



International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)





Smart Shopping Trolley

Mr. Chaitanya Sanjay Gosavi¹, Mr. Sahil Lawoo Dhauskar², Ms. Neha Sudhir Kawale³,
Ms. Leena Shivram Chavan⁴, Mr. S.M.Mayekar⁵

Student, Yashwantrao Bhonsale Institute of Technology, Sawantwadi, Maharashtra, India ¹²³⁴

Faculty, Yashwantrao Bhonsale Institute of Technology, Sawantwadi, Maharashtra, India⁵

ABSTRACT: This research paper explores the design and implementation of the Smart Shopping Trolley, an innovative solution aimed at transforming the retail shopping experience. The system enhances convenience and addresses inefficiencies in traditional shopping methods. The trolley features Automatic Billing, powered by an integrated barcode reader, which scans items in real time, providing accurate cost updates and reducing checkout queues. Its Human-follow functionality, enabled by Bluetooth/Wifi and a unique network ID, offers hands-free navigation for shoppers. Ultrasonic sensors are used to detect obstacles, ensuring smooth movement even in crowded environments. With IoT technology integration, the trolley allows real-time monitoring and control, while Bluetooth/Wifi ensures seamless communication between the trolley and the shopper's device. This paper highlights the trolley's ability to combine automation, intelligent navigation, and real-time tracking to improve shopping efficiency. By redefining the modern shopping journey, the Smart Shopping Trolley sets a new standard for retail automation, offering a streamlined and user-friendly experience. Additionally, a user interface (UI) i.e Smart Shopping Trolley Control Panel which is provided at the mall owner/administrator site for real-time monitoring and control of the trolleys in the store.

KEYWORDS: Smart Shopping Trolley, Automatic billing, Human-follow functionality, Bluetooth/Wifi technology, IoT(Internet Of Things) technology.

I. INTRODUCTION

Retail shopping has evolved significantly over the years, with technology enhancing customer convenience and operational efficiency. The Smart Shopping Trolley emerges as an innovative solution to persistent challenges in traditional shopping, such as long checkout queues, manual item scanning, and navigation inefficiencies. By integrating advanced features like automatic billing, real-time updates, human-follow capabilities, obstacle detection, and seamless payment options, the Smart Shopping Trolley aims to redefine the consumer shopping experience. At its core, the trolley features an automatic billing system utilizing a barcode reader to scan items instantly as they are placed inside, eliminating the need for manual checkout and significantly reducing waiting times. Complementing this is an integrated speaker system that announces item details, such as names, prices, and the running total, keeping shoppers informed and engaged during their shopping journey. The human-follow functionality allows the trolley to autonomously track and follow shoppers throughout the store, offering hands-free operation, particularly beneficial in large retail spaces. Advanced obstacle detection sensors ensure safe navigation by identifying and avoiding obstacles, enabling uninterrupted movement through crowded aisles. Additionally, seamless payment processing enables transactions to be completed directly at the trolley, bypassing traditional checkout counters and further enhancing efficiency. The incorporation of IoT technology ensures real-time monitoring and control, making the trolley adaptive and responsive to dynamic retail environments. Bluetooth/Wifi integration facilitates smooth communication between the trolley and shoppers' devices, eliminating the need for additional applications. By blending automation with intelligent navigation, the Smart Shopping Trolley addresses the evolving needs of modern consumers.

Moreover, a Smart Shopping Trolley Control Panel, provided at the mall owner/administrator's site, enables real-time monitoring and management of the trolleys within the store, ensuring smooth operation and control over the entire system. This paper delves into the design, features, and potential impact of the Smart Shopping Trolley, emphasizing its transformative role in the future of retail and its contribution to establishing new benchmarks for intelligent shopping solutions.



International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

II. PROBLEM STATEMENT

Traditional shopping methods are inefficient, with long checkout times, manual item scanning, and difficult navigation in crowded stores. These issues result in poor customer experience and reduced operational efficiency. Shoppers face delays due to long queues, and pushing carts in large stores can be cumbersome. Additionally, the lack of automation and real-time updates creates inefficiencies in the process. Current payment systems are limited to checkout counters, further contributing to delays. There is a need for a solution that automates billing, tracks shoppers, and enhances navigation. The Smart Shopping Trolley aims to address these challenges, offering real-time billing, hands-free movement, obstacle detection, and seamless payment. This innovative solution can transform the shopping experience, making it faster, safer, and more efficient.

