ECE 3999 - TECHNICAL ANSWERS FOR REAL WORLD PROBLEMS
J - COMPONENT REVIEW
Winter 2020 - 2021

Smart Trolley System Using IoT

Group Name: ***RansomWhere***

Presented to **Dr. Reena Monica**

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OBJECTIVE

The team's objective is to develop a project that will help with the tedious and time consuming process of grocery shopping by greatly reducing the billing time and shopping time. It is targeted towards customers of all types for easy and seamless shopping. This promotes contactless shopping and transaction which is need of the hour now. We are planning to achieve the same by using a smart trolley system that uses RFID tags to help ease the hassle. This benefits both the customer and the shopkeeper in various ways.

MOTIVATION

- This project has aimed at the concept of “**Smart Shopping**”, promotes **Social Distancing** and tries to adhere to all the Government norms that pertain to the Covid’19’s Lockdown Regulations and Policies, given that we still have the Covid-19’s threat amongst us.
- There has been one and only one way to tag the given products to their cost, **the Barcode**, and sometimes the Barcode fails to scan the given the product given that it will be printed over the product's packaging and it might be damaged.
- The **RFID tag** process proposed in this Project and Product works smoothly given that it needn’t only gives the cost of the product when the tag is scanned, but in turn gives about a **small, brief information about the product too**, to educate the customer and the queue near the Billing Counter can be drastically reduced since the Bill is **automated** and can be paid using a Secure Payment Gateway.
- Our “Smart Shopping” is also motivated at **reducing the labour cost** and the cost of the labour can be used in servicing the Smart Trolley after getting a good use out of it over the years.

LITERATURE SURVEY & FIELD SURVEY

Customer Questionnaire

Shopkeeper Questionnaire

Literature Survey

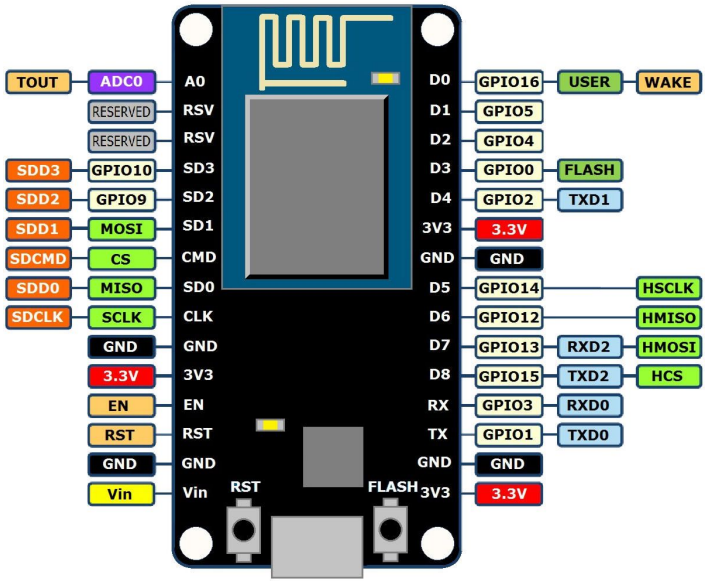
HARDWARE COMPONENTS

- **ESP8266 NodeMCU *x 1* -**
  - NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.controlling unit which contains the information regarding the products, calculates the bill amount and sends to LCD for display
- **EM18 RFID Reader Module *x 1* -**
  - To transmit and receive radio waves in order to communicate with **RFID** tags.used to read RFID tags
- **RFID Tags**

HARDWARE COMPONENTS - *NodeMCU*

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna

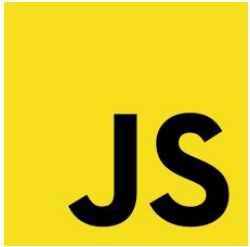


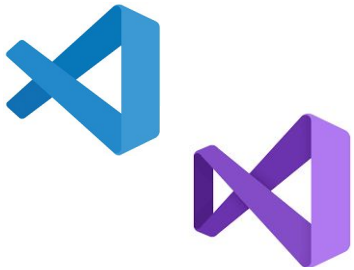
HARDWARE COMPONENTS - *RFID*

EM-18 Features and Specifications

- Operating voltage of EM-18: +4.5V to +5.5V
- Current consumption:50mA
- Can operate on LOW power
- Operating temperature: 0°C to +80°C
- Operating frequency:125KHz
- Communication parameter:9600bps
- Reading distance: 10cm, depending on TAG
- Integrated Antenna

SOFTWARE USED





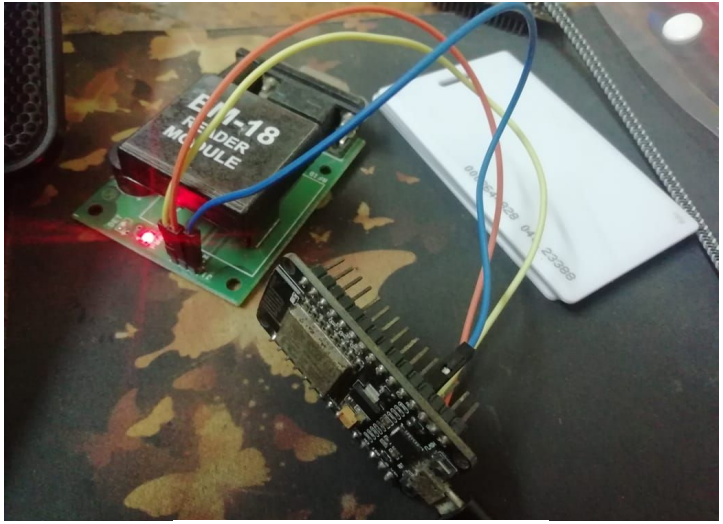
SOFTWARE COMPONENTS

- **XAMPP - Modules : Apache and MySQL** - XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages.
- **Arduino IDE for Hardware** - The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.
- **IDE - Visual Studio Code** - Visual Studio Code is a freeware source-code editor made by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.

SOFTWARE COMPONENTS

- **Language (Website) :**
  - **HTML (Hypertext Markup Language)** - The language for building web pages
  - **CSS (Cascading Style Sheets)** - The language for styling web pages
  - **JS (JavaScript)** - The language for programming web pages
  - **PHP (Hypertext Preprocessor)** - A web server programming language
- **Language (Hardware) : C++** - C++ is a general-purpose programming language created by Bjarne Stroustrup as an extension of the C programming language, or "C with Classes".

REAL TIME IMPLEMENTATION



Hardware used for RFID Rx/Tx:

User gives input from the RFID tag for giving the product credentials and bills it to the final receipt.

- The Signal from the RFID tag is tagged to a specific product and the reader picks it up once the tag happens.
- The information from the tag is sent to the database and a copy is made visible to the customer's UI where the customer can increase the count.
- The consolidated bill is sent to Razorpay and the payment is commenced.
- After the successful payment, the customer proceeds to check out aisle and drops the trolley.

