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IoT-BASED SMART SHOPPING CART USING RFID TECHNOLOGY

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Abstract -Many consumers struggle to wait in a long line for their items to be billed. For the wrong customer, this means a poor bill and financial loss. To make shopping easier, grocery stores and supermarkets use trolleys. With the recommended smart cart, shopping can be made easier by automatically recognizing the products being added to the cart and displaying the necessary details on the user interface. Even though people frequently become excited about online buying via e-commerce websites, shopping malls are still very popular. In shopping centers and malls, a wide variety of shopping carts are available. This project introduces an autonomous shopping cart with technology assistance that can identify products. With a unique cart system that uses RFID technology to provide a smart solution to the billing process, the main goal of this work is to shorten wait times in crowded supermarkets and other shopping malls. The smart cart device is the main focus of the project. It is made up of an LCD, a keypad, an Arduino microcontroller, a GSM module, and an RFID reader. The system will have the ability to produce a bill for each item added to the cart. With the suggested strategy, billing lines in malls will be easier to avoid. The traditional queuing method for billing generation in the proposed design facilitates simple and pleasurable purchasing.

***IndexTerms**: Automatic billing, Radio Frequency Identification (RFID), Arduino, Global System for Mobile Communication (GSM), Matrix Keypad.*

I. INTRODUCTION

People often get frustrated waiting in long lines at supermarkets, leading to stress and negative attitudes. To solve this, a faster and cost-effective alternative to traditional billing is needed. In today's world, where people prefer technology to simplify tasks, smart trolleys equipped with RFID technology offer a quick and convenient shopping experience, but only for customers with a loyalty card.

Here's how it works: The suggested system kicks in when a customer enters the store and grabs a cart. Each product has an RFID tag, and when loaded onto the cart, the RFID reader scans and displays the name, price, and quantity on an LCD. After shopping, customers pay the predetermined sum, reducing the challenging and time-consuming billing process.

The smart trolley, consisting of Arduino Uno, GSM Module, LCD, RFID tag, and RFID reader, aims to minimize labor demand, lower costs, and increase efficiency. This RFID-based system cuts down on wait times, traffic, and the need for human labor. During the COVID-19 pandemic, it also helps customers maintain a safe distance.

The project goals include creating a durable and interactive application that connects the virtual and physical worlds. The system calculates and displays the total amount as customers add or remove items, showcases daily deals, and automates the billing process. Customers signal the end of their purchase by pressing a button, and the RFID tag is read in the billing section. The user interface is designed to be clear and easy to use, enhancing the overall shopping experience.

II RELATED WORKS

Rajesh Nayak. etc. all [1] focuses on streamlining shopping mall transactions and reducing long queues at billing counters, an Automated Shopping Trolley with barcode scanners, Arduino, GSM module, and weighing sensor was designed. The trolley automatically logs scanned products into a database, expediting bill creation and improving overall efficiency.

Ghatol Sonali.etc.all [2] introduced "SMART SHOPPING USING SMART TROLLEY," an innovative concept leveraging

RFID technology, where RFID tags on items enable automatic scanning and cost display on an LCD screen in the cart. The AVR microcontroller and Bluetooth module facilitate seamless communication with the main computer, streamlining the billing process at the counter in shopping malls.

Sathishkumar P.etc.all[3] this project aims to develop a real-time consumer goods capture system using QR codes and Android smartphones, enhancing product authentication by decoding QR codes and validating information through server communication. The focus is on efficient designs, especially in scenarios with endless square grids or binary Hamming spaces, providing optimal solutions for extracting information with minimal input hints for consumers.

Hiba Sadia.etc.all[4] their proposal integrates RFID technology into mall shopping carts, automating billing as products with RFID tags are added. Smart shelves aid inventory management, and carts equipped with LCD and mobile points of sale eliminate the need for customers to endure lengthy checkout lines. All transaction data is stored for future analysis.

Thilagavathi S.etc.all[5] This paper proposes a smart retail system to enhance public safety during the ongoing COVID-19 pandemic. It includes a mobile app for prebooking, a deep learning model for face mask detection, and a wearable device using ultra-wideband radio for social distancing alerts. The system extends to various sectors beyond retail, such as religious places, cinema theatres, training centers, and browsing centers.

