iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XI **Month of publication:** November 2022

DOI: https://doi.org/10.22214/ijraset.2022.47633

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XI Nov 2022- Available at www.ijraset.com

Smart Trolley System

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Abstract: While shopping is really exciting and appealing, it also means growing exhausted from waiting in long lines to pay bills. Therefore, it is suggested that a smart trolley be created that can handle both shopping and invoicing. By doing this, the consumer may enter the store without stopping, load up the smart trolley with their purchases, and then leave. He receives the electronic bill in the mail and may examine the specifics of his transaction on the store's website. We need an Arduino board, an RFID reader, an RFID tag, an LCD display, an Wi-Fi module, a database manager, and a website to keep customer and product information that can be viewed from anywhere in the globe by the admin in order to do this. The trolley can communicate with the global network using this IOT-based technology.
Keywords: smart trolley, Arduino, RFID, database, IOT-based

I. INTRODUCTION

Shopping means going to a store, inspecting the items, purchasing them, going through the billing area, standing in a lengthy line, scanning the merchandise, calculating the total cost, and paying the bill using cash, credit or debit card. However, it is not always enjoyable for everyone. According to the findings, individuals struggle a lot while shopping, which irritates them. In this system, there are three components. The first component comprises the actual trolley. The trolley consists of the primary storage unit, two servo motors, a weight sensor, and one Nodemcu microcontroller with wifi. The Nodemcu runs an HTTP server that takes the smartphone's input.

The smartphone has a custom android app installed which performs communication with the trolley and the web server and has a QR code scanner for product scanning. The mobile app also keeps track of the whole shopping list. The Apache web server is designed for storing information on the available products and making alterations to them. The mobile phone interacts with the web server to retrieve product information. Then submit the final shopping data. Thus when we look at the whole picture it consists of all these components working together. The android app interacts with the web server and the shopping trolley and sends appropriate instructions to it. This is how the whole system works.

II. LITERATURE REVIEW

A. Yewatkar [1] in the paper *Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft* developed a smart shopping cart system that will keep a track of purchased products and also online transaction for billing using RFID and ZigBee. The system will also give suggestions for products to buy based on user purchase history from a centralized system.

D. P. Acharjya and T. K. Das [2] in the paper *A framework for attribute selection in marketing using rough computing and formal concept analysis* their approach is aimed at handling an information system that contains numerical attribute values that are “almost similar” instead of “exact similar”. To handle such an information system they used two processes—pre-process and post-process. In pre-process, they used rough set on intuitionistic fuzzy approximation space with ordering rules to find knowledge and associations, whereas in post-process formal concept analysis to identify the chief attributes affecting decisions is used.

G. Roussos [3] in the paper *Enabling RFID in Retail* highlights that RFID tagging offers tangible benefits to both suppliers and retailers. However, widespread deployment will ultimately depend on public concerns about privacy protection.

H. H. Chiang et al. [4] in the paper *Developing a humanless convenience store with AI System* developed a system that comprises of two key parts, namely the Customer’s Application and the Smart Shelf. The Customer’s Application provides a platform for the customers to perform self-checkout through online transactions. The Smart Shelf assists the retail store owners in managing inventory and providing a smooth flow in the business. Within the Smart Shelf, the face recognition helps to provide additional security features and help retail store owners keep track of the number of customers who have successfully registered.

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III. MOTIVATION

Our application is admiringly valuable for shoppers. It offers the following advantages to its users:-

1) It is convenient and saves a lot of time for consumers.
2) Our system handles both shopping and invoicing.
3) It streamlines, secures, and speeds up the checkout process.

