

Automated Shopping Cart with Real-Time Billing & Mobility Assistance

KEERTHI C M¹, C M SUMANA²

¹ Dept. of Electronics & Communication, RYM Engineering College, Ballari

² Dept. of CSE (Artificial Intelligence & Machine Learning, RYM Engineering College, Ballari

Abstract- Long lines at billing counters or in a crowded shopping mall is becoming progressively common features of modern shopping experiences, which frequently makes the customer experience unhappy. So, we propose an intelligent shopping cart system leveraging RFID technology for seamless and automated billing, aiming to boost customer satisfaction & operational efficiency in modern retail environments. This model minimizes checkout delays by automatically calculating the total bill in real time. It provides a user-friendly and affordable experience. This project will also help elderly people by identifying them and having the Smart Trolley follow behind, & making shopping way easier. The Smart Trolley system can be designed to assist elderly shoppers by autonomously following them, automatically scanning items. The design and implementation of this project are described in this paper.

Index Terms- Smart Trolley, RFID tag, RFID Reader, Arduino UNO, Automated Billing, Shopping Cart maneuverability.

I. INTRODUCTION

Currently, shopping malls rely on the Barcode System, which although an improvement over manual methods, still has significant drawbacks. Customers often face long queues, tedious scanning processes, and wasted time, leading to frustration. Given these limitations, it's clear that a more efficient system is needed. The Smart Cart system, leveraging Arduino and RFID technology, offers a groundbreaking solution for Supply Chain Optimization. By eliminating the need for lengthy checkout queues, this system saves customers' time and enhances their shopping experience.

The Smart Cart system not only streamlines the shopping process but also aids in money management. By utilizing RFID tags, which offer faster and more reliable scanning than traditional barcodes, customers can scan products directly into their cart. The Arduino-based device installed on the cart calculates the total cost in real-time, providing

customers with a clear estimate of their expenses. This feature enables effective time management by eliminating checkout queues and facilitates money management by keeping customers informed about their spending. As an embedded system, the Smart Cart offers a seamless and efficient shopping experience.

The Smart Shopping Trolley is an innovative solution for supermarkets, reducing labor requirements while enhancing the shopping experience. By allowing customers to scan items as they shop, the trolley significantly cuts down shopping time and eliminates lengthy checkout lines. This cutting edge technology focuses on user interaction, providing real-time displays of purchased items, a feature that sets it apart from existing solutions. By streamlining the shopping process, the Smart Shopping Trolley offers a convenient and efficient experience for customers.

II. LITERATURE REVIEW

1. [T K Das and et.al] they have presented their work which is of "A Smart Trolley for Smart Shopping," this paper presents solution is an IoT-based system consisting of a smart trolley equipped with an Arduino board, RFID reader, RFID tag, LCD display, ESP8266 Wi-Fi module, and a website to maintain product and customer details. The trolley can interact with a network spread worldwide, allowing customers to purchase products, receive e-bills through email, and view purchase details through the shop's website.

2. [S. Kowshika and et.al.] they have presented their work which is of "IoT based Smart Shopping Trolley with Mobile Trolley Application", they proposed Smart Trolley in this paper offers easy and quick payment of bills using IoT and a mobile application. It uses RFID, load cell, LCD display and Raspberry Pi to scan products and prevent theft.

3. [M. Jaishree and et.al] they have presented their work which is of "Smart Shopping Trolley Using IOT, this paper proposes an automated shopping trolley with a barcode scanner and LCD display, using the Raspberry Pi device. It aims to reduce waiting time in queues during rush hours at supermarkets.

4. [Kiran Ingole and et. al.] they have presented their work which is of "A Review of Techniques used in Automatic Human Following Trolley" and their work emphases about Automatic human following trolley is a cart which follows the user by maintaining constant distance from user. This reduces the human effort of pulling or pushing the cart. Researchers have used different methodologies for fabricating such trolleys with multiple features and usages.

5. [K G Sawarkar and et. al.] they have presented their work which is of "Smart Shopping Cart for Physically Challenged" and their work emphases on new time and effort efficient technology has been proposed for the ease of senior citizens and Divyangjans , a mechanism has been included to make the cart wirelessly follow them.

III. METHODOLOGY

Fig1 shows the Block Diagram Intelligent Trolley System. The main objective of this paper is to:

- To reduce billing and checkout-related issues.
- To design an intelligent trolley system.
- To assist elderly and physically challenged individuals.