Yewatkara A.etc.all[6] presented a paper titled "Smart Cart with Automatic Billing, Product Recommendation Using RFID & Zigbee with Anti-Theft". The paper explores a system integrating RFID and Zigbee technologies for a smart shopping cart, featuring automatic billing, product recommendations, and anti-theft measures.

Anjalipedarth.etc.all[7] they developed the smart trolley which utilizes a loyalty card, camera, and load cell to streamline product scanning, weight measurement, and billing, providing a flexible and convenient shopping experience.
P Sastheena. etc. all[8] present techniques such as loyalty accounts, image processing, recommendation, voice assistants person counting, and payment checkout alert systems are used to enhance the performance of a smart trolley. The loyalty card is used to identify each customer and can be used to access the trolley. Smart trolley contains a camera and load cell which will scan the product measure the product weight and display all the information on the LCD screen.

Sunil Kumar. etc. all[9] present a smart trolley system that has been designed using a smartphone and Arduino to address common issues faced by customers in supermarkets or hypermarkets. This system eliminates the need for customers to wait in queues for product scanning and billing. The smart trolley feature is exclusive to customers with membership cards, promoting customer loyalty as a strategic approach by supermarkets and hypermarkets to enhance the overall shopping experience.

D Yoshida. etc. all[10] This paper introduces an automatic method for accurately counting passing people using a stereo camera, addressing the limitations of conventional methods in crowded scenarios. The stereo camera, positioned overhead at the gate, prevents data overlap in crowded situations. This setup enables precise segmentation of human and road regions in captured images, improving accuracy. Experimental results from a simple system validate the effectiveness of the proposed method.

Nithin k.etc.all.[11] , a smart way to shop in malls has been developed. Each product has an RFID tag instead of a barcode. The Smart Trolley features an RFID reader and LCD module. When a person places any product on the trolley, it is scanned and the product's cost, name, and expiration date are displayed. The total cost will be added to the final checkout bill. The bill is stored in the microcontroller's memory.

P. Chandrasekar. etc. all[12] propose the" Smart Shopping Cart System "that will save the track of items that are bought and figure the bill utilizing RFID per user and Transmitter and Receiver. The framework will likewise give ideas for items to purchase depending on the client's buy history from a brought-together framework. In the "Smart Shopping Cart System" each item in the Mart will be appended with an RFID tag, and each Trolley will have RFID Reader, LCD show, and Transmitter and beneficiary connected to it.

Kumar M.etc.all[13] The main idea of the project is to automate the process of shopping in such a manner that we will scan the products using RFID attached to the products and an RFID reader attached to the trolley as well as display the total amount on the LCD. We also have included a feature to send a message to the customer\'s registered mobile number. This process not only helps in reducing the waiting time in the long queues and moving the trolley automatically but also helps in managing and checking the budget while shopping which indeed provides a huge difference in their shopping experience as well.

Krishna Murli. etc.all[14] The project involves the development of a trolley that is equipped with a variety of sensors and scanning technology, which allows it to scan and track the items added to it. One of the primary benefits of the Smart Trolley is that it eliminates the need for manual item scanning at checkout. Instead, the trolley's technology automatically detects and

tallies the items as they are added, providing customers with a seamless checkout experience. This not only saves time for shoppers but also helps to reduce long queues and congestion at checkout counters. In addition to improving the shopping experience for customers, the Smart Trolley also offers benefits for stores.

Hanel D.etc.all[15] This paper explores using RFID technology to enhance mobile robots and individual localization. It presents a probabilistic measurement model for accurately localizing RFID tags with a mobile platform equipped with RFID antennas. Experiments show that fusing RFID data with laser data significantly reduces computational requirements for global robot localization.