IV. METHODOLOGY

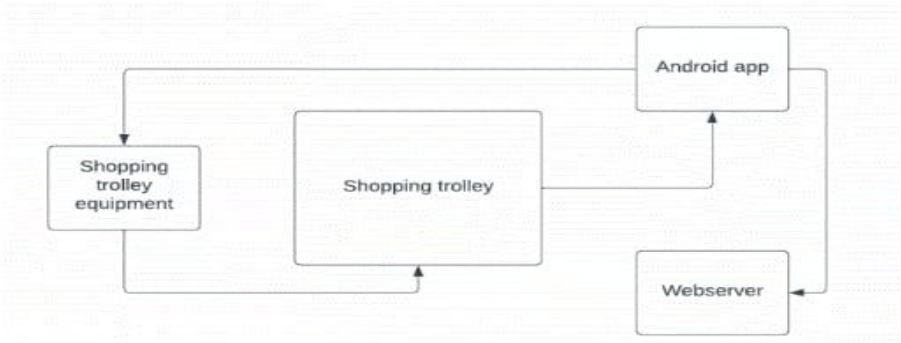

Fig. 4.1. Block Diagram

This part describes the whole architecture of the system. The architecture consist of Shopping trolley with its equipment, the android app and the web server interacting with each other.

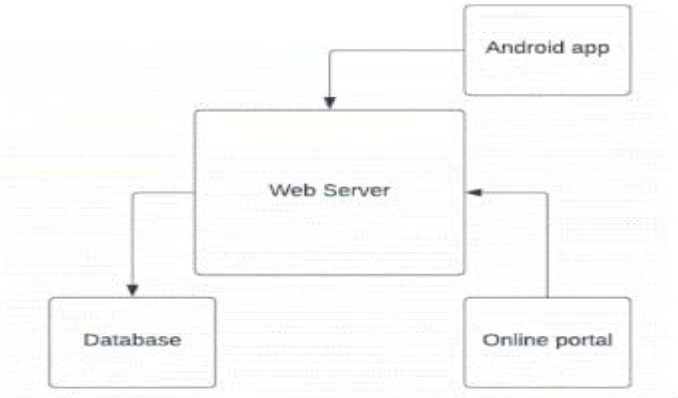

Fig. 4.2. Web Server Interaction

This part shows how the web server interacts with the Database, online portal and the Android app.

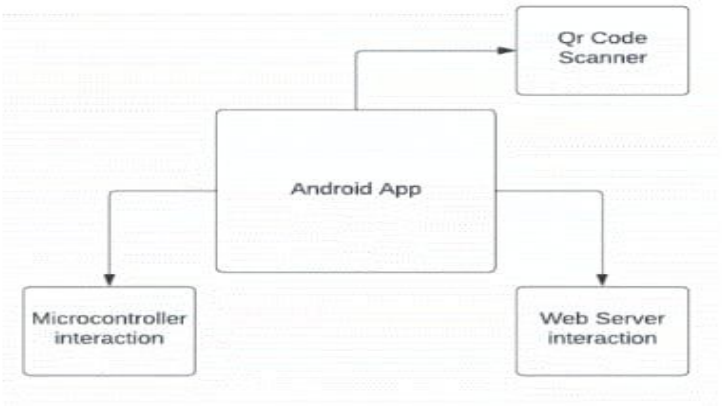

Fig. 4.3. Mobile App Interaction

This part shows how the mobile app interacts with QR scanner, web server and micro-controller in the trolley

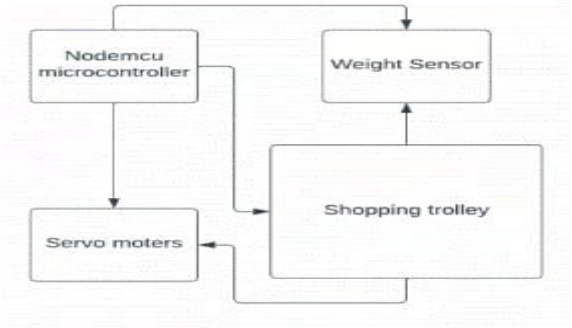

Fig. 4.4. Automation of Shopping Trolley

This part consist of a Nodemcu micro-controller, a weight sensor to detect weight, servo motors integrated into the shopping trolley.

