

Smart Shopping Trolley that Follows Customer

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Abstract: *In modern supermarkets and shopping malls, customers often experience inconvenience while pushing heavy shopping trolleys during shopping. To improve the shopping experience, a Smart Shopping Trolley that follows the customer is proposed. The system is designed to automatically move behind the customer using sensors and a microcontroller-based control system. Ultrasonic sensors are used to detect the distance between the trolley and the customer as well as to identify obstacles in the path. The microcontroller processes the sensor data and controls the motors to move the trolley in the required direction while maintaining a safe distance from the customer.*

The proposed system aims to reduce physical effort and provide a convenient and efficient shopping experience. By automating the movement of the trolley, customers can focus on selecting products without worrying about pushing the cart. The system can also improve retail automation and customer satisfaction in supermarkets and shopping malls. In the future, the smart shopping trolley can be enhanced by integrating technologies such as Internet of Things (IoT), computer vision, and artificial intelligence for better tracking and intelligent navigation.

Keywords: Smart Shopping Trolley, Autonomous Shopping Cart, Ultrasonic Sensor, Customer Tracking, Retail Automation

I. INTRODUCTION

In the modern world, technology and automation are playing an important role in improving everyday activities. One of the areas where technology can greatly improve convenience is the retail and shopping sector. In supermarkets and shopping malls, customers usually use shopping trolleys to carry products while shopping. However, pushing a trolley throughout the store can become uncomfortable and tiring, especially when the trolley becomes heavy. This situation can be more difficult for elderly people, children, and physically challenged individuals. Therefore, there is a need for a smart and automated system that can assist customers during shopping.

The Smart Shopping Trolley that Follows Customer is designed to provide a convenient solution to this problem. The main idea of this system is to develop a trolley that can automatically follow the customer while maintaining a safe distance. The trolley is equipped with sensors, a microcontroller, motor drivers, and motors that allow it to move automatically according to the customer's movement. Ultrasonic sensors are used to measure the distance between the trolley and the customer and also to detect obstacles in the path. The microcontroller processes the data received from the sensors and controls the motors to move the trolley forward, stop, or change direction when required.

This system works based on the principle of sensor detection and automated control. When the customer moves forward, the sensor detects the increased distance and sends a signal to the microcontroller. The microcontroller then activates the motors so that the trolley moves forward and follows the customer. If the customer stops, the trolley also stops automatically. If an obstacle appears in the path, the sensors detect it and the system prevents collision by stopping or changing direction. This ensures safe and smooth movement of the trolley inside the shopping environment. The development of a smart shopping trolley also supports the concept of smart retail and automation. Many supermarkets and retail stores are adopting modern technologies to improve customer satisfaction and operational efficiency. The implementation of an automated trolley system can reduce the effort required by customers and provide



a better shopping experience. It can also help store management in organizing trolley usage and improving customer service.

In the future, this system can be further improved by integrating advanced technologies such as the Internet of Things (IoT), computer vision, and artificial intelligence. These technologies can help the trolley recognize customers more accurately, navigate complex environments, and communicate with store systems for features like automatic billing and product information. Thus, the Smart Shopping Trolley that Follows Customer represents an innovative step toward intelligent retail solutions and enhanced customer convenience.

II. LITERATURE SURVEY

Many researchers have worked on smart shopping trolley systems to improve the shopping experience in supermarkets and retail stores. Traditional shopping methods often require customers to push heavy carts and wait in long queues for billing. To overcome these problems, different technologies such as **RFID, IoT, sensors, and mobile applications** have been proposed to automate the shopping process and reduce manual effort.

A study on **RFID-based smart shopping trolleys** proposed a system where each product contains an RFID tag and the trolley has an RFID reader. When a product is placed in the trolley, the system automatically detects it and updates the bill on a display screen. This approach helps reduce billing time and avoids long queues at checkout counters. The system typically uses components such as Arduino, RFID readers, LCD displays, and wireless communication modules to manage shopping data and send billing information to the store database.

Another research work focused on **IoT-based smart shopping carts**, where the trolley is connected to the internet and communicates with the store's server. In this system, customers can scan products while shopping and the total bill is updated automatically. The integration of IoT allows real-time data communication between the trolley and the store system, improving shopping efficiency and reducing human errors during billing.

Some researchers have also developed **intelligent or automated shopping carts** that combine sensors and robotic technologies. These systems use ultrasonic sensors, cameras, or smartphone sensors to detect the position of the customer and navigate the trolley automatically. The trolley behaves like a mobile robot that can follow the user and avoid obstacles while moving through the store. Such systems improve customer convenience by reducing the need to push or pull the cart manually.

Recent developments in smart retail systems focus on creating fully automated shopping environments where smart carts, mobile applications, and backend systems work together. These systems aim to improve customer experience, reduce waiting time, and enhance operational efficiency in supermarkets. Advanced technologies such as artificial intelligence, computer vision, and recommendation algorithms are also being explored to provide personalized shopping assistance and smarter retail environments.

Overall, the literature shows that smart shopping trolley systems can significantly improve the retail shopping experience by introducing automation, reducing billing time, and increasing convenience for customers. However, many existing systems still focus mainly on automatic billing rather than autonomous movement. Therefore, the proposed **Smart Shopping Trolley that Follows Customer** aims to improve these systems by introducing automatic customer-following functionality using sensors and microcontroller-based control.