III. OBJECTIVE OF PROJECT

The Smart Shopping Trolley aims to revolutionize the retail experience by integrating advanced technologies, such as real-time automatic billing, human-follow capabilities, and obstacle detection. These innovations enhance the shopping process, providing customers with an efficient, hands-free, and safe experience while streamlining store operations.

Following are the objectives according to each module:

1. Automatic Billing and Payment System Using Barcode Technology:

- **Implement Real-Time Scanning:** Utilize barcode readers to automatically scan and add items to the trolley's total as they are placed inside, ensuring accurate and instantaneous billing.
- **Provide Continuous Cost Updates:** Integrate a speaker system to announce the name and price of each item, along with the cumulative total, keeping the shopper constantly informed about their expenditures.
- **Enable Seamless Payment:** Develop an integrated payment system that allows customers to pay directly at the trolley, eliminating the need for traditional checkout counters and reducing wait times.

2. Human Follow Capability:

- **Bluetooth/Wifi Based Tracking:** Design a Bluetooth/Wifi system that connects with the shopper's device using their unique network ID, enabling the trolley to autonomously follow the shopper and eliminating the need for manual pushing.
- **Enhance Navigation with Bluetooth/Wifi:** Ensure the trolley can accurately track and follow the shopper throughout the store, using Bluetooth/Wifi to navigate obstacles and provide a smooth, hands-free shopping experience.

3. Obstacle Detection and Safety Features:

- **Integrate Obstacle Detection Technology:** Equip the trolley with motion sensors that detect obstacles in real time, allowing the trolley to safely navigate around them and avoid collisions.
- **Improve Safety Alerts:** Implement a processing module that triggers alerts, such as a buzzer or an audio notification, to inform the shopper of obstacles in the trolley's path, ensuring safe and uninterrupted movement.

IV. SCOPE OF PROJECT

The scope of the Smart Shopping Trolley research project encompasses various facets of modern retail technology, focusing on automation, navigation, and real-time payment systems to enhance both customer experience and operational efficiency. Key areas of investigation include:

- **Automatic Billing and Payment Systems:** The Smart Shopping Trolley will integrate real-time item scanning using barcode readers, eliminating manual scanning and speeding up the billing process. The system will automatically update the running total as items are placed in the trolley. An integrated payment system will allow customers to complete transactions directly at the trolley, bypassing traditional checkout counters and reducing waiting time, making the shopping experience more efficient.

- **Human-Follow Capability:** The trolley will be equipped with Bluetooth/Wifi based tracking technology, allowing it to autonomously follow the shopper throughout the store. By connecting to the shopper's device via a unique network



International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

ID, the trolley eliminates the need for manual pushing, providing a hands-free and convenient shopping experience. This feature will be optimized for smooth navigation in crowded retail spaces.

- **Obstacle Detection and Safety Features:** Advanced sensor technologies, including motion and proximity sensors, will be incorporated into the trolley to detect and navigate around obstacles. The system will use real-time data processing to identify obstacles and avoid collisions. If an obstacle is detected, the trolley will alert the shopper through a buzzer or speaker, ensuring safe and uninterrupted movement within the store.
- **Usability and Scalability in Retail Environments:** Evaluate the usability and adaptability of the Smart Shopping Trolley in various retail environments, from small shops to large department stores, ensuring the system can scale to meet different store sizes and layouts.

This project aims to push the boundaries of retail technology by merging advanced automation, IoT, and real-time systems to create a more efficient and enjoyable shopping experience, with a focus on enhancing customer convenience, store efficiency, and operational cost savings.

V. EXISTING SYSTEM

Existing shopping systems largely rely on manual item scanning at checkout counters, which often leads to long waiting times and inefficient customer service. Traditional trolleys require shoppers to manually push them through crowded aisles, which can be tiring and cumbersome. Additionally, existing payment systems are limited to checkout counters, requiring customers to wait in long lines to complete transactions. Current retail environments lack automation for item tracking, making it difficult for stores to offer real-time updates or personalized shopping experiences. Furthermore, obstacle detection systems are often rudimentary, leading to potential accidents or disruptions in crowded stores. Shoppers still face challenges when it comes to easy navigation, especially in large or busy retail spaces. Existing systems also lack integration with advanced technologies like IoT or machine learning, preventing optimization of in-store operations and personalized shopping. Moreover, security and privacy concerns around data collection and transmission remain unaddressed in many traditional systems. The overall shopping experience is limited by these inefficiencies, which is where innovations like the Smart Shopping Trolley aim to make a significant impact.