V. PROPOSED WORK

In the proposed system, we are using different components to make the system much more flexible to work with. The system consists of three modules that are the trolley module, the app module, and the server module. The trolley module consists of two servo motors that control the opening and closing of the shopping trolley. It consists of a Nodemcu microcontroller that broadcasts wifi and it also has a weight sensor. So when the mobile app scans the trolley it scans for local wifi with the SSID of a particular pattern of the trolleys. From this, we select the trolley we want to connect to. Once connected the user can take that trolley and perform shopping operations. The mobile app has a QR code scanner that scans the products and retrieves the product information. Once the user finalizes a product it opens the trolley for a specific amount of time. Once the user enters the product into the trolley the weight sensor calculates the initial weight and weight added to determine whether the same product was added. This way the customer can continue performing their shopping operations. Once done the user can submit their final list to the web server the web server will then process this list and create a payment portal for the user and once done the process will be completed. This way the user won't need any help from the cashier at the counter which can save a lot of time for malls, especially on a busy day.

A. Customer Registration and Login

The customer has to first create his account on the app. The customer details will be saved on the web server.

B. Shop Database Maintenance

The shop database will contain all the data regarding each component. This is where the information about the product will be stored and manipulated. The customer's account data as well as the billing data will also be stored here.

C. Shopping Trolley Selection

Once the user logs in to the mobile app they will have a prompt to scan available shopping trolleys. The shopping trolleys will be identified will an SSID with a specific pattern. Once the user has scanned all the trolleys he can select a specific one. Once selected the mobile phone will be connected to that shopping trolley wifi enabling them to communicate with each other.

D. Shopping with the Shopping Trolley and the Mobile App

Once the mobile app and the shopping trolley are connected through wifi the customer can start with the shopping operations. When the customer wants to buy a particular product he will be required to scan the product's QR code through the QR code scanner in the mobile app. Once the scan is completed the mobile app will send a request to the HTTP server running on the Nodemcu. The Nodemcu will then send the instruction to the motor driver to open the front of the trolley using the arms shifted through the servo motors. This will open the trolley for a specific amount of time. The customer then can enter the product in the trolley. The Nodemcu will then calculate the weight of the product added by comparing it to the initial weight and send it to the mobile app through its HTTP session. Then the mobile app will compare the weight added with the product's weight and determine whether the same product. If not it will put the shopping operations in an idle state. If it is the same product the user can continue the shopping operations.

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E. Billing and Payment

Once done with the shopping process the user then can finalize his shopping list. When done the web server will open a payment portal for the user depending on his choice of payment. Once the process is completed successfully the shopping data will then be saved on the server and appropriate data changes will be performed. Once done the user can just walk out of the shopping mall.

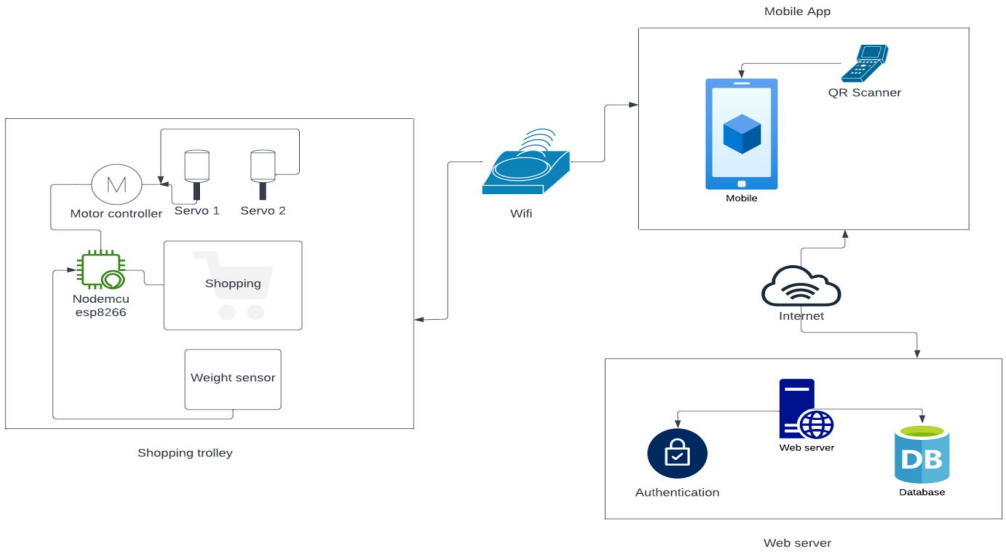

Fig. 5.1. System Architecture

VI. RESULTS AND EXPERIMENTATION

The following are the implementation snapshots that demonstrate the step by step working of our application:-