In the traditional method, customers have to wait in long queues at checkout counters, and elderly or physically challenged people may face difficulty in manually pushing trolleys, causing inconvenience. So these glitches can be solved by this paper which is explained in detail below.

This paper is classified into two parts: (i) Automated Billing system. (ii) Shopping Cart maneuverability.

1) AUTOMATED BILLING SYSTEM

- This technology streamlines the purchasing process by enabling faster product selection and payment.

- Each item in the store is fitted with an RFID tag that holds product details. The shopping cart is equipped with an RFID reader and Arduino Uno, which read the RFID tags as items are scanned and placed in the cart. As customer's scan the item, the LCD screen displays details such as: the price, item count, and total cost in real time.

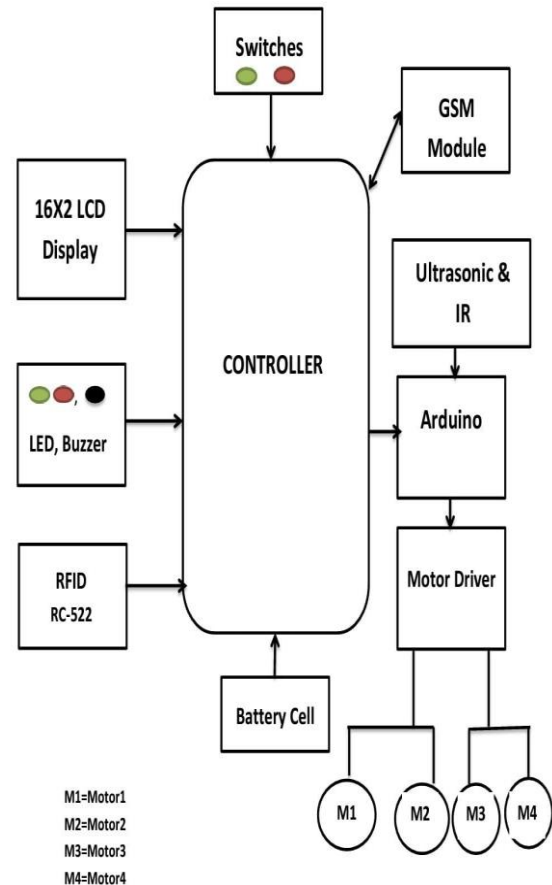


Fig1: Block Diagram Intelligent Trolley System

- A 'Remove' button lets customers easily remove items by scanning them again, instantly updating the item count and overall cost. This system ensures customers know exactly how many items they have in the cart, making the purchase process more efficient. Additionally, customers can pay directly at the shopping cart, eliminating the need to wait at traditional checkout counters.

2) SHOPPING CART MANEUVERABILITY

- Elderly individuals and people with disabilities often struggle with shopping due to challenges

like carrying heavy shopping carts, which can exacerbate their health conditions and cause frustration.

- This issue can be resolved by incorporating Ultrasonic & IR sensor with motorized wheels on trolleys that sense the person and move accordingly, providing a more accessible and convenient shopping experience.

Advantages of this model is,

- Real-time billing eliminates the need for traditional checkout lines, reducing wait times and making shopping more efficient.
- Mobility assistance features, such as trolley movement, can assist customers with mobility issues, making shopping more accessible and convenient.
- Automation can reduce the need for store staff to manage checkout processes, allowing them to focus on customer service and other tasks.
- Automated shopping carts can improve the overall shopping experience, leading to increased customer satisfaction and *loyalty*.