VI. LIMITATION

Limitations according to each module:

MODULE 1: AUTOMATIC BILLING AND PAYMENT

1. Technical Glitches Errors in item recognition or system malfunctions can lead to incorrect billing, causing inconvenience for both shoppers and staff.
2. High Implementation Cost The initial setup and integration of automatic billing and payment systems involve significant financial investment, which can be a barrier for some retailers.

MODULE 2: HUMAN FOLLOW CAPABILITY

1. High Initial Cost Incorporating human-follow technology increases the initial investment for retailers, making it a more expensive solution.
2. Potential Tracking Errors The system may occasionally fail to accurately follow the user, especially in crowded or cluttered environments, leading to inconvenience.

MODULE 3: OBSTACLE DETECTION

1. False Positives The system may occasionally detect non-existent obstacles, causing unnecessary stops and interruptions in the shopping experience.
2. Complexity in Integration Integrating obstacle detection technology with existing store infrastructure and ensuring compatibility can be challenging and time-consuming.

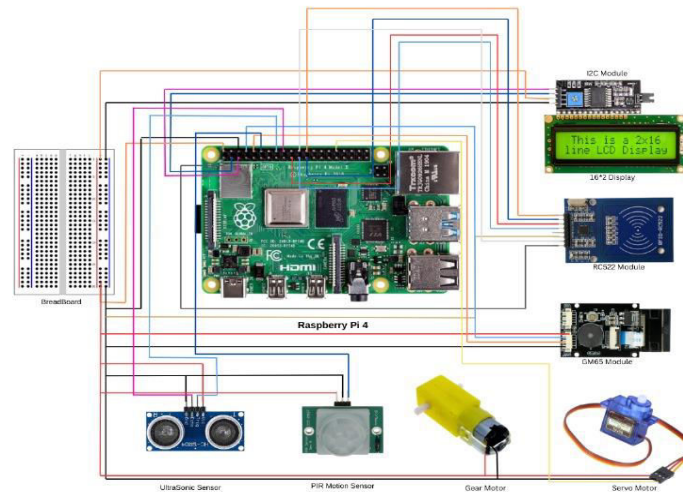


International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

VII. PROPOSED SYSTEM

This proposed work introduces a Smart Shopping Trolley to revolutionize the retail experience with features like an automatic billing system using a barcode reader, which scans items, updates the total in real-time, and announces details via a speaker and when a product is scanned, the product details, along with its cost, are automatically updated in the product owner's user interface (UI) for real-time tracking and management. It incorporates human-follow capability using Bluetooth/Wifi to track shoppers and navigate safely while avoiding obstacles through advanced sensors. Additionally, the trolley enables integrated payment at the end of the shopping trip, allowing customers to bypass traditional checkout queues for a seamless and efficient shopping experience.



Circuit Of Smart Shopping Trolley Using Raspberry Pi 4

Components Used,

- **Raspberry Pi 4:** Central controller for processing inputs from sensors and modules, executing programs, and controlling outputs.
- **I2C Module:** Reduces GPIO pin usage while enabling communication between the Raspberry Pi and the LCD display.
- **16x2 Display:** Displays product information, pricing, and instructions to the user in real time.
- **RC522 Module:** Reads RFID tags to identify human and proceed the payment system.
- **GM65 Module:** Scans barcodes on items and sends decoded product details to the Raspberry Pi.
- **Servo Motor:** Performs controlled angular motion, typically used for actuating mechanisms like locks or gates.
- **Gear Motor:** Powers the trolley wheels for movement, providing sufficient torque to handle loads.
- **PIR Motion Sensor:** Detects human presence to activate the trolley's follow mechanism.
- **Ultrasonic Sensor:** Measures distances to detect and avoid obstacles in the trolley's path.
- **Breadboard:** Allows temporary circuit assembly for testing and prototyping connections without soldering.