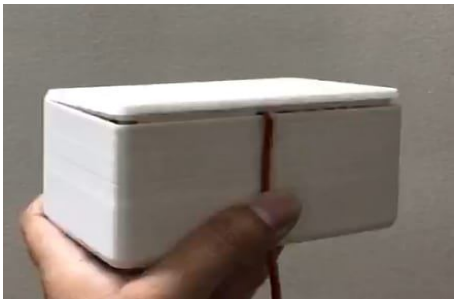

Fig. 6.1. Initial state

This is the initial and idle state of the smart trolley.

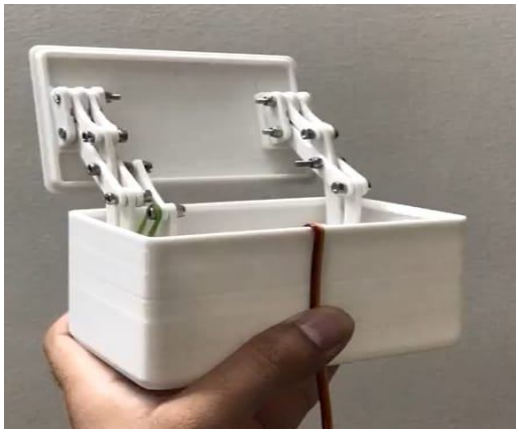

Fig. 6.2. Opened state

This is the opened state of the smart trolley. This state will be only active for a small specific amount of time. Once the order is placed this state will be active and after some time it will go back to the initial state.

Fig. 6.3. Scanning

This is the scan activity of the app. This will be responsible for helping the user with get connecting with is trolley.

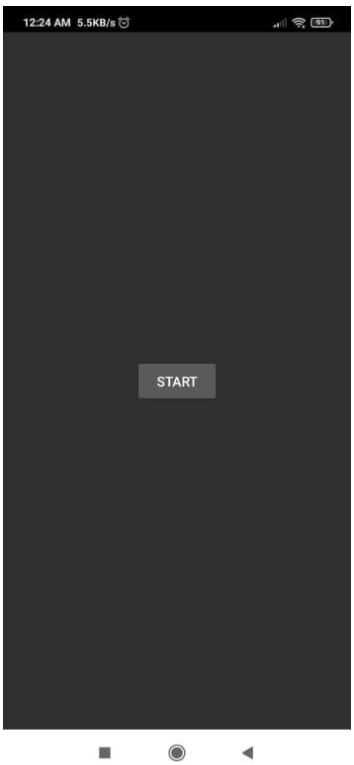

Fig. 6.4. Start Shopping

Once connected, the user can start with the shopping process by clicking on the start button.

