



AUTONOMOUS RETAIL CART WITH SMART BILLING AND FOLLOW ME FUNCTIONALITY

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ABSTRACT

This project presentation the design, development, and implementation of “AUTONOMOUS RETAIL CART WITH SMART BILLING AND FOLLOW ME FUNCTIONLITY” equipped with IoT capabilities for enhanced control and functionality. The primary objective of the proposed system is to create interaction between humans and robots, facilitating effortless item retrieval while adapting to dynamic environmental conditions. The robot's architecture comprises state-of-the-art hardware components including sensors, actuators, and processing units, seamlessly integrated with IoT modules for real-time communication and control. Advanced computer vision algorithms enable the robot to recognize and track human movements, ensuring precise following behavior even in crowded or complex environments. The IoT integration enables remote control and monitoring of the robot's operations, providing users with the flexibility to initiate and customize item retrieval tasks through web or mobile interfaces. Additionally, the system incorporates machine learning techniques for personalized item recommendations based on user preferences and historical data. Furthermore, the paper discusses the implementation challenges and the strategies employed to overcome them, including sensor fusion techniques for robust perception, efficient path planning algorithms for obstacle avoidance, and secure communication protocols for IoT connectivity. Through experimental validation in real-world scenarios, the effectiveness and reliability of the proposed human-following robot system are demonstrated.

I.INTRODUCTION

Shopping mall is a place where people get their daily necessities ranging from food products, clothing, electrical appliances etc. Sometimes customers have problems regarding the incomplete

information about the product on sale and waste of unnecessary time at the billing counters. Continuous improvement is required in the traditional billing system to improve the quality of shopping experience to the customers. Now day's numbers of large as well as small shopping malls has increased throughout the global due to increasing public demand & spending. At the time of festivals, special discounts, holidays, etc. there is a huge rush in shopping malls

II. METHODOLOGY

The methodology that we propose is based on the idea of creating an automatic billing system while shopping made possible using RFID assisted by other IOT based technologies. All the products in the shopping malls or supermarkets are provided a unique RFID tag instead of a barcode. Each shopping trolley has its own setup which contains an RFID reader, a servo motor along with a door, ESP module, a push button to make payments or cancel orders, and an LCD screen to display all information related to the item. Each tag is fitted with a microchip that is used for storing the number as well as a coil which is used as an antenna for the radiation of information through radio-frequency waves.

III. PROBLEM FIND OUT

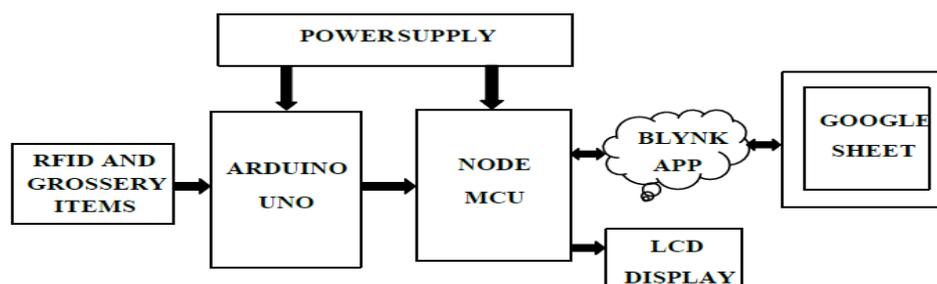
The working class and most of our community prefers to go to malls or supermarkets and get their shopping done. Due to increasing populations, shopping is a cumbersome process as one has to wait in long queues to get their processing done. Clearly, it is a waste of time and a tedious affair. The major problem lies with the system of barcodes where every item is being scanned individually which makes the process slow and time consuming. RFID based shopping cart is a new way of shopping and avoiding long queues.

IV. PROPOSED SYSTEM

In this proposed system, each product will have a passive Radio Frequency ID tag which is bearing a unique Electronic Product Code. When the customer puts the product in the Smart Trolley, the Radio Frequency ID reader scans the tag and the Electronic Product Code number is generated. Radio Frequency ID reader passes the Electronic Product Code to the microcontroller.