III EXISTING METHOD

They have been using the conventional barcode scanning technique in the current system. Each product must be scanned using the barcode scanner shown in Fig.1, which makes the process extremely slow. A barcode reader is a component of an electronic device that reads barcodes

fig.1 Barcode Scanner

The RFID-based billing system is one of the technologies we introduced to stop the process. The user has the option of paying with cash or credit/debit cards. However, it is a time-consuming process for invoicing purposes. The Radio frequency ID reader automatically detects the merchandise by scanning the tag while the consumer is still holding the product in the smart trolley. An automatically produced electronic product code number is assigned to it. Microcontroller memory is used with LCD to store information on item prices and total billing. The product's name and price are provided by this electronic product code.

IV. PROPOSED SYSTEM

Figure 2 shows the block diagram of the suggested electronic module that is attached to the shopping cart. It has details on each of the following: an RFID reader, a CPU, an LCD screen, a GSM module, a keypad, and more. RFID technology is used. When a customer enters a business or shopping mall, they are given the project with the trolley.

ALGORITHM:

STEP1: Start and initialize the system
STEP2: Go to the website and register your number
STEP3: Press and hold key A then scan the RFID Tags through the RFID reader to add the items
STEP4: Press and hold key B then scan the RFID Tags through the RFID reader to remove the items
STEP5: Press Key C to display the total amount
STEP6: Press and hold key D and scan the payment card to recharge 1000 per scan if the total amount is more than that of the billing cost
STEP7: Press and hold key C and scan the recharge card to complete the payment
STEP 8: Open the IOT app to verify whether the payment is completed or not.
STEP9: Automatically SMS and mapped location will be shared with the registered number