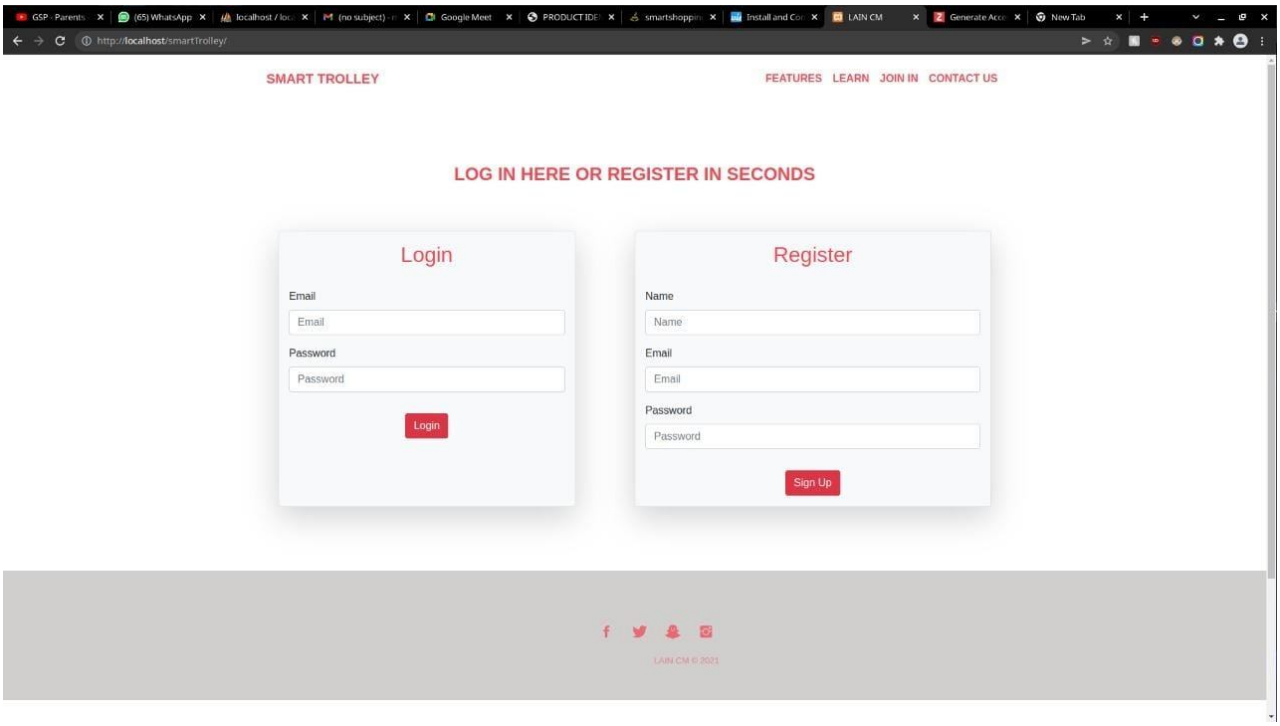

Fig. 6.5. Login and Register

The login and registration screen for the shop owners.

