

Seamless shopping experience with Hassle-free Trolley

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Abstract— Shopping at large malls has become a routine activity, especially bustling during holidays and weekends. Customers select various items and place them into trolleys, but upon completing their shopping, they often face long queues at billing counters. Here, cashiers manually scan each item using barcode reader is time-consuming process contributing to these delays. To address these challenges and enhance the shopping experience, our project introduces a smart shopping trolley equipped with RFID technology and autonomous movement capabilities. This advanced trolley is designed to follow a specific individual throughout the store, eliminating the need for manual pushing and enhancing convenience, especially for those with limited mobility. The integration of RFID technology allows for real-time product recognition, automatically tracking items as they are added or removed from the cart. To further streamline the shopping experience, users can manually enter the total amount into a secure mobile application for payment, effectively reducing wait times at checkout. By addressing common pain points in the retail environment, this smart trolley system aims to improve customer satisfaction and operational efficiency.

Index Terms—Smart Trolley, RFID Scanner, Human Follower, Arduino uno, IR Transmitter, IR Receiver

I. INTRODUCTION

In today's fast-paced retail environment, shoppers often face challenges such as crowded aisles and lengthy waits at billing counters. To enhance the shopping experience and address these issues, our project introduces a smart shopping trolley equipped with RFID technology and autonomous movement capabilities. This advanced trolley follows customers throughout the store, eliminating the need for manual pushing and allowing hands-free shopping. Each item is tagged with an RFID label; as products are placed into or removed from the trolley, an integrated RFID reader automatically scans these tags, ensuring accurate, real-time tracking. The trolley's system calculates the total cost of selected items and displays

it on an LCD screen. Upon completing their shopping, customers can manually enter the total amount into a secure mobile application and complete their payment without waiting in long queues. This approach offers flexibility and convenience, allowing users to review their purchases and finalize payments at their own pace. By integrating these features, our smart shopping trolley aims to streamline the shopping process, reduce checkout times, and provide a more efficient experience.

Problem Statement

Traditional shopping trolleys require physical effort to push and maneuver, which makes the overall shopping experience less convenient, especially for elderly individuals and those with physical disabilities. Additionally, long queues at the billing counters lead to time-consuming delays and significantly reduce the operational efficiency of retail stores. To address these issues, we propose an RFID-enabled smart trolley system designed to minimize the need for manual handling while also streamlining the billing process. This smart trolley is capable of autonomously following the customer throughout the store and is integrated with a web-based interface that provides real-time updates on product information, including the item name, quantity selected, individual price, and the total bill amount. This approach ensures a smooth, transparent, and stress-free shopping experience by increasing convenience and improving the overall efficiency of the process.

II. LITERATURE REVIEW

[1] A Comprehensive Study on Developing a Smart Trolley with Internet of Things and RFID Technology

applications. The integration of IoT in smart trolley technology has revolutionized the retail experience by eliminating long checkout queues and enabling fast, contactless payments using RFID. This advancement

significantly enhances customer convenience and shopping efficiency. However, the current research emphasizes the need to strengthen data security, resolve technical challenges, and improve overall system reliability to ensure consistent performance in real-world environments.

CartTech is at the forefront of developing intelligent purchasing systems by integrating advanced technologies for accurate product identification, real-time weight measurement, and swift data transmission using NodeMCU modules. These features work together to provide a smooth and efficient shopping journey. Additionally, the system supports precise inventory management and delivers instant updates on an LCD screen, contributing to a more streamlined and intelligent retail environment.

[2] Smart shopping trolley Using Arduino UNO

This paper introduces a Smart Trolley system equipped with an Automatic Billing System using RFID technology, aiming to improve the retail shopping experience by streamlining the checkout process. The main objectives are to design and implement a trolley that can automatically bill customers as they shop, thereby reducing wait times and increasing overall efficiency. The study reviews how RFID technology has been applied in retail, especially for tasks like inventory control, supply chain optimization, and enhancing customer interaction. It also examines existing smart trolley systems to identify current gaps, which the proposed solution aims to fill.

The system architecture includes RFID readers, microcontrollers, and various sensors, all integrated into the trolley to support real-time product tracking and automatic billing. The design process covers both the physical trolley and the integration of RFID components. Details are provided on how the RFID system works with the billing mechanism to ensure accurate item tracking and real-time updates. Field tests and customer feedback help assess the system's effectiveness in reducing checkout time and improving accuracy. The paper also addresses challenges faced during implementation and offers potential solutions. In conclusion, the study emphasizes the transformative potential of Smart Trolleys in retail and suggests directions for future

research and development.

[3] Automatic billing trolley for an enhanced supermarket using rfid

Many customers find it challenging to wait in long lines for billing during their shopping trips, leading to frustration, financial losses, and potential billing errors. To address this issue, the study proposes an innovative solution in the form of a smart shopping cart, which aims to enhance the shopping experience. By utilizing RFID technology, the smart cart automatically identifies the products placed in the cart and generates the corresponding bill in real-time. The system integrates an RFID reader, Arduino microcontroller, LCD display, keypad, and GSM module to ensure smooth and efficient billing. This approach eliminates the need for customers to wait in long queues, making shopping faster and more convenient.

The smart cart system provides a more intelligent and automated method of managing the shopping process, particularly in supermarkets and shopping malls, where congestion often results in long wait times. By automatically detecting products and generating bills without manual input, this system streamlines the checkout process, improving customer satisfaction. Additionally, the integration of the GSM module enables seamless communication, allowing customers to bypass traditional checkout lines. This approach offers a more efficient and enjoyable shopping experience while reducing the time spent in queues and minimizing the risk of incorrect billing.