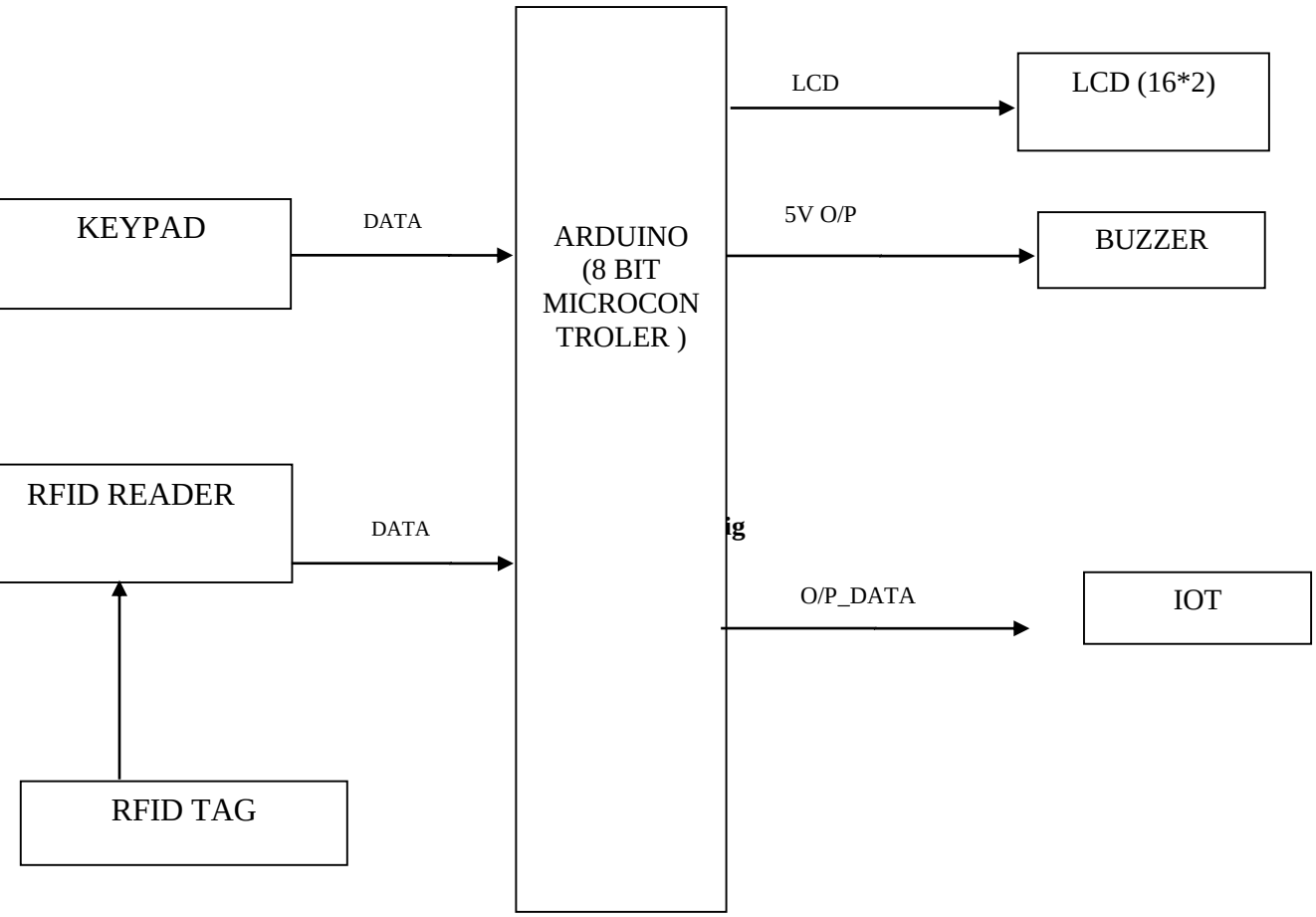


fig.2 block diagram for proposed system

RFID READER:
- High-frequency RFID reader for efficient communication with RFID tags.
- Read range optimized for supermarket trolley tracks.
- Compatibility with ISO 14443 standards for RFID communication.

RFID TAG:
- Passive RFID tags with unique identification for each supermarket trolley.
- Operating frequency compatible with the RFID reader.
- Durable and tamper-resistant design for extended use.

ARDUINO CONTROLLER:
-Arduino boards have onboard flash memory for storing the program (code).
-Arduino boards usually have a voltage regulator, allowing them to be powered by an external power source or through USB.

GSM MODEM:
- GSM modem for sending SMS notifications and data updates.
- Support for 2G/3G networks for reliable communication.
- Integration with the central billing system for real-time updates.

KEYPAD:
- Robust and user-friendly keyboard for inputting necessary data.
- Customized keys for specific functions related to billing and tracking.
- Water-resistant design to withstand the supermarket environment.

LCD:
- Clear LCD for presenting billing information to users.
- Backlit display for visibility in various lighting conditions.
- Integration with the billing system to show real-time transaction details.