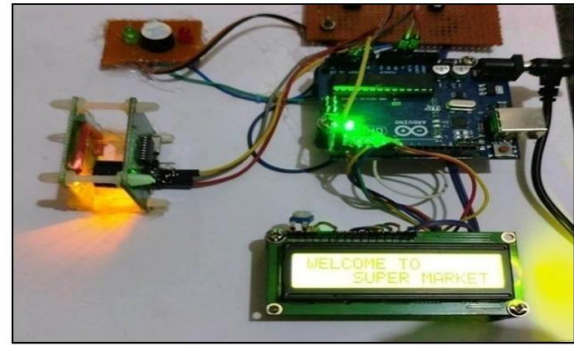
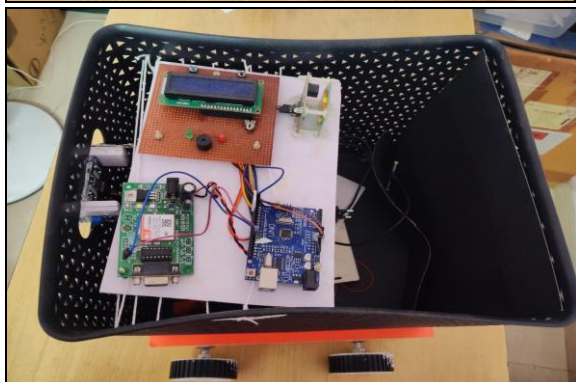
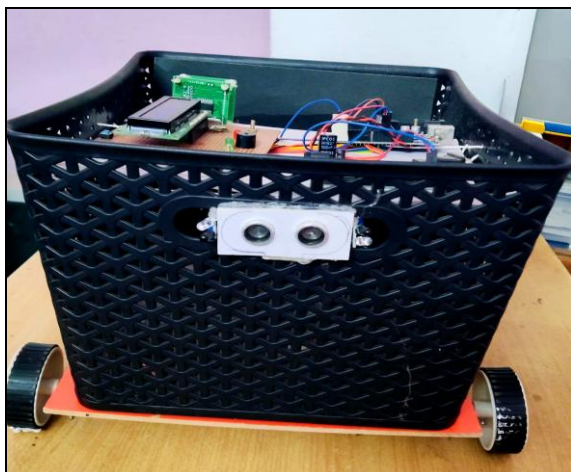


Fig2: Implementation

IV. FLOWCHART

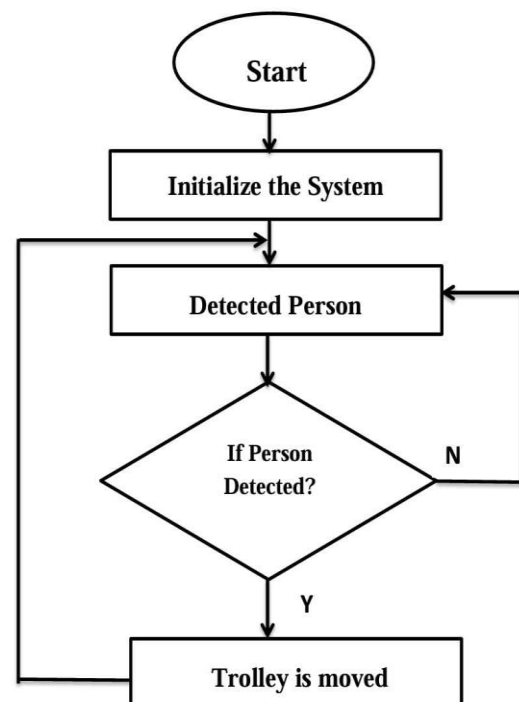


Fig3: Flowchart of Shopping Cart Maneuverability

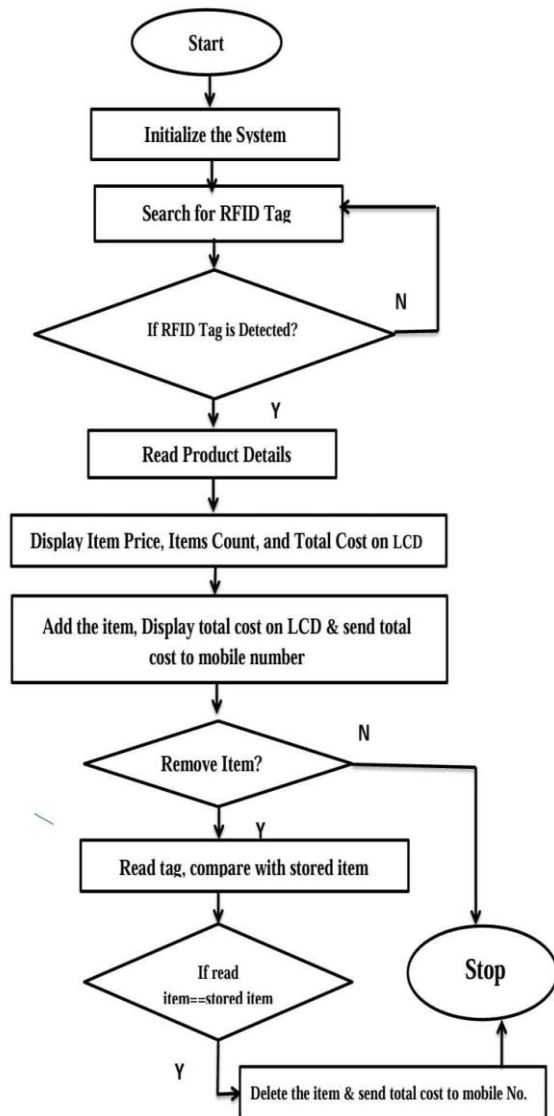


Fig4: Flowchart of Automated Billing System

Fig3 & Fig4 shows graphical representation of flowchart (proposed model).