[4] Smart Trolley with Automatic Master Follower and Billing System

The “Smart Trolley with Automatic Master Follower and Billing System” is designed to enhance the shopping experience in malls by automating cart movement and billing. As soon as a customer enters the mall, the trolley autonomously follows them using Bluetooth and ultrasonic sensors. Each trolley is equipped with an RFID reader, a digital display, and the necessary sensors. Every product in the store has an RFID tag, and when an item is placed into the trolley, its unique ID is detected. This automatically displays details like the product name, price, expiry date, and any discounts on the screen while

simultaneously updating the total bill.

If a customer decides to remove an item, they can press a button on the trolley and rescan the product, which then subtracts its value from the total bill. After shopping, the customer presses an upload button, sending the final bill to the billing counter. Payment is made through a digital payment app, and once completed, the system updates the exit gate with the payment confirmation. At this point, the trolley disconnects from the customer, allowing them to exit seamlessly. This system aims to reduce checkout lines and enhance the convenience and efficiency of the shopping process.

[5] Human friendly smart trolley with automatic billing system.

This Shopping is an essential part of everyday life, especially in large supermarkets where a wide variety of products are available. However, one of the major inconveniences for customers is standing in long billing queues, which often leads to wasted time and, in some cases, billing errors. While trolleys are commonly used to make shopping more convenient, managing them while navigating crowded aisles can still be challenging. To address these issues, an automated, customer-following trolley system has been developed, designed to minimize the physical effort required by the shopper and reduce reliance on traditional billing counters.

This smart trolley system uses a web camera and RFID tag recognition to follow the customer and calculate the total bill for items placed inside. When a customer with a specific tag approach the camera detects the tag, prompting the trolley to follow the user autonomously. The integrated RFID reader and Raspberry Pi receiver inside the trolley identify and log each item added by the customer, generating the total cost in real-time. This innovation offers a streamlined and user-friendly shopping experience, eliminating the need to pull a trolley manually or wait in long queues for checkout.

III. PROPOSED WORK

In this project, we propose a Smart Trolley System designed to enhance the shopping experience by

incorporating automation, sensor integration, and a web interface. The trolley autonomously follows the customer and automatically tracks the products added to it using RFID technology. It also displays real-time product details on a web-based interface, offering a seamless, transparent, and efficient shopping experience.

Modules of the Proposed System

Microcontroller Module: Arduino Uno microcontroller is used as the central control unit. It processes inputs from sensors, controls the motors, and manages RFID communication.

Obstacle Detection Module: Ultrasonic sensors are mounted on the trolley to detect nearby obstacles and measure distances. This helps the trolley avoid collisions while navigating through the store.

User-Following Module: Infrared (IR) sensors receive signals from an IR transmitter carried by the user. This allows the trolley to track and follow the user automatically.

Mobility Module: DC motors and wheels enable autonomous movement. A motor driver module is used to control the direction and speed of the motors based on the sensor input.

Power Supply Module: The system is powered by a 3.75V Li-ion rechargeable battery, which provides efficient energy for prolonged operation without the need for external power.

Billing and Product Detection Module: An RFID reader is mounted on the trolley to scan RFID tags attached to products. When a product is added or removed, the system automatically updates the item list, quantity, and pricing.

Web Interface Module: A web-based interface is integrated with the trolley, which displays real-time product information including Product name, Quantity, price per item, Total bill

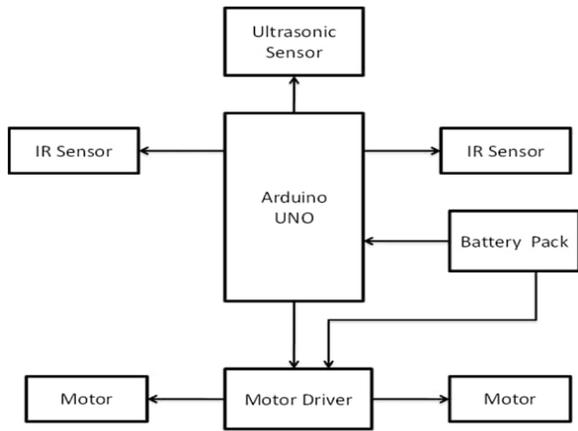


Figure 1: Block Diagram of Proposed System

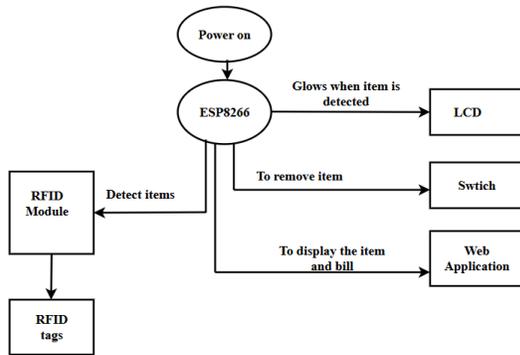


Figure 2: Working of RFID

IV. CONCLUSIONS

The human-following trolley has been successfully developed and implemented, utilizing advanced sensor technologies to track and follow a specific user without the need for manual intervention. This cost-effective solution reduces physical effort, providing enhanced convenience for users. Designed with low power consumption and affordability, the device is ideal for various environments such as malls, hospitals, and railway platforms. Taking into account the rapidly evolving trends in retail shopping, it is clear that the intelligent shopping cart is an essential tool for modern retail stores. It enables businesses to stay competitive by embracing technological advancements, ultimately saving time and reducing the need for manual labour. With the automatic-following functionality, supermarket owners can easily incorporate the system into their

shopping carts, offering users a hands-free shopping experience. As technology continues to play an increasingly vital role in consumer convenience, the intelligent shopping cart proves to be a valuable and market-ready solution for enhancing the retail experience.

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