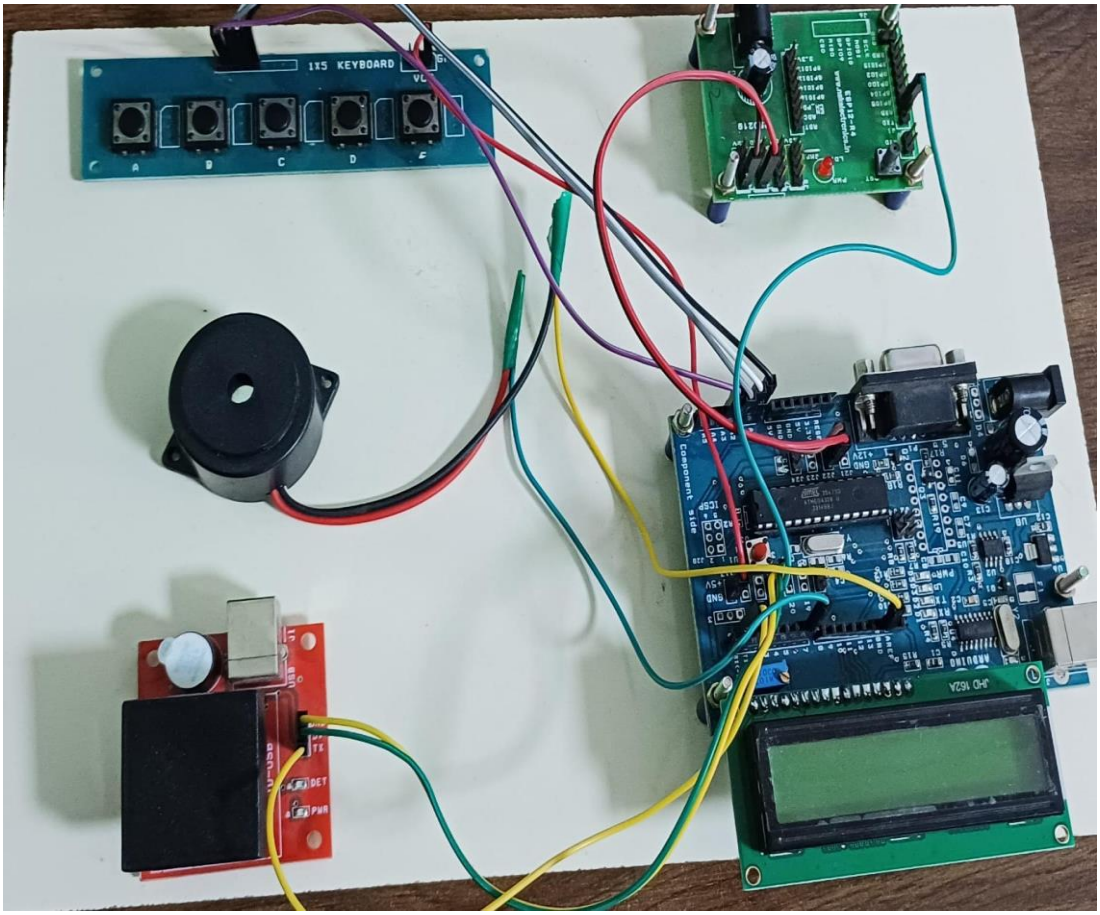


fig.3 Circuit Diagram

V. RESULTS AND DISCUSSION

The Arduino offers full access to controller or processor operations, along with the ability to utilize the input/output pins, configure the controller, and communicate. In an RFID reader, the signals that turn on the tag are sent via radio waves. The tag sends a wave back to the antenna after activation, where it is converted into data.

1. Press the button in Arduino to restart the kit

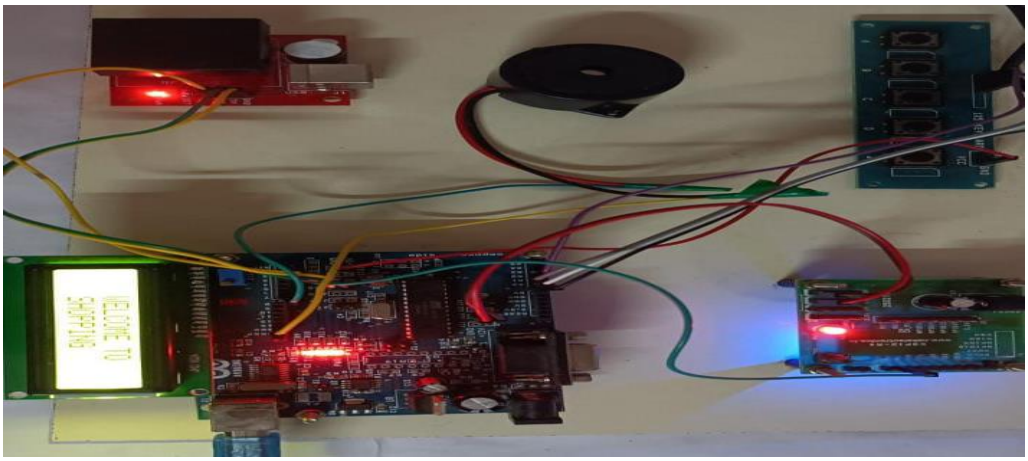


fig.5 restarting of kit

2. Press the key A and scan the items through the RFID reader

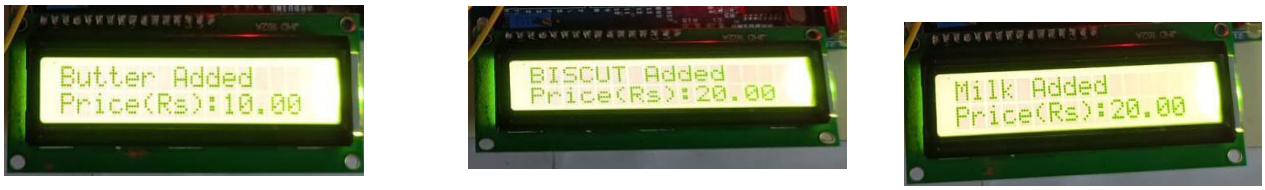


fig.6 items are scanned through RFID tags

3. Press key C to display the total amount

z

fig.7 final bill

4. Press key C and scan the payment card to pay the amount. By default, the 500 amount will be there in the kit for payment purposes when the kit is initialized, if the customer requires more amount then recharge it by scanning the payment card again and again, and 1000 will be added at each scan