III. SCOPE OF THE PROJECT

The scope of the **Smart Shopping Trolley that Follows Customer** project is to design and develop an intelligent shopping trolley that can automatically follow the customer while shopping in supermarkets and retail stores. The main objective of this project is to reduce the physical effort required to push a trolley manually and provide a more comfortable and efficient shopping experience. By using sensors and automated control systems, the trolley can detect the movement of the customer and move accordingly while maintaining a safe distance.

This project mainly focuses on the integration of **sensor technology, microcontroller-based control, and motor-driven movement** to create an automated trolley system. Ultrasonic sensors are used to detect the distance between the



trolley and the customer and also to identify obstacles in the path. The microcontroller processes the data received from the sensors and controls the motor driver to move the trolley in the desired direction. If the customer moves forward, the trolley follows the customer. If the customer stops, the trolley also stops automatically. In case of obstacles, the system detects them and prevents collisions by stopping or changing direction.

Functional Scope

The functional scope describes the main functions and operations performed by the **Smart Shopping Trolley that Follows Customer** system.

1. Customer Following Function:

The primary function of the system is to allow the trolley to automatically follow the customer while shopping. The trolley detects the movement of the customer and moves in the same direction.

Distance Detection:

The system uses ultrasonic sensors to measure the distance between the trolley and the customer. This helps the trolley maintain a safe distance while following the customer.

Obstacle Detection:

The system is capable of detecting obstacles in the path using sensors. When an obstacle is detected, the trolley stops or changes direction to avoid collision.

Automatic Movement Control:

The microcontroller processes sensor data and controls the motors of the trolley. The trolley can move forward, stop, or change direction depending on the customer's movement.

Safe Operation:

The system ensures safe operation by stopping automatically if the customer stops or if an obstacle is detected.

2. Non-Functional Scope

The non-functional scope describes the quality requirements and performance characteristics of the system.

Reliability:

The system should work consistently and accurately follow the customer without frequent errors.

Safety:

The trolley must detect obstacles properly and prevent accidents or collisions inside the shopping area.

Efficiency:

The system should respond quickly to the customer's movement and provide smooth trolley operation.

Usability:

The trolley should be easy to use by customers of all age groups without requiring special instructions.

Low Power Consumption:

The system should consume minimal power so that the battery can operate for a longer duration.

Cost-Effectiveness:

The design should use affordable components so that the system can be easily implemented in supermarkets.

Scalability:

The system should allow future improvements such as IoT connectivity, automatic billing, and smart navigation.

IV. METHODOLOGY / APPROACH

The methodology of the **Smart Shopping Trolley that Follows Customer** project is implemented in a step-by-step process to design, develop, and test the automated trolley system.



Step 1: Problem Identification and Requirement Analysis

The first step is to identify the problem faced by customers while pushing heavy shopping trolleys in supermarkets and shopping malls. The requirement is to design a smart trolley that can automatically follow the customer and reduce manual effort during shopping.

Step 2: System-Design

In this step, the overall design of the system is prepared. The required components such as microcontroller, ultrasonic sensors, motor driver, DC motors, wheels, and power supply are identified. A block diagram is created to show the connection and working of each component in the system.

Step 3: Hardware-Implementation

The selected components are assembled on the trolley. Ultrasonic sensors are installed for distance measurement and obstacle detection. The microcontroller is connected to the motor driver and DC motors to control the movement of the trolley.

Step 4: Programming and System Integration

The microcontroller is programmed to process the signals received from the sensors. Based on the distance and obstacle detection, the program controls the motors so that the trolley follows the customer while maintaining a safe distance.

Step 5: Testing & Evaluation

Finally, the system is tested to ensure that the trolley correctly follows the customer and detects obstacles in the path. The performance of the system is evaluated, and necessary improvements are made to ensure reliable operation.

V. OUTPUT



VI. ADVANTAGES

Reduces Physical Effort

The smart shopping trolley reduces the need for customers to manually push heavy carts, making shopping easier and more comfortable.

Improves Shopping Convenience

Since the trolley automatically follows the customer, users can focus on selecting products without worrying about moving the cart.

Enhances Customer Experience

The automated trolley provides a modern and innovative shopping experience in supermarkets and malls.

Obstacle Detection for Safety

The system uses sensors to detect obstacles in the path and prevents collisions, ensuring safe operation inside the shopping area.

Time Efficient

Customers can move freely around the store without managing the trolley manually, which makes shopping faster and more efficient.

Useful for Elderly and Physically Challenged People

The system helps elderly people and individuals with physical limitations by reducing the effort required to carry or push heavy items.

VII. APPLICATIONS

Supermarkets

The smart shopping trolley can be used in supermarkets to help customers carry products easily without pushing heavy carts manually.

Shopping Malls

In large shopping malls, the trolley can automatically follow customers while they shop, making the shopping process more convenient.

Retail Stores

Retail stores can implement smart trolleys to improve customer experience and introduce automation in their shopping systems.

Smart Retail Environments

The system can be part of modern smart retail systems where automation and technology are used to improve store management and customer services.

Large Commercial Shopping Centers

In large shopping complexes where customers purchase many items, the smart trolley can help transport goods easily by following the customer automatically.

Assistance for Elderly and Physically Challenged People

The smart trolley can assist elderly customers or people with physical difficulties by reducing the effort required to move heavy shopping carts.



VIII. CONCLUSION

The **Smart Shopping Trolley that Follows Customer** is an innovative system designed to improve the shopping experience in supermarkets and retail stores. The main objective of this project is to reduce the physical effort required to push a shopping trolley by enabling it to automatically follow the customer. By using technologies such as ultrasonic sensors, microcontrollers, motor drivers, and DC motors, the system can detect the movement of the customer and control the trolley accordingly.

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