REAL TIME IMPLEMENTATION

Prototype UI as perceived by the user.

- This is the prototype where the user scans the product to the RFID Reader which is attached to the Tablet (to be installed on the Smart Trolley along with the reader)
- The user will access a tab which is the UI where they will be able to see the purchases they made throughout the shopping

CODE SNIPPET

sketch_apr10a

```
/*
 * HTTP Client POST Request
 * Copyright (c) 2018, circuits4you.com
 * All rights reserved.
 * https://circuits4you.com
 * Connects to WiFi HotSpot. */

#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ESP8266WebServer.h>
#include <ESP8266HTTPClient.h>

int count = 0;
char input[12];

/* Set these to your desired credentials. */
const char *ssid = "Mohan";  //ENTER YOUR WIFI SETTINGS
const char *password = "08121110";

//Web/Server address to read/write from
const char *host = "192.168.0.107";   //https://circuits4you.com website or IP address of server

//=======================================================================
//                    Power on setup
//=======================================================================

void setup() {
  delay(1000);
  Serial.begin(9600);
  WiFi.mode(WIFI_OFF);        //Prevents reconnection issue (taking too long to connect)
  delay(1000);
  WiFi.mode(WIFI_STA);        //This line hides the viewing of ESP as wifi hotspot

  WiFi.begin(ssid, password);     //Connect to your WiFi router
  Serial.println("");
```

sketch_apr10a

```
  Serial.print("Connecting");
  // Wait for connection
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }

  //If connection successful show IP address in serial monitor
  Serial.println("");
  Serial.print("Connected to ");
  Serial.println(ssid);
  Serial.print("IP address: ");
  Serial.println(WiFi.localIP());  //IP address assigned to your ESP
}

//=======================================================================
//                    Main Program Loop
//=======================================================================
void loop() {
  HTTPClient http;    //Declare object of class HTTPClient

  String ADCData, station, postData,data;
  if(Serial.available())
  {
    count = 0;
    while(Serial.available())
    {
      input[count] = Serial.read();
      data = data + input[count];
      count++;
      delay(5);
    }
  }
  Serial.println(data);
  ADCData = data;
```

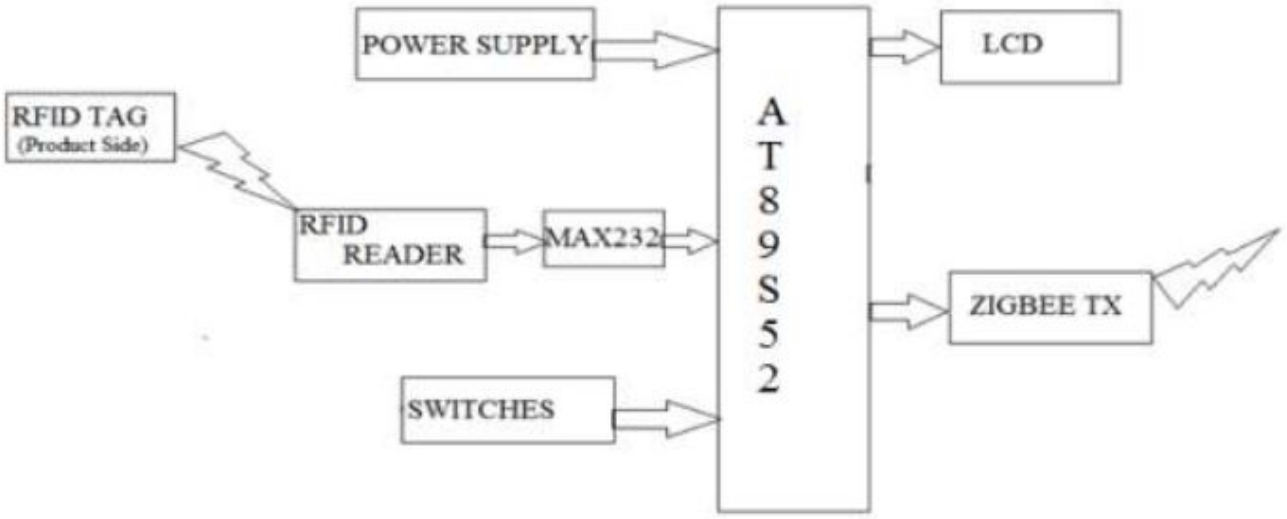
CODE SNIPPET

```
  station = "A";

  //Post Data
  postData = "status=" + ADCData + "&station=" + station ;
  http.begin("http://192.168.0.102/tarp-nt/postdemo.php");                //Specify request destination
  http.addHeader("Content-Type", "application/x-www-form-urlencoded");    //Specify content-type header

  int httpCode = http.POST(postData);   //Send the request
  String payload = http.getString();    //Get the response payload

  Serial.println(httpCode);   //Print HTTP return code
  Serial.println(payload);    //Print request response payload

  http.end();  //Close connection

  delay(1000);  //Post Data at every 5 seconds
}
//=======================================================================
```