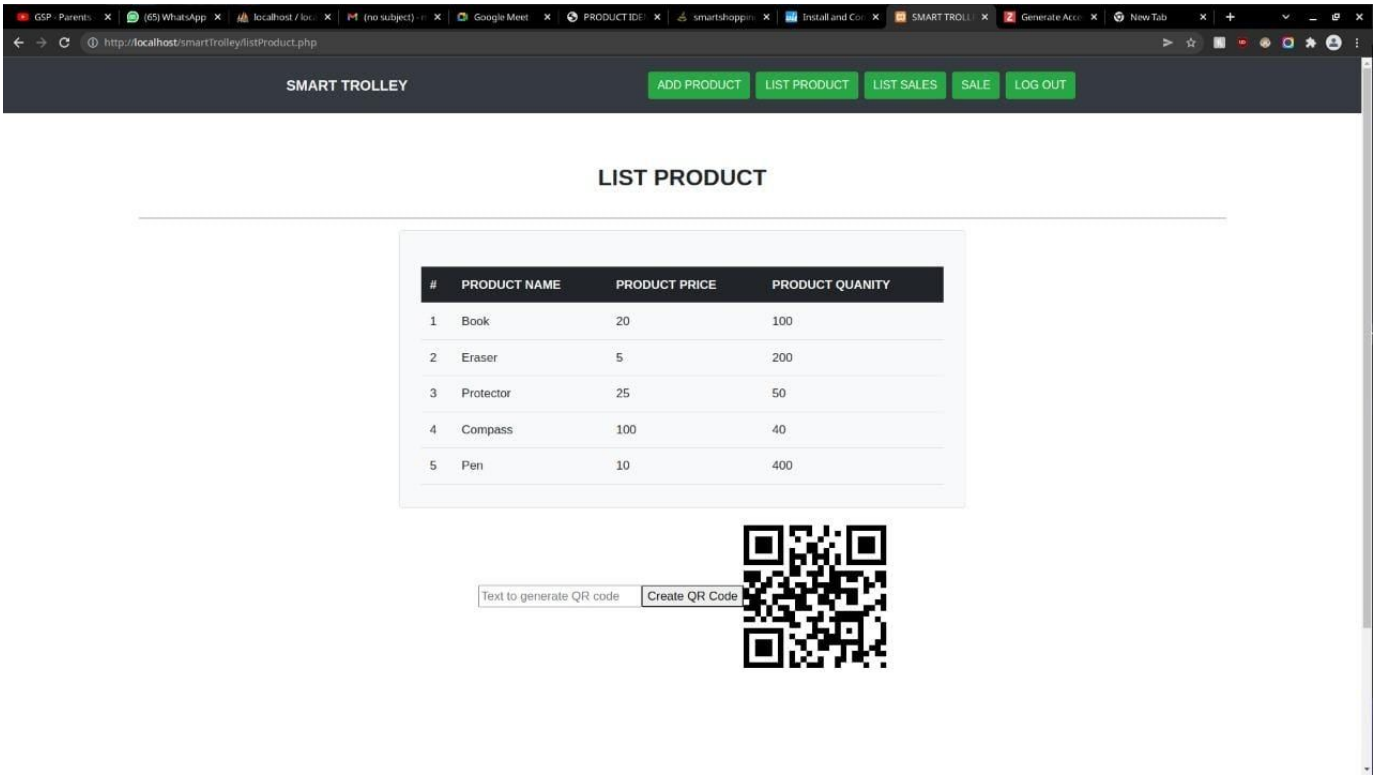

Fig. 6.6. List of Product

This is the web page to manage products and generate QR codes for the list of products.

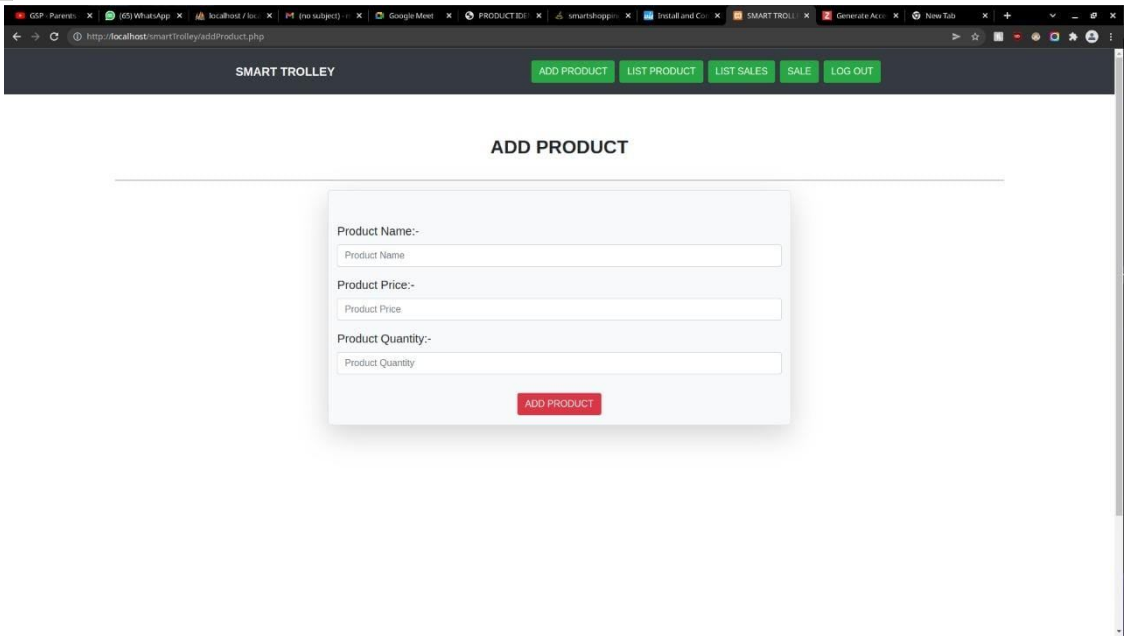

Fig. 6.7. Add Product

This is the web page to add products to the owner's shop database.