VIII. CONCLUSION AND FUTURE WORK

A. CONCLUSION

The Smart Shopping Trolley represents a significant leap in retail technology, addressing issues like long checkout queues, manual item handling, and navigation inefficiencies. With features like automatic billing, human-follow functionality, and obstacle detection, it enhances the shopping experience while streamlining operations. The integrated



International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

payment system removes the need for checkout counters, reducing wait times and improving convenience. Additionally, the UI provided for store owners/admins allows real-time monitoring and control of the trolleys, ensuring operational efficiency. This research showcases the trolley's potential to redefine retail automation, offering both convenience for shoppers and efficiency for store management.

B. FUTURE WORK

The future of the Smart Shopping Trolley lies in further integrating advanced technologies to enhance shopping experiences. With AI-driven recommendations and machine vision for improved obstacle detection, the trolley could adapt more intelligently to consumer needs. Expanding IoT capabilities to include real-time inventory tracking and advanced analytics will enable better store management. Enhanced payment options, like biometrics, and large-scale trials in diverse environments will refine its functionality, ensuring it meets the evolving demands of modern retail.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude and appreciation to the experts who have contributed to the development of the Smart Shopping Trolley. We would also like to extend our heartfelt thanks to our HOD & project Co-ordinator Mr. P. D. Kate and guide Prof. S. M. Mayekar for their constant support, guidance, valuable suggestions, and modifications to enhance the quality of our project work. Their insights and encouragement have been instrumental in the success of our project. We would also like to thank the faculty members of our department for their valuable feedback and support throughout the project.

REFERENCES

1. Apeksha Jagtap (Smart Shopping Trolley With Automated Billing) International Research Journal of Modernization in Engineering Technology and Science May 2023. https://www.irjmets.com/uploadedfiles/paper/issue_5_may_2023/39685/final/fin_irjmets1684745168.pdf
2. Sayali N Joshi (Design and Development of Human Following Trolley) International Journal of Innovative Science and Research Technology April 2019. <https://ijisrt.com/design-and-development-of-human-following-trolley>
3. Prof. Roopa, Nivas Chandra Reddy (Research on Smart Shopping Cart) International Journal of Scientific Research in Computer Science, Engineering and Information Technology July-August 2022. https://www.researchgate.net/publication/347094766_Research_on_Smart_Shopping_Cart
4. Prof. Ganesh R. Phulay (Robot For Obstacle Avoidance) International Research Journal of Modernization in Engineering Technology and Science May 2023. https://www.irjmets.com/uploadedfiles/paper/issue_5_may_2023/40631/final/fin_irjmets1685357267.pdf
5. K. Y. K. G. R. Srinivasu (Iot Based Autonomous Robot For Safety Enhancement) International Journal for Research in Science Engineering & Technology IJRSET June 2022. <https://www.ijrset.in/index.php/ijrset/article/view/549/423>
6. Mayuresh M Kodape, Tejas Kinare , Yash Mangrulkar , Nakul Kasar, Dr. Prof. Shripad Bhatlawande (Smart Trolley System) International Journal For Research IJRASET January 2023. <https://doi.org/10.22214/ijraset.2023.48731>
7. Dr. Jeevanandham, Hariharan.P, Dhanraj PL S, Alex Amitraj Philips, Gokulapriya.N (Rfid And Iot Based Smart Trolley) International Journal of Scientific & Engineering Research Volume 12, Issue 3, March 2021. <https://www.ijser.org/researchpaper/RFID-AND-IOT-BASED-SMART-TROLLEY.pdf>
8. T. Manikandan, C.S. Balasubramaniam, S. Deepak Kumar, S. Dhanish (A Human Following Trolley) International Journal of Research Publication and Reviews Oct 2022. <https://ijrpr.com/uploads/V3ISSUE10/IJRPR7395.pdf>
9. Leena Thomas, Renu Mary George (Smart Trolley with Advanced Billing System) International Journal of Advanced Research in Electrical, 3, March 2017. https://www.ijareeic.com/upload/2017/march/130_MBITS_EEE8.PDF
10. Snehal Kulkarni, Dr. Supriya Shanbhag, Tejaswini Kamat, Tejaswini Thorwat (Smart Shopping Cart System) International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 1, December 2022. <https://ijarsct.co.in/A7675.pdf>



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



SJIF Scientific Journal Impact Factor



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING



9940 572 462



6381 907 438



ijircce@gmail.com



www.ijircce.com

Scan to save the contact details