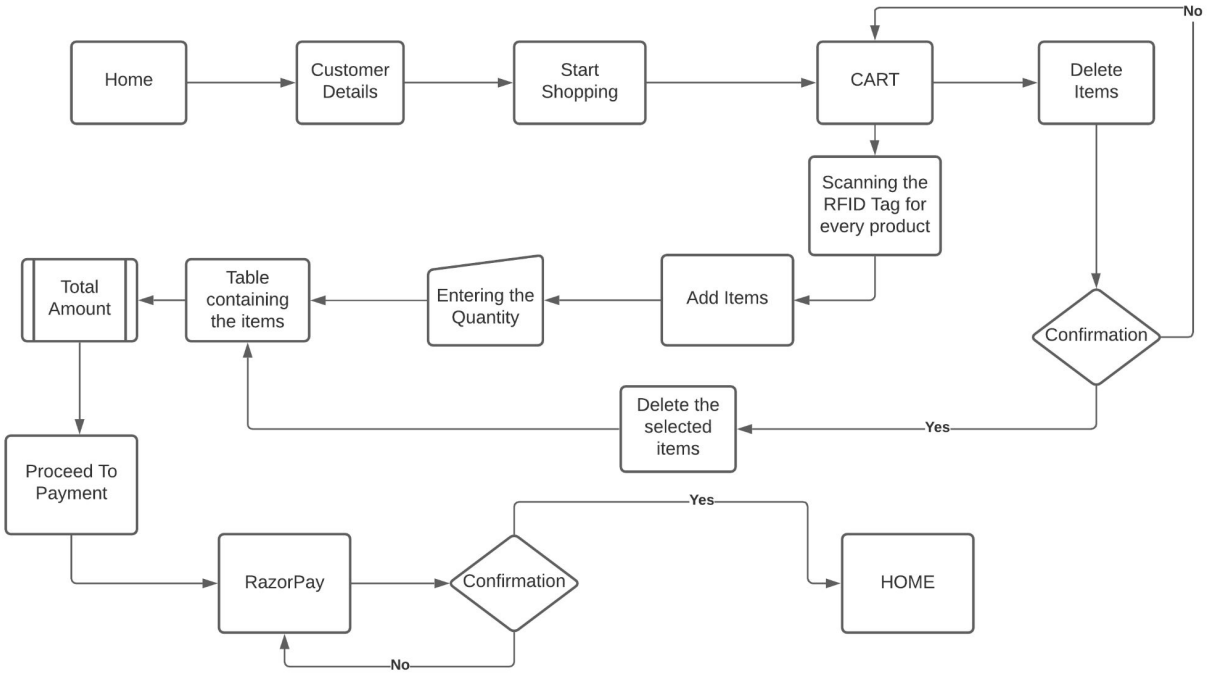
METHODOLOGY

- Our plan is to initially begin with the hardware portion of the project first , complete it and then move to the software portion. The circuit is designed in such a way that :
- Initially when the customer places the product equipped with RFID tag in the trolley it is read by the EM18 RFID reader.
- This sends information to controlling unit (NodeMCU) which checks for the product details in its database.
- Transfer the required details to a new customer table.
- The database of the details of the products available in the supermarket are fed to the website by the admin (shopkeeper)
- The prices of each product and final bill amount is displayed on the website.
- The bill calculation is also done using the backend scripts