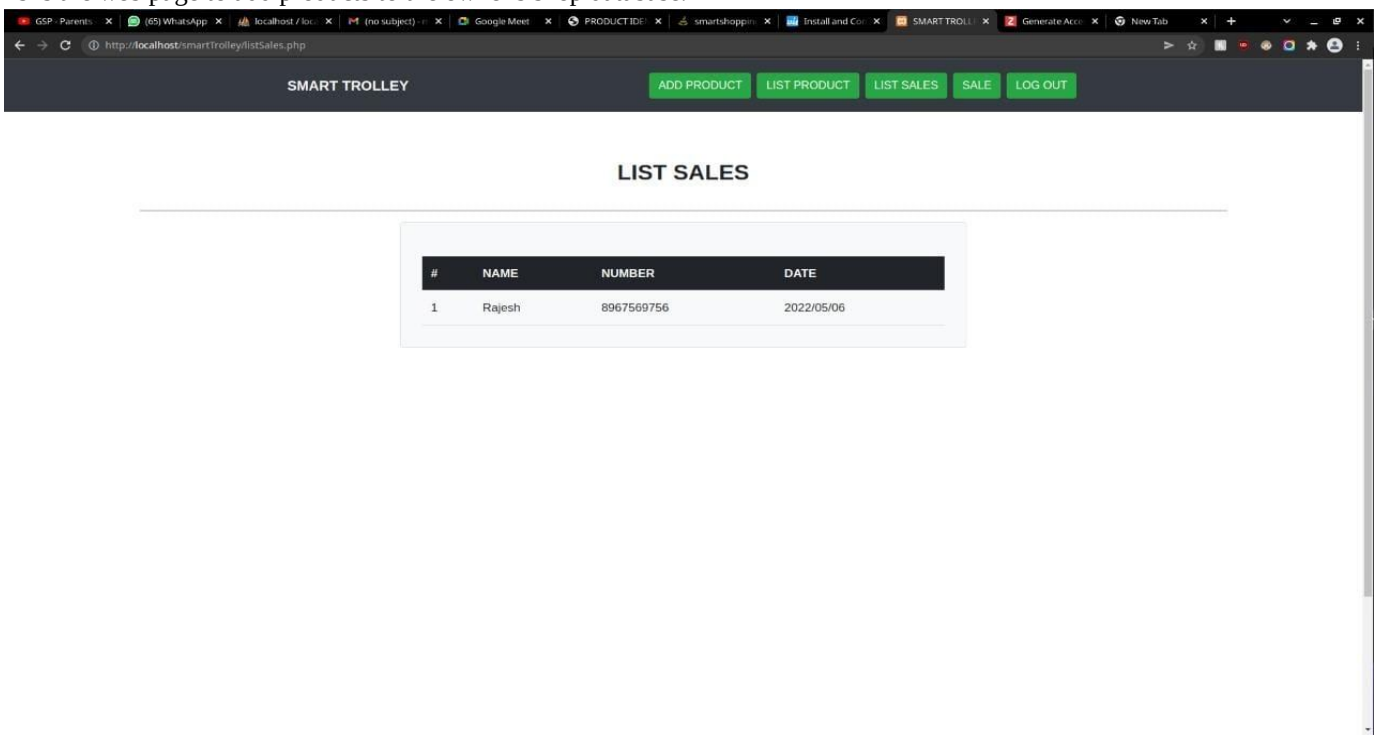

Fig. 6.8. List Sales

This is the web page to view the sales of the shop.

VII. CONCLUSION

In this way, we created a user-friendly system that is quite beneficial in the real world. It will completely automate the process of shopping providing better amenities. Overall, our system is worthwhile for consumers. It is time-saving and economically efficient. The IoT devices are safe and demonstrate high accuracy. It reduces human effort as it handles invoicing along with shopping.