fig.8 payment status

5. Go to the website http://iot25.com/IOT_2k18_Full_Options/login.php and log in with a username and password (Iot2k23142).

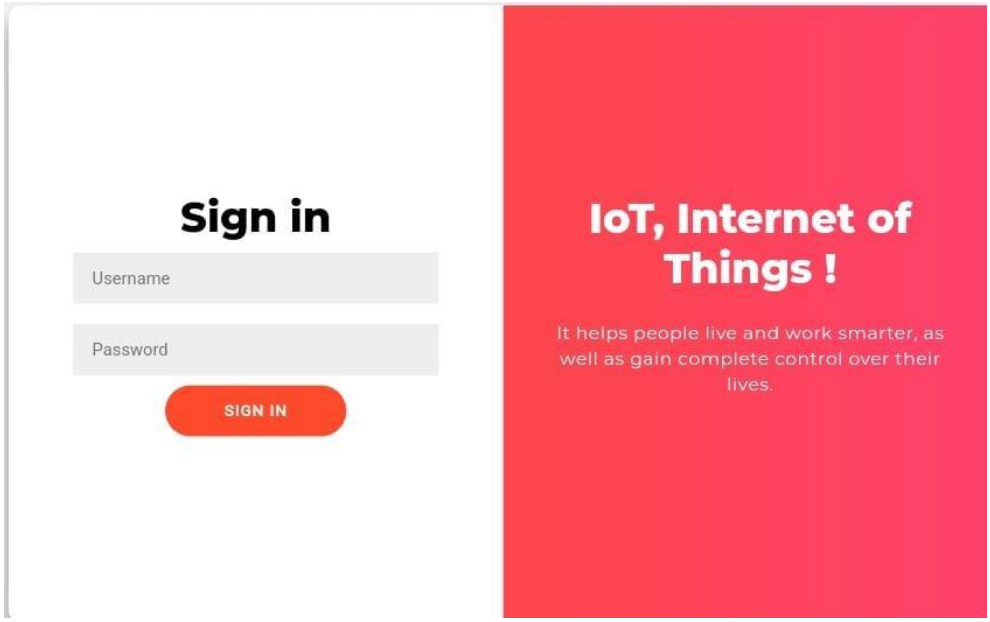


fig.9 Login page

6. Dashboard will open and to register the number click on master configuration and then on update number to register the user number. Also on this page, we can see a list of billing items by pressing on view iot data shown in fig 12.