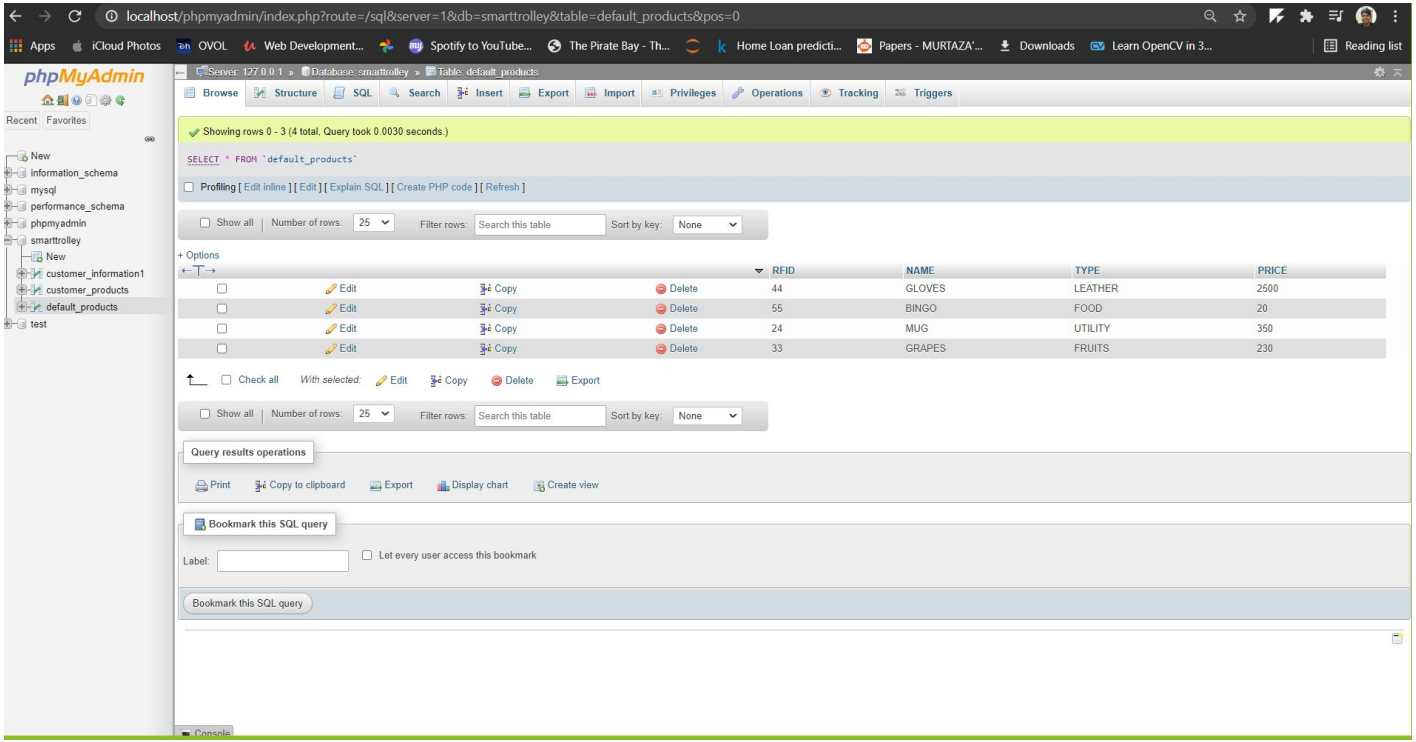
BLOCK DIAGRAM



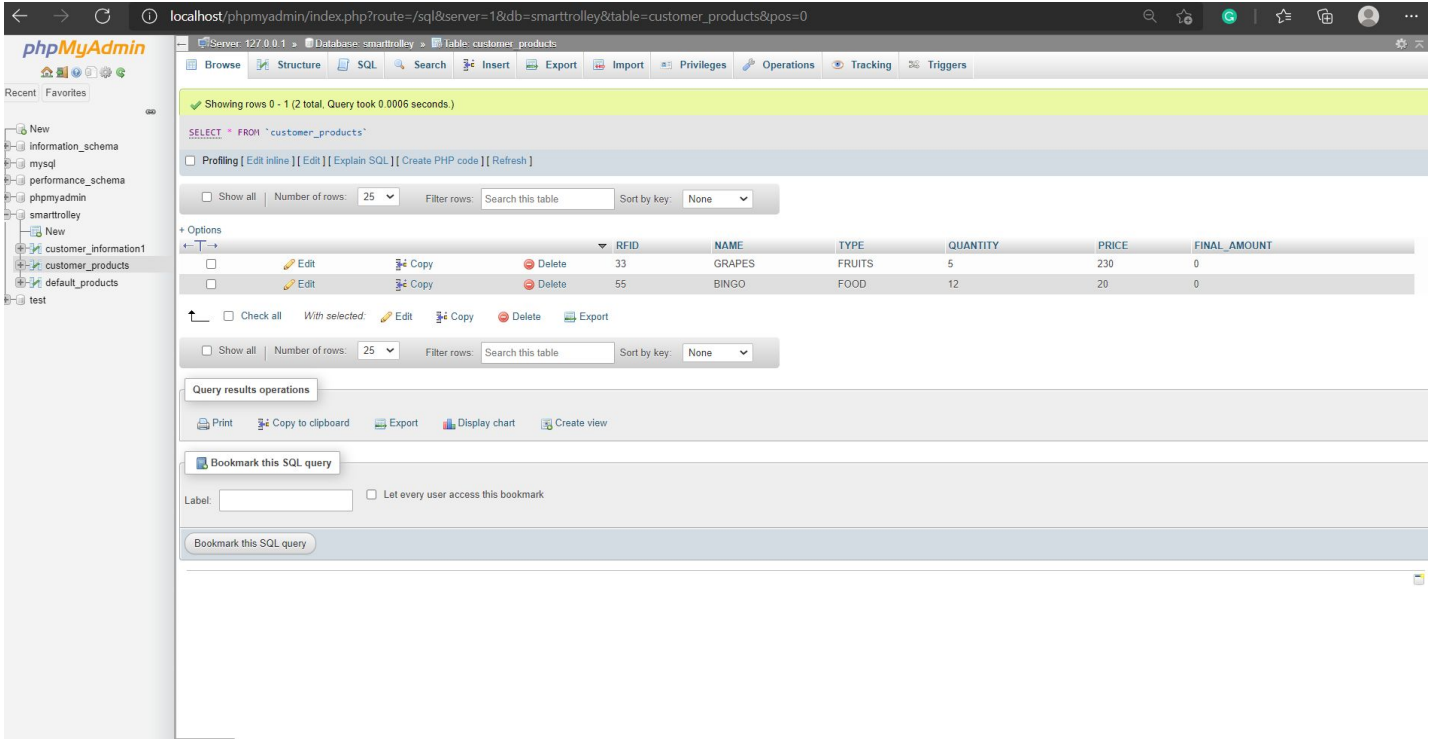
FLOW CHART


Home
Customer Details
Start Shopping
CART
Delete Items
No
Scanning the RFID Tag for every product
Total Amount
Table containing the items
Entering the Quantity
Add Items
Confirmation
Delete the selected items
Yes
Proceed To Payment
RazorPay
Confirmation
Yes
HOME
No