The name and price of the product obtained by the controller gets displayed on the LCD of the Smart Trolley, where client can see the item data. The customers have to add the products after a short scan in the trolley and when they're done, the amount will be displayed in the trolley. The customer can also log in to the app which will display the list of all the products added and their amount. Once done, the customer can pay digitally through the Blynk app; thus, cutting down on the time that would be otherwise spent in long queues and relieve them from the tediousness of scanning bar codes.

V. BLOCK DIAGRAM



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VI. RESULT AND DISSCUSSION

In this proposed paper, a secure smart shopping system utilizing RFID technology is employed in enhancing shopping experiences and security issues. The smart shelves are able to monitor the items on the shelves by reading the RFID signals from the tags. The smart carts are able to read and retrieve information of the items inside the carts and finally, the checkout points can validate the purchase made by a customer. This concept has erased the tradition of customer relying on the shopkeeper for acquiring information about products. Billing is completely avoided which in turn saves time for the customer and makes process easy for shopkeeper. It avoids queue for customer since billing is completed in the trolley.

VII. CONCLUSSION & FUTEREXTENSION

The Smart Trolley using RFID technology is an innovative solution aimed at enhancing the shopping experience by automating the checkout process. This system eliminates the need for manual scanning of items at the billing counter, thereby reducing time spent in queues and improving overall shopping efficiency. By integrating RFID tags and readers, the trolley automatically identifies products as they are placed in the cart, provides real-time updates on the total cost, and allows for seamless payment processing.

The Smart Trolley demonstrates the potential of RFID technology to transform retail by automating checkout processes and streamlining the shopping experience. It offers benefits like reduced labor costs, fewer billing errors, and enhanced operational efficiency. Future enhancements could include integrating IoT for inventory management, GSM modules for mobile billing, and robotic arms for automated item handling. Features like voice assistance and online payment systems further elevate customer convenience and accessibility.

VIII. SENSOR MODEL

Ultrasonic Sensor

It is a digital sensor, and we can use it to determine the water level and relay the results to a Raspberry Pi. An ultrasonic sensor is a piece of technology that uses ultrasonic sound waves to measure a target object's distance and then turns the sound that is reflected back into an electrical signal. The speed of audible sound is greater than the speed of ultrasonic waves (i.e. the sound that humans can hear)

IR Sensor

A detector that responds to infrared (IR) radiation is known as an infrared detector. Thermal and photonic detectors are the two primary types (photodetectors). Numerous temperature-dependent events allow us to follow the thermal impact of the incident IR radiation. Changes in resistance are the basis of bolometers and micro-bolometers. The thermoelectric effect is used by thermocouples and thermopiles. Thermal expansion is followed by Golay cells. The most common type of detector used in IR spectrometers is the pyroelectric one

12v-Power Supply

It takes a 170-230 volt AC input and outputs 12 V DC at 400 mA of current. The Arduino Uno and Motor Driver are powered by it. For operation, all electronic circuits require a DC power supply with a sufficient voltage

Working of System

When a customer approaches a smart trolley and turns it on, the trolley will start to follow the user no matter which direction they are walking in and will also detect any obstacles in its path. The Arduino Uno, ultrasonic sensor, and infrared sensor used in this system. The model uses an ultrasonic sensor to detect people. With a range in the prototype of between 30 cm and 100 cm. The model uses two IR sensors to direct (turn) the trolley: a left-side IR sensor and a right-side IR sensor.

IX. FUTURE DEVELOPEMENT

The Smart Trolley equipped with RFID technology is revolutionizing the shopping experience by automating checkout processes and eliminating queues at billing counters. This system simplifies retail operations, improves efficiency, and enhances customer convenience. RFID tags seamlessly interact with trolley readers to identify products, calculate costs, and enable smooth payment processing in real time.

Additional features like GSM modules for mobile billing and built-in payment systems make transactions effortless. Robotic arms for item handling and voice assistance create an intuitive and accessible user experience. IoT integration can further unlock capabilities like inventory tracking, customer analytics, and personalized offers. By reducing labor costs and minimizing errors, this innovation benefits both customers and retailers significantly. The Smart Trolley represents a leap forward in modernizing the retail industry to meet growing automation demands.

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