
12	Biscuit, Tea, Rice, Soap	10, 1, 6, 3	35, ₹45, ₹55, ₹38	₹839	Paid
13	Biscuit, Tea, Rice, Soap	10, 1, 9, 4	35, ₹45, ₹55, ₹38	₹1042	Unpaid
14	Biscuit, Tea, Rice, Soap	5, 3, 5, 3	35, ₹45, ₹55, ₹38	₹699	Unpaid
15	Biscuit, Tea, Rice, Soap	6, 6, 5, 7	35, ₹45, ₹55, ₹38	₹1021	Unpaid
16	Biscuit, Tea, Rice, Soap	6, 8, 4, 10	35, ₹45, ₹55, ₹38	₹1170	Unpaid
17	Biscuit, Tea, Rice, Soap	4, 1, 9, 6	35, ₹45, ₹55, ₹38	₹908	Unpaid
18	Biscuit, Tea, Rice, Soap	6, 8, 9, 5	35, ₹45, ₹55, ₹38	₹1255	Unpaid
19	Biscuit, Tea, Rice, Soap	2, 6, 10, 7	35, ₹45, ₹55, ₹38	₹1156	Unpaid
20	Biscuit, Tea, Rice, Soap	7, 8, 8, 5	35, ₹45, ₹55, ₹38	₹1235	Unpaid

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THANK YOU