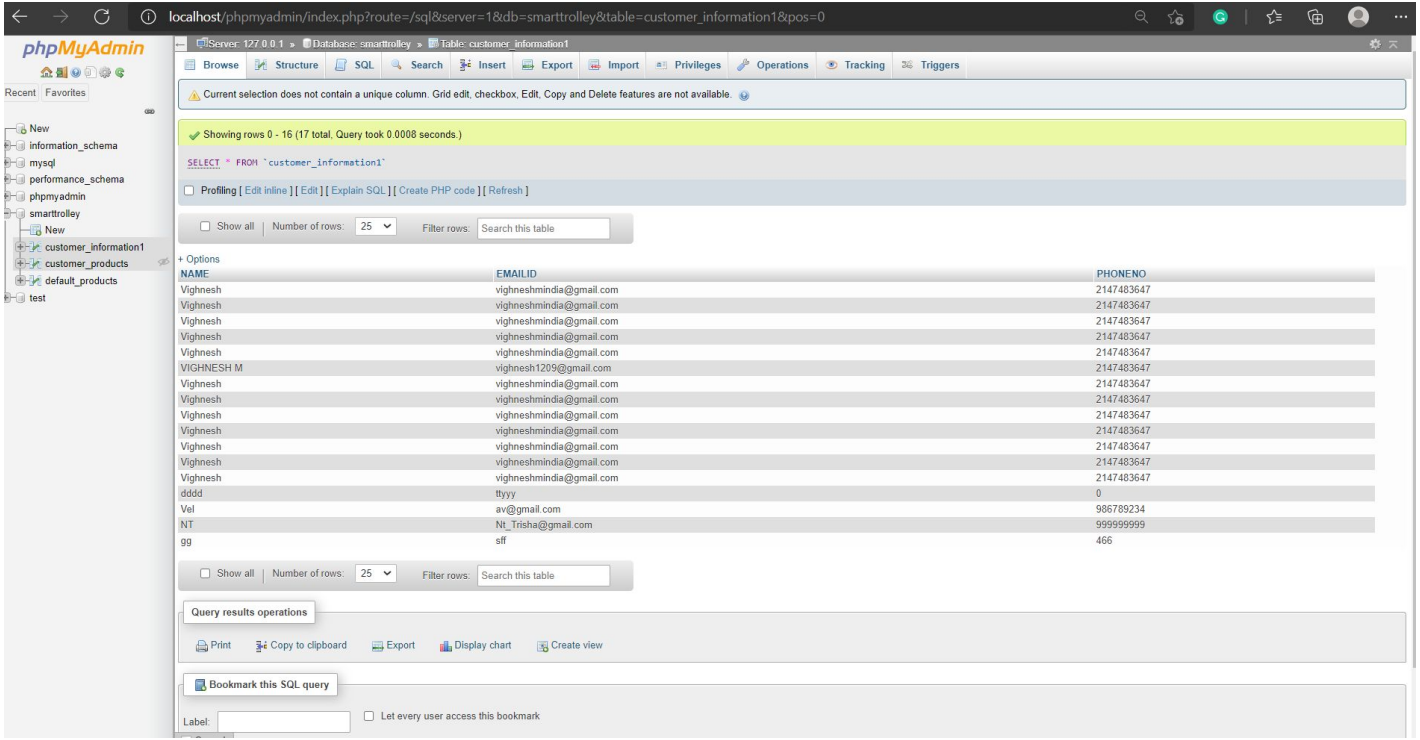
RESULTS: *Back-end*



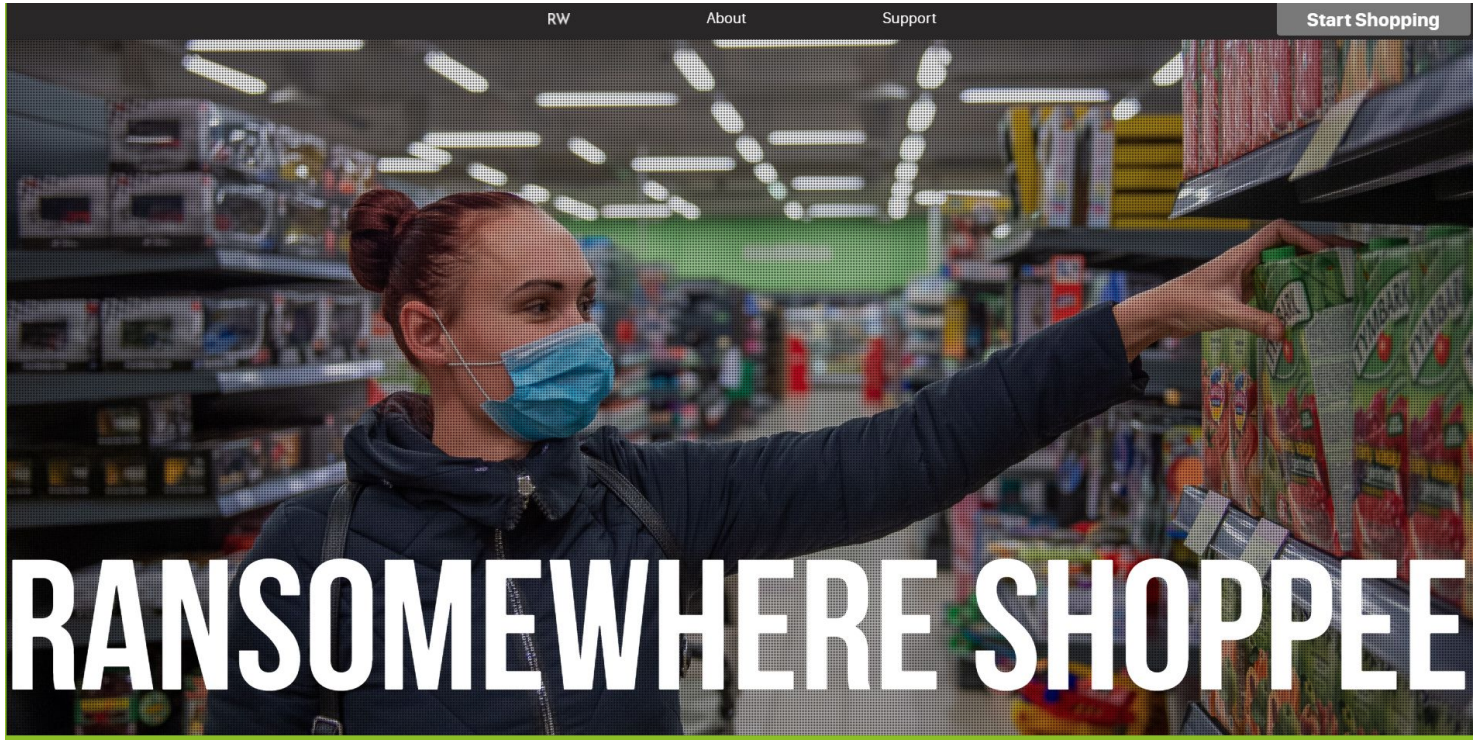
RESULTS: *Back-end*



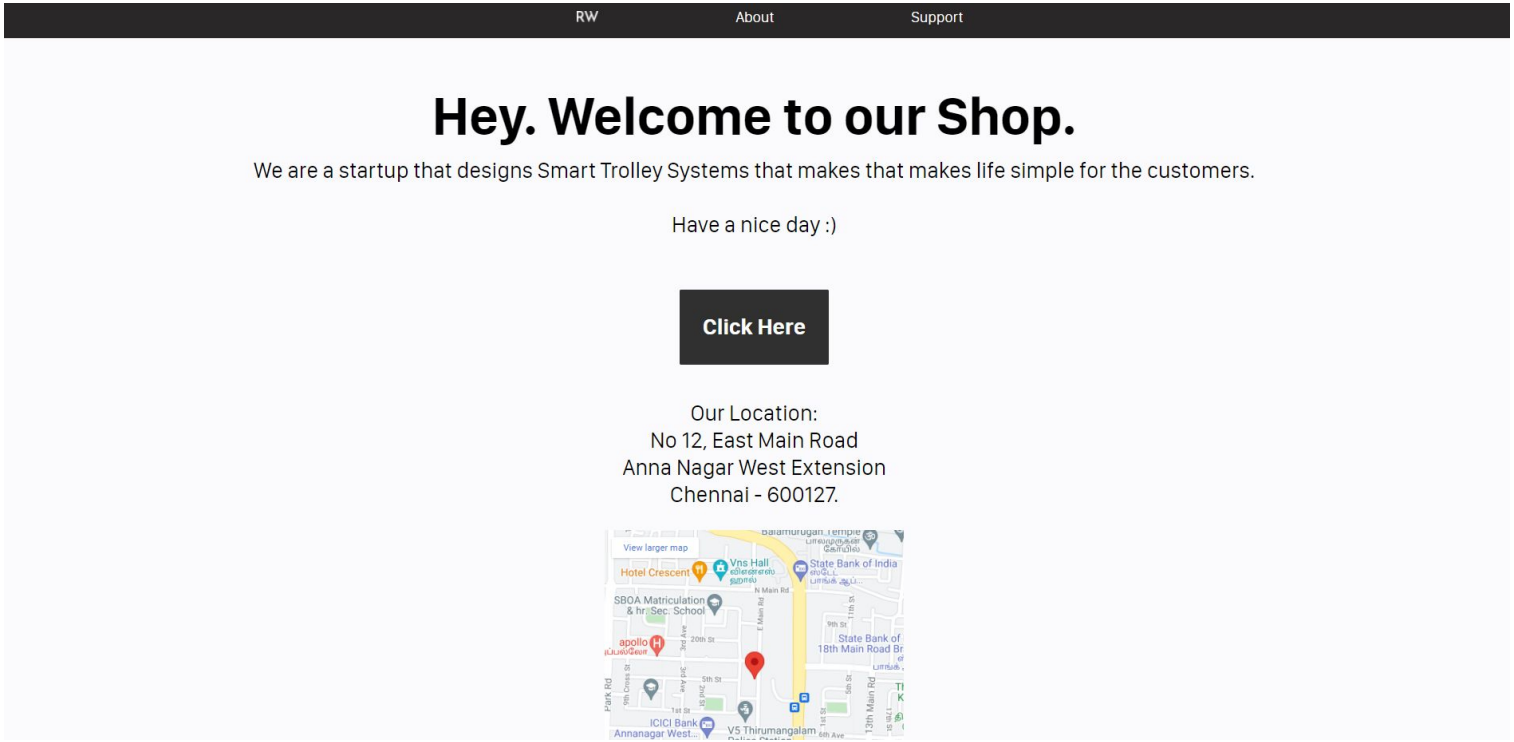
RESULTS: *Back-end*



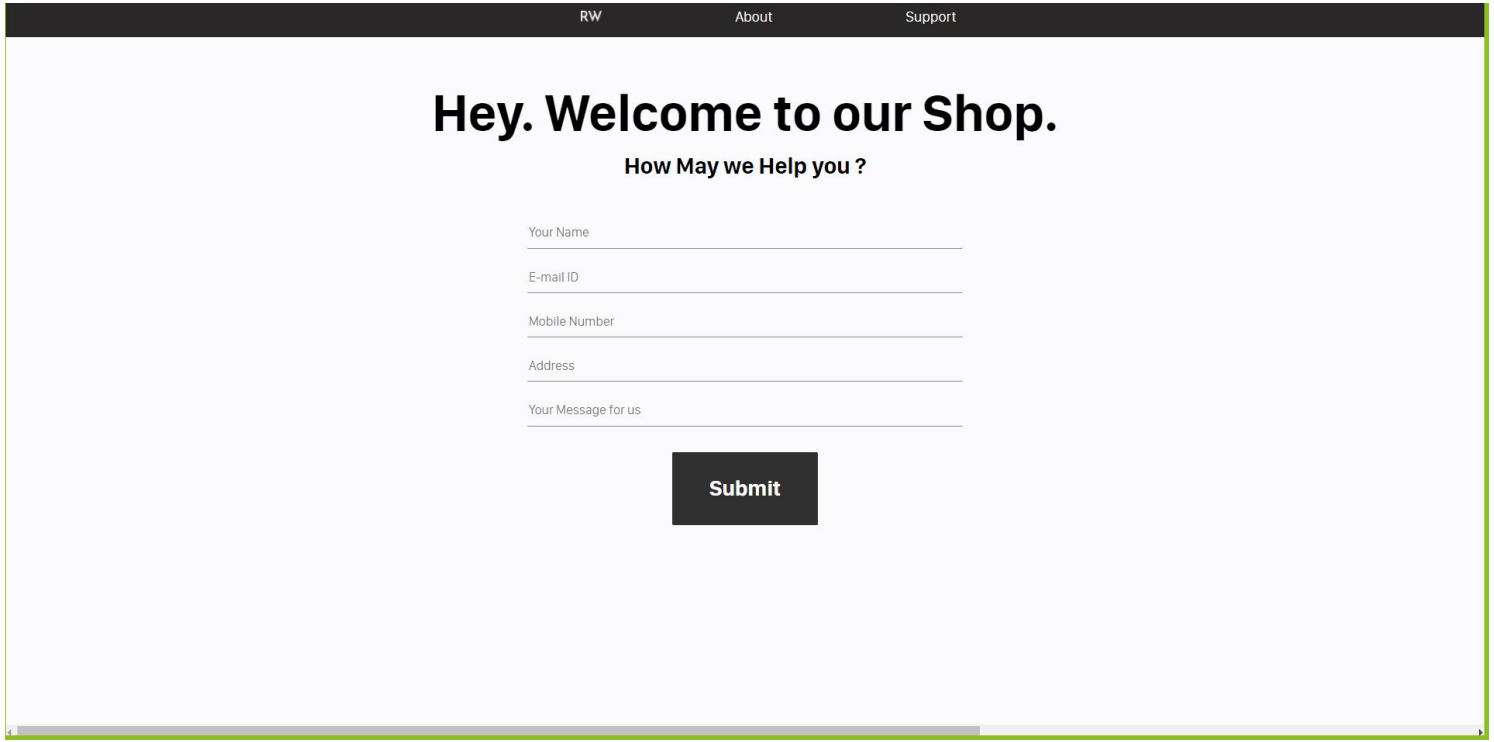
RESULTS: *Front-end*



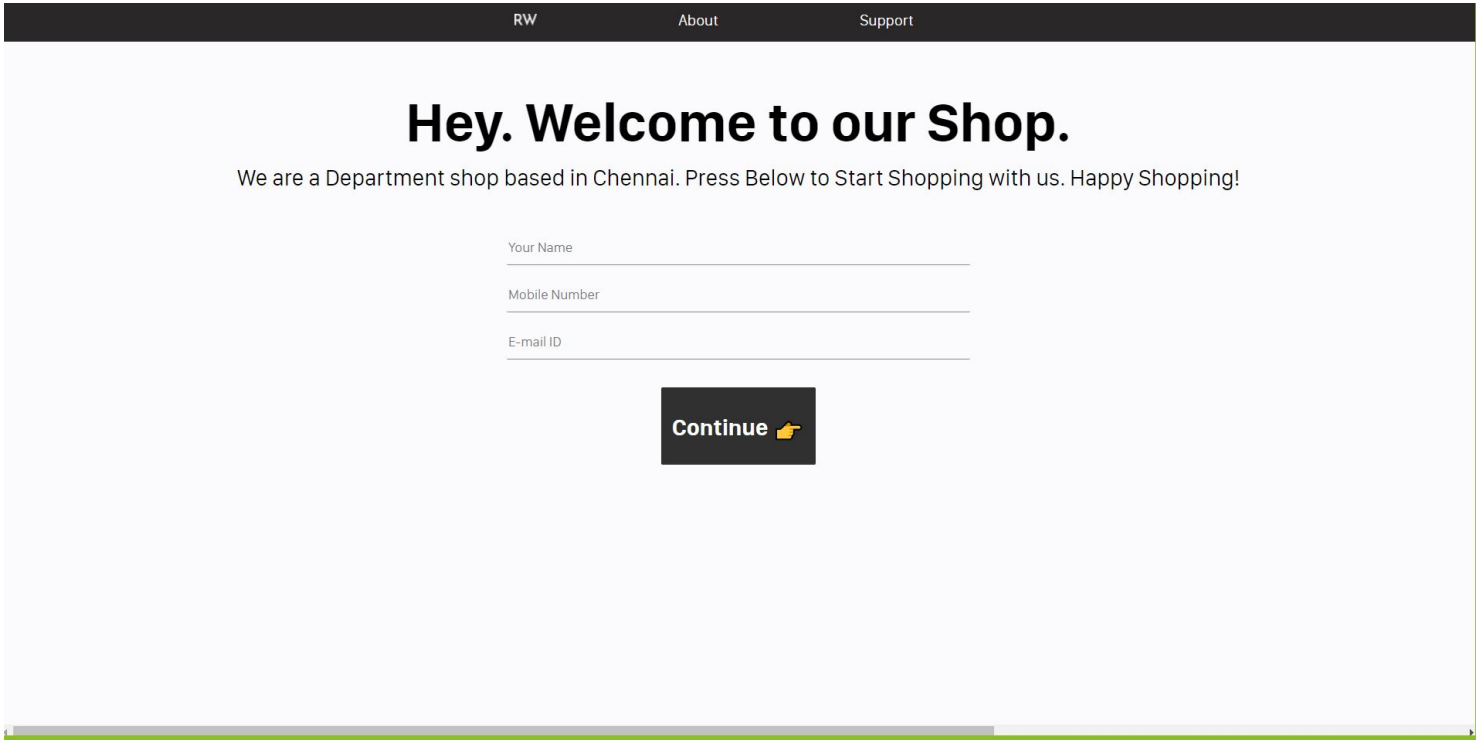
RESULTS: *Front-end*



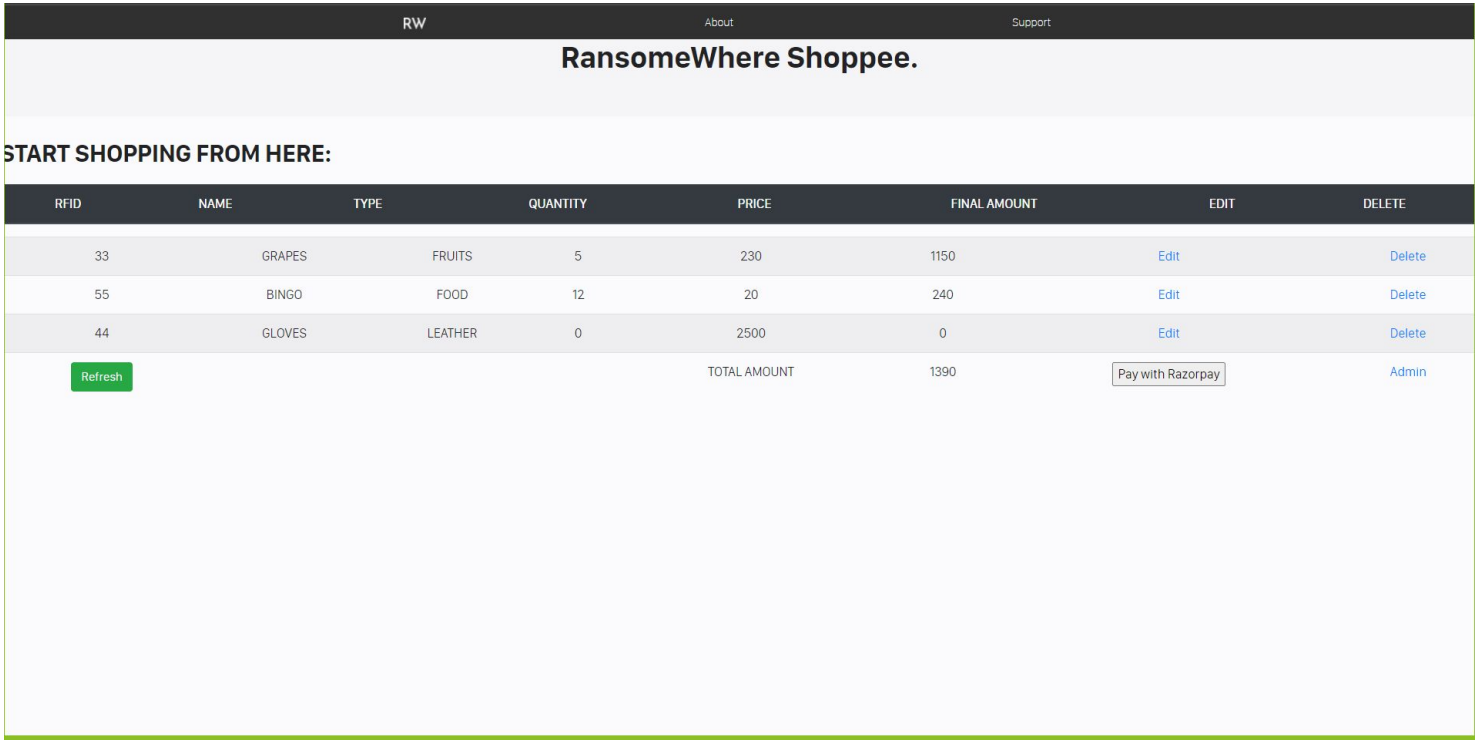
RESULTS: *Front-end*



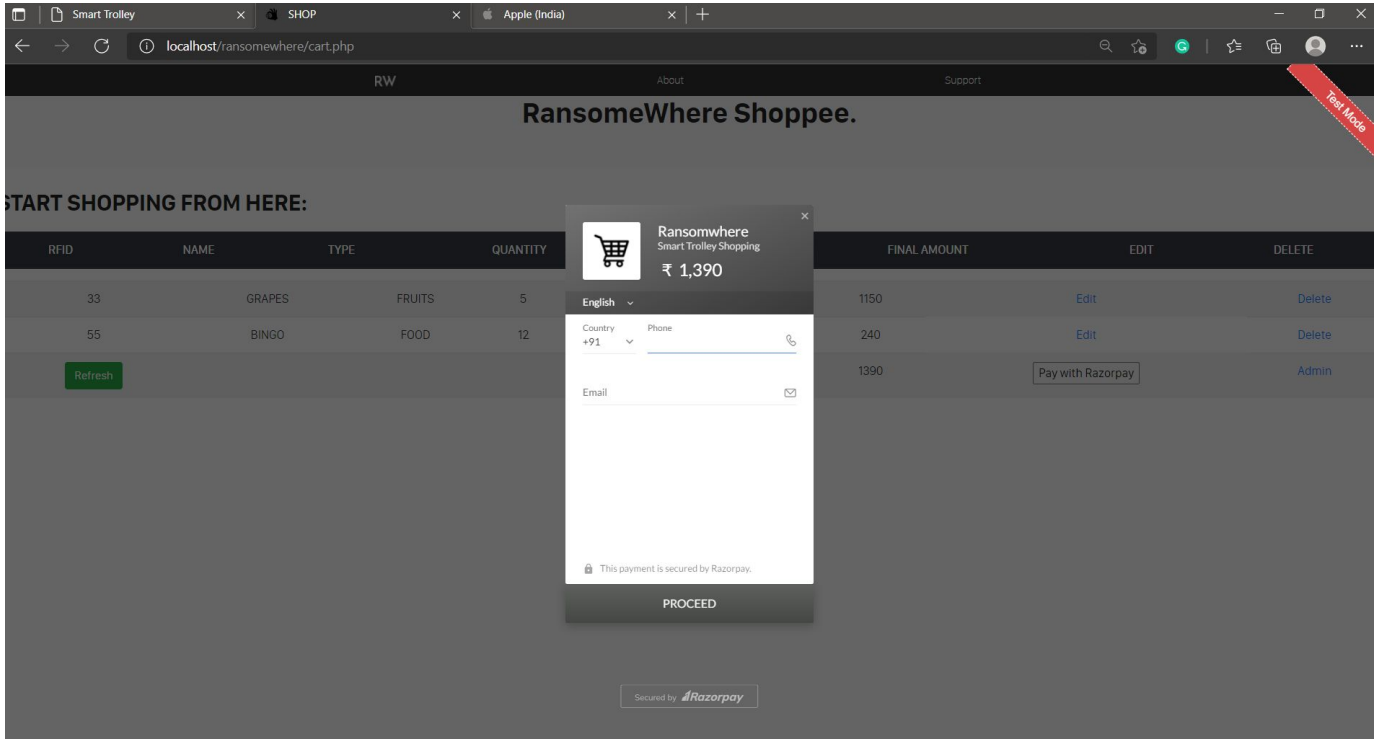
RESULTS: *Front-end*



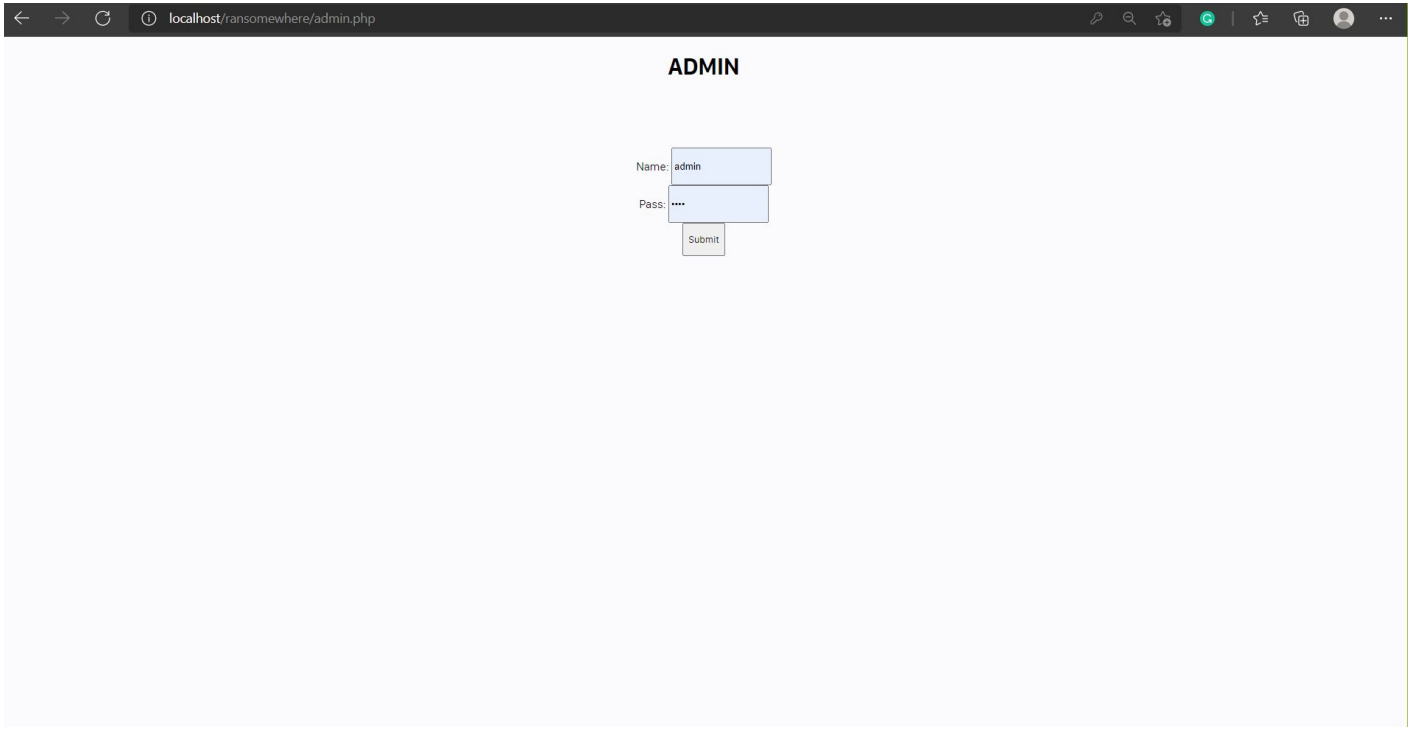
RESULTS: *Front-end*



RESULTS: *Front-end*



RESULTS: *Front-end*



TIMELINE

- **Week (1 - 3) :** Project title selection , Literature Survey and Field Survey
- **Week (4 - 6) :** Building up the Hardware of the Project