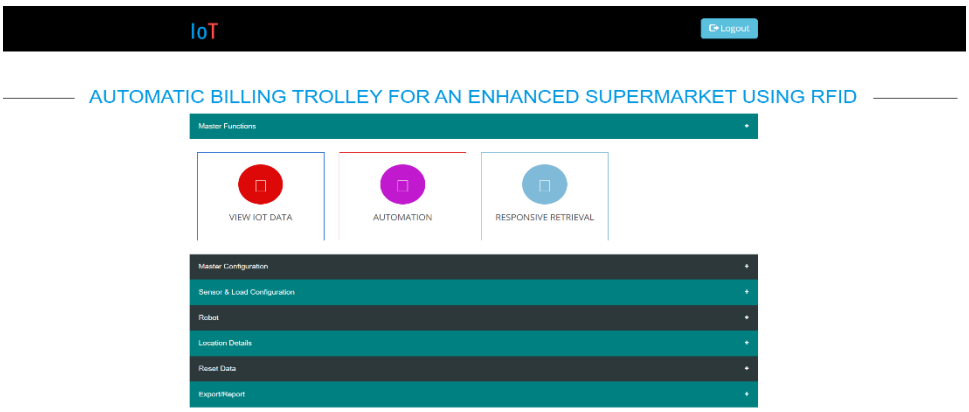


fig.10 dashboard

6. Open the IOT App and again log into it to get SMS along with the mapped location

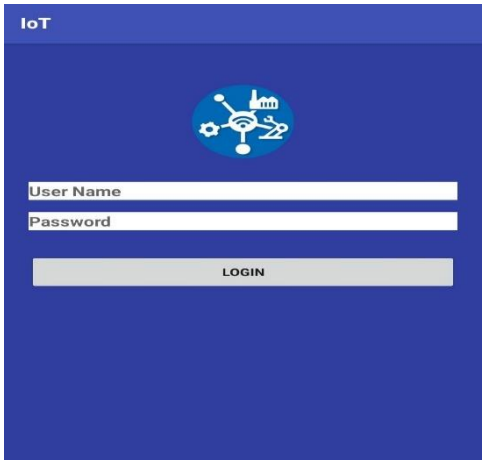
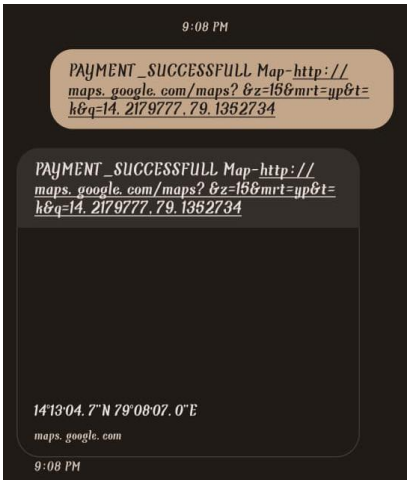


fig.11 sign in Iot App

7. SMS is received through the GSM module and a list of items will be displayed on the website



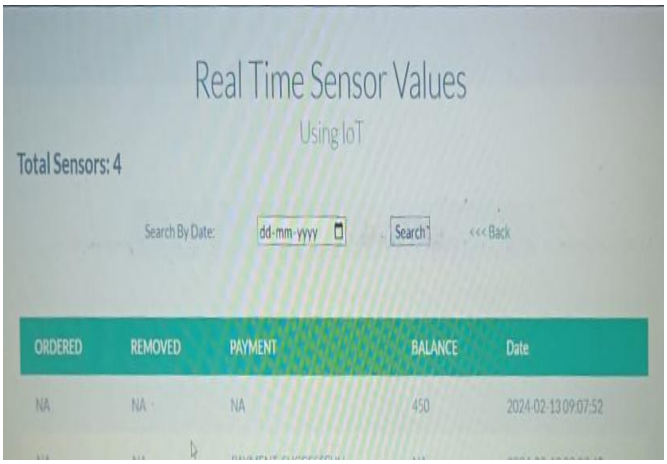


fig.12 SMS recieved

The information about the goods is read from the RFID card and presented on the LCD. The system's local memory will be used to store the information regarding the product name, quantity, and price. After finishing your shopping, you can read all of these materials and handle the billing. After that, the server will receive the product information and update the main memory.

- ✓ Scan the merchandise, identify it using RFID tags, and sync it with the main database.
- ✓ Automatization of billing.
- ✓ Lists the products' names and prices.
- ✓ Every time you buy a product, update the system.

Complete product list with prices displayed on LCD. Due to the decreased crowds and potential for safe use during a pandemic, the supermarket saw a significant increase in profits. Later, it would be expanded to include auto QR for bill payment to increase client comfort and payment ease.

The suggested model is simple to use and easily accessible. It doesn't call for any specialized training. The user will spend less time in the billing line because there is less labor involved. The ability for multiple users to attend at once is advantageous for both customers and retailers.

Faster billing is made possible with the help of this technology. Knowing the facts of the bill beforehand enables the buyer to make cost-effective plans. Notifies customers of the current deals available by displaying a pop-up on the trolley screen. By attracting more customers and offering prompt service, it aids in supermarkets' commercial marketing. Simple to use and doesn't require any specialized training. Artificial intelligence development enhances sales revenue for vendors. Each time a product is bought, update the system. Full display of the price list for all items on the LCD.