V. CONCLUSION

The future scope of the smart shopping trolley with automated billing system is vast and exciting. As technology continues to evolve, the smart trolley can be enhanced and upgraded to incorporate emerging technologies such as augmented reality, virtual reality, and artificial intelligence, creating a more immersive and personalized shopping experience for customers. The system can expand into new markets globally, adapting to local regulations, languages, and cultural preferences. Integration with e-commerce platforms could provide a seamless Omni channel shopping experience, bridging physical and digital retail.

Advanced data analytics capabilities may be developed to give retailers deeper insights into customer behaviour, preferences, and shopping patterns, enabling personalized marketing and targeted promotions. The system could also be optimized for sustainability by using eco-friendly materials, reducing energy consumption, and minimizing waste. Potential partnerships and collaborations with retailers, technology companies, and research institutions can further drive the development of smart trolley technology and unlock new applications. Overall, the future of the smart shopping trolley with automated billing system holds tremendous potential for innovation, growth, and transformation in the retail industry.

REFERENCES

- [1] Dr. B. Rama Rao, Ch. Sathvika, M. Hari Sai Keerthika, S. Vijaya Ram Raju, K. Tarunkumar "Smart Shopping Trolley With Automated Billing System" IRJMETS, Volume:06/Issue:04/April-2024.
- [2] Meghana T K, Rahul S Bedare, Ramakrishna M, Vignesh P, Maria Pavithra, "Smart Shopping Cart with Automated Billing System" IETE-2020 Conference Proceedings, Volume 8, Issue 11.
- [3] John Wesley, Komal Patil, Bacha Sravya, Bhuvaneshwari Dani, Aishwarya Durge" Smart Shopping Trolley With Automated Billing" © 2025 JETIR January 2025, Volume 12, Issue 1.
- [4] Mr. A. Shankar, J. Sathishkumar, R. Tamilselvan, M. Vignesh "Tot Asset Tracking System", IRJET, Volume: 09 Issue: 01 | Jan 2022.
- [5] Kiran Ingole, S. R. Khedkar, "A Review of Techniques used in Automatic Human Following Trolley", IRJET, Volume: 08 Issue: 01 | Jan 2021.
- [6] Ashmeet Kaur, Avni Garg, Abhishek Verma, Akshay Bansal, Arvinder Singh, "Arduino Based Smart Cart" I International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Volume 2, Issue 12, December 2013.
- [7] Tanushree, Siddharth Yadav, Saksham Aggarwal, Sagar, Mohit Yadav, Neeraj Gupta, Shruti Karkra. "Ingenious Shopping Cart: RFID Enabled for Automated Billing." IJCSMC, Vol. 5, Issue. 5, May 2016, pg.209 – 214.

- [8] Muhib A. Lambay, Abhishek Shinde, Anupam Tiwari, Vicky Sharma. "Automated Billing Cart." International Journal of Computer Science Trends and Technology (IJCST) – Volume 5 Issue 2, Mar – Apr 2017.
- [9] T K Das, Asis Kumar Tripathy, Kathiravan Srinivasan, "A Smart Trolley for Smart Shopping"July2020,DOI:10.1109/ICSCAN49426.2020.9262350,Conference:2020,International Conference on System, Computation, Automation and Networking (ICSCAN).
- [10] S Kowshika, S.S Madhu mitha, G Madhu Varshini, V Megha, K Lakshmi "IoT based Smart Shopping Trolley with Mobile Trolley Application"DOI: 10.1109/ICACCS51430.2021.9441866, IEEE *Xplore*: 03 June 2021.
- [11] M. Jaishree, Lakshmi prabha.K.R, Jeyaprabha.S, Mohan.K "Smart Shopping Trolley Using IOT March2021,DOI:10.1109/ICACCS51430.2021.9441786,Conference: 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS).
- [12] K G Sawarkar , Sanchit Pandey "Smart Shopping Cart for Physically Challenged International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 11 Issue 11, November-2022.