- **Week (7 - 9) :** Designing the Website and Developing the Software
- **Week (10 - 12) :** Testing, Summary, Results and Report

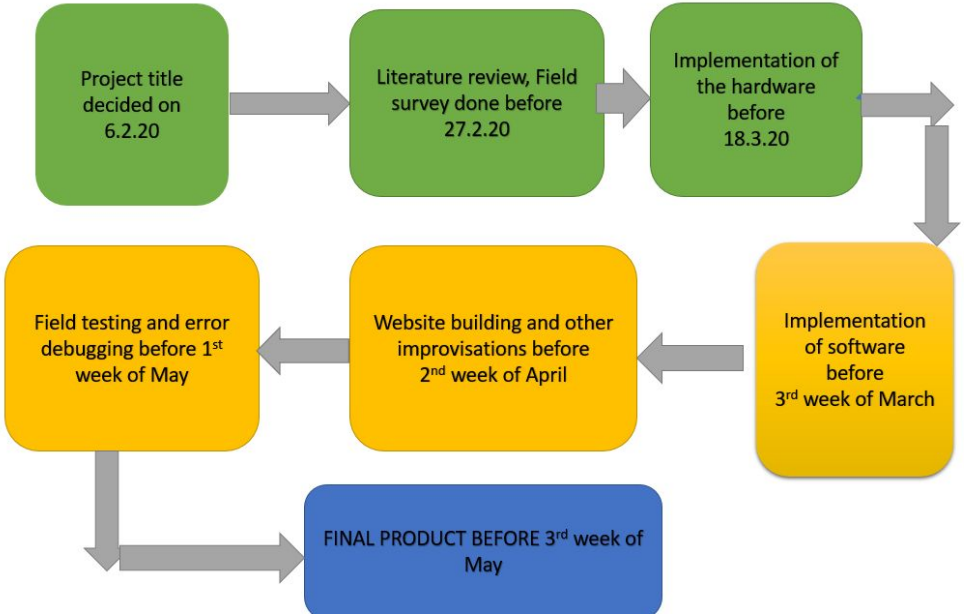
FUTURE SCOPE

- We hope to save people's time by reducing the crowd at the particular shop. All the product details are stored in a cloud so the people can see the details of the products from anywhere.
- We also hope to be eco-friendly by saving paper as the soft copy of the customer's bills will be sent to their respective mobile phone then and there. We hope to employ more engineers to program and make our device, thus increasing employment opportunities.