VI CONCLUSION

The goal objectives were achieved by the project model that was developed. The project's finished output was both cost-effective and user-friendly. The project functions as a proof of concept, but a few more features will be added to make the smart shopping cart a complete product and improve its stability and usability. Figure 5 also featured a user experience survey. With this approach, a central automated pricing structure is established for supermarkets and retail centers. Customers can pay their invoices without having to wait in line at the cash register since the information about the products they purchased is transferred to a central billing system. Alternatively, individuals might make use of their debit or credit cards. This Arduino is capable of receiving data from an RFID reader in the format of 8 bits. The user-friendly smart trolley's automated billing system tracks customers and generates bills for the products they purchase. It will be much easier for children and senior citizens to use the trolleys. We can save the consumer time by using the program, particularly when it comes to the billing process. Current ordinary trolleys may be converted to smart trolleys for less money by using affordable electronic components and a structural design that can be installed on an existing trolley because the suggested system is a unique solution.

REFERENCES

[1] Rajesh Nayak and Ravi S Raikar, " Automated Trolley for Shopping," in IJIREEICE Vol. 5, Issue 6, June 2017 DOI:10.17148/IJIREEICE.2017.5646

[2] Ghatol Sonali Digambar and Mrs.V.S.Jahagirdar , "Smart Shopping using smart trolley,"2018.

[3] P. Sathishkumar and A. Selvaganesh, "Smart Shopping using QRcode, "2018.
[4] Hiba Sadia and Shubhansu Jee, "Iot application based dvantages shopping trolley, "IJEAT ISSN: 2249-8958 (Online), Volume-8 Issue-4, April 2019.

[5] Thilagavathi Shanmugavel and K S Nivethitha, "IoT-based Smart Retail System with Social Distancing for Covid19 Outbreak" June 2021, Journal of Physics Conference Series 1917(1):012030

DOI:10.1088/1742-6596/1917/1/012030

[6] F. A. Yewatkara, "Smart Cart with Automatic Billing, Product Recommendation Using RFID & Zigbee with Anti-Theft," 7th International Conference on Communication, Computing, and Virtualization 2016, pp. 793-800, 2016.

[7] A. P. A. G. A. K. M. M. J. ANJALIPERADATH, "RFID Based Smart Trolley for Supermarket Automation," International Research Journal of Engineering and Technology (IRJET), vol. 4, 2017.

[8] Pranavi Satheesan, Sithivinajagamoorthy Nilaxshan, Jesuthasan Alosius, Rajaratnam Thisanthan, Priyanka Raveendran, Janani Tharmaseelan. Enhancement of Supermarket using Smart Trolley. International Journal of Computer Applications. 174, 15 (Jan 2021), 22-26. DOI=10.5120/ijca2021921031

[9] Sunil Kumar and Mr. Gupta. A “Smart Trolley using Arduino”,2017.

[10] Daisuke Yoshida and Kenji Terada"An Automatic Method of Counting Passers-by Using Stereo Camera", June 2000, IEEJ Transactions on Electronics Information and Systems 120(6):850-856
DOI:10.1541/ieejeiss1987.120.6_850

[11] K. Nithin Sai and Y. Vipul, “Auto billing smart cart,” IRJETCS,Volume:05,Issue:06,June-2023,DOI :10.56726/IRJMETS42699

[12] Mr. P. Chandrasekar and Ms. T. Sangeetha “Smart shopping cart with automatic billing system through RFID and transmitter and receiver”, IEEE, 2014

[13] Mr. Kumar and Mr. Gupta.“Smart Trolley using Arduino”, IJRASET, JAN 2019 DOI:10.22214/ijraset.2023.48731 2017.

[14] Krishna Murali and Swathi, “Smart trolley using Arduino UNO,” International Journal of Research Publication and Reviews, Vol 4, no 6, pp 2753-2756 June 2023

[15] D. Hahnel, W. Burgard, D. Fox K. Fishkin, and M. Philipose, "Mapping and localization with RFID technology", Proc. IEEE Int. Conf Robot. Autom, pp.1015 - 1020 2004.