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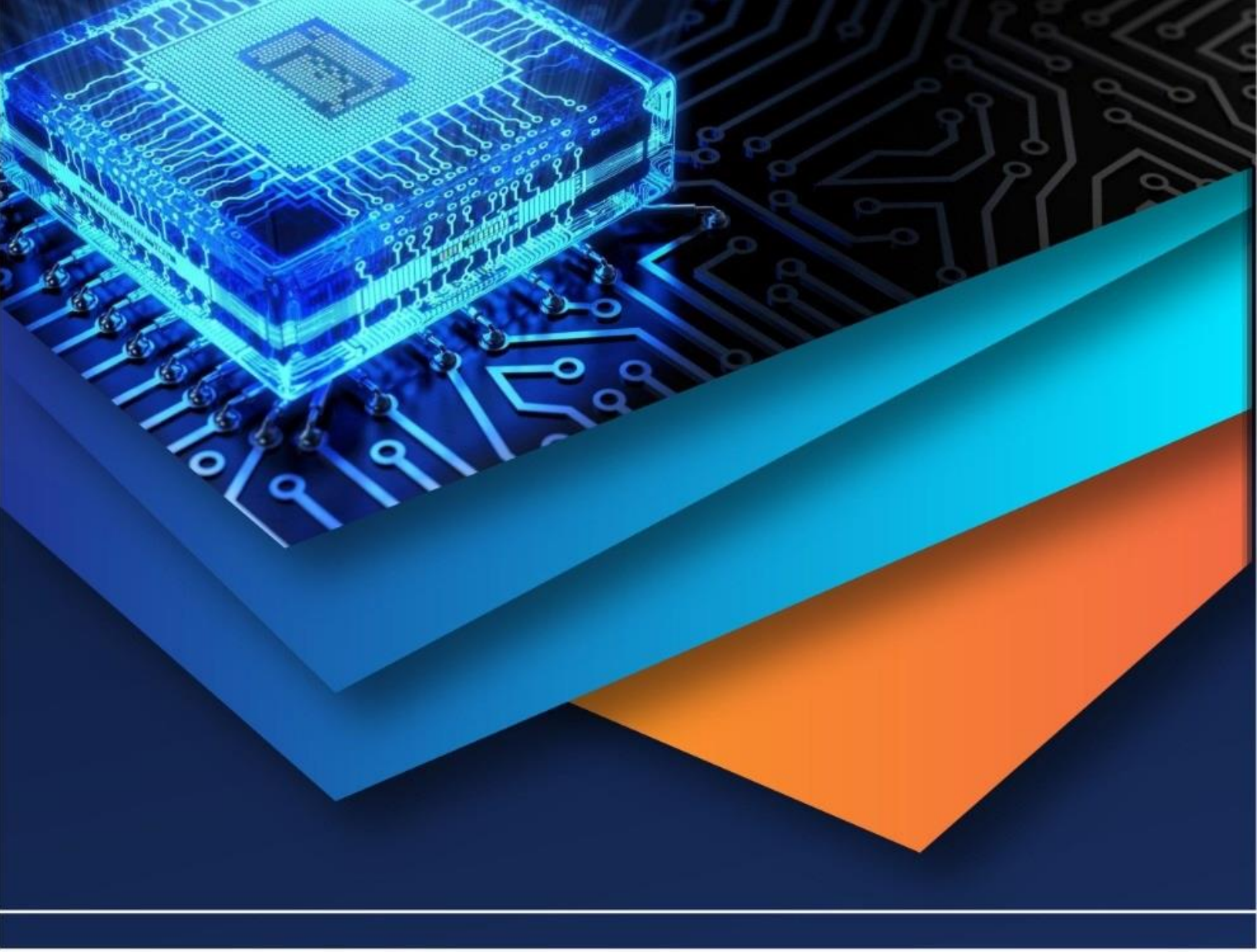

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