- We finally aim to move one step closer to a Digital India. If multiple supermarkets implement our technology, we will also be able to tell our customers the nearest venue from their current location where a particular product is available, ifin case it isn't available in one shop

WORK DONE

- Designing a user friendly UI from scratch for the Smart Trolley system.
- Building up of RFID Rx/Tx with Arduino and interfacing with User Interface.
- Styling the website UI with CSS.
- Creating the database for tallying the user products using MySQL
- PHP is used to fetch data from the database to the website.
- Integrating the database (backend) with the Website UI (frontend).
- Integrating the RazorPay API for checkout and payment.

TIMELINE FLOW



CONCLUSION

The Smart Trolley was designed to function as a mobile self-checkout system providing users the flexibility to make transactions from it within the retail store. It is designed to be highly efficient and fully synchronised with the retailer's current system.It is more reliable and provides ease for shopping. Here we conclude that the proposed system is time saving i.e. faster check out process.This system reduces the number of salesmen at the counter.

FINAL REPORT LINK

[Smart Trolley System - RansomWhere]

PRESENTATION AND COMPLETE DEMO LINKS

Presentation Link

Complete Demo Link


Thank You :)

ROLES

Project Manager - Vighnesh M, Sushil Kumar

Design Leads - R Vignesh, Abinesh Vel

Liaison - Andrew John

Financial Officer - Pramod K

Project Archivist - N T Srihari, Sushil Kumar