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Development of Smart Shopping Trolley Using RFID Data Module

Prof. S. A. Bagal[1], Rohini J. Bisen[2], Prajakta N. Ramteke[3], Yash U. Mate[4]
[1]*Assistant professor, Dept. of Electronics and Telecommunication, K.D.K. College of Engineering, Nagpur*
[2, 3, 4]*Student, Dept. of Electronics and Telecommunication, K.D.K. College of Engineering, Nagpur*

Abstract: ***In today's technological age, most customers must stand in line at the supermarket to shop because it is a time-consuming process. Because of a barcode-based billing method, a large population in the supermarket during discount offers or weekends causes problems with long lines. The Smart Shopping System with RFID Data Module is a revolutionary approach to enhance the traditional shopping experience by incorporating Radio-Frequency Identification (RFID) technology. This project aims to streamline and optimize the shopping process, making it more efficient, convenient, and personalized for both retailers and consumers. Each product is equipped with an RFID tag containing unique identification information, allowing for seamless monitoring and management throughout the supply chain. This project proposes a smart way for people to bill their products while they shop and it provides an android application based smart trolly assistant for people to navigate in big shopping malls.***
Keywords: RFID reader; RFID tags; Arduino Micro-controller; Bluetooth Module; Switch; LCD Display etc.

I. INTRODUCTION

In the fast-paced world of retail, technological innovations continually redefine the shopping experience, making it more efficient, personalized, and interconnected. The smart shopping system with RFID data module is a groundbreaking project that leverages radio-frequency identification (RFID) technology to revolutionize the traditional shopping process. RFID, with its ability to wirelessly identify and track objects, offers a transformative solution for inventory management, customer engagement, and overall retail efficiency. Traditional retail systems often face challenges such as inaccurate inventory management, time-consuming checkout processes, and limited means of personalizing customer experiences. The integration of RFID technology addresses these challenges by providing real-time data and insights that enhance various aspects of the shopping journey.

RFID involves the use of small electronic tags, or RFID tags, attached to products, which can be wirelessly read by RFID readers. Each tag contains a unique identifier, enabling precise tracking and management of individual items. RFID is known for its speed, accuracy, and the ability to operate without direct line-of-sight, making it a powerful tool for the retail environment.

The Smart Shopping System with RFID Data Module project represents a paradigm shift in the retail landscape, promising a more connected, efficient, and customer-centric shopping experience. By harnessing the power of RFID technology, this project addresses longstanding challenges in the industry and sets the stage for a smarter and more sophisticated retail environment.

The main objective of our project is to provide a technology oriented, easily scalable system for assisting shopping in-person. Each product in the supermarket is attached with an RFID tag, the tag contains the details of the product including product id, brand name, price of the product, manufacturing date, expiry date etc.

The RFID reader module is installed on the shopping trolley. When a registered user comes to the supermarket, he/she login to the corresponding trolley taken buy them using the mobile application installed on their mobile.

II. PROBLEM IDENTIFICATION

Technology innovation is evolving at an exponential rate in this quickly changing world. Many businesses are investing in research and development to assure consumer happiness at all levels.

Shopping carts, which also are commonly referred to as shopping trolleys are a way of transportation of products temporarily before cashing out. Since their inception, shopping carts have seen very minor modifications.

The majority of the expansions have been made to change the capacity and weight of the cart. However, as technology advances, some of the company's research has resulted in the development of a customer-friendly shopping system.

In this project, the information of the product like price will be stored in the RFID tag which is attached to the product.

We have to scan the RFID tag using the reader and then the details of the product which is stored in the tag will be read by the reader and the information will be sent to the application in the mobile through the Bluetooth module.

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III. PROPOSED SYSTEM

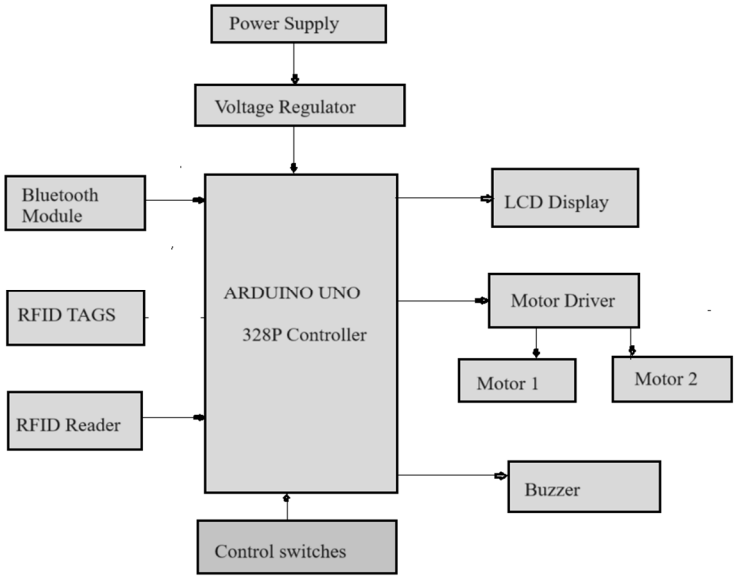

Fig. 1. Block Diagram of system

Our proposed method introduces automatically moving trolley. The trolley has a robotic structure**.** The proposed method has RFID tag and reader, Bluetooth module, Driver IC and DC motor.
The DC motor is attached to the trolley, which is used to move the robot to reach the exact location of the product in the shopping mall.
The Bluetooth module is used to drive the trolly in any direction. Also it used to monitor all updates from shopping trolly.
The proposed system has the feature of automatic billing when a customer carries a trolley full of items through RFID tag and reader.
All products have unique id, with that code it will identify the product price and generates the bill automatically through internet.
The objective is to create a smart shopping trolley system using RFID technology to automate item tracking, cost calculation, and checkout processes.
This system aims to enhance the shopping experience for customers, improve operational efficiency for retailers, and offer personalized promotions based on customers shopping history.

IV. COMPONENTS SPECIFICATION

1) Adapter
2) Battery
3) Power supply unit
4) Bluetooth module
5) Arduino controller
6) LCD Display
7) Motor Driver
8) DC Motor
9) RF ID Tags
10) RF ID reader
11) Buzzer
12) Wheels
13) Frame
14) Others

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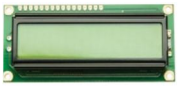
A. Arduino Uno (12v)

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

B. LCD Display (5v)

A liquid crystal display (LCD) is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures.

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs).



C. 12 v Battery

12 V , 2 Amp Battery is high power battery easily handle all the function.

Main things are to collect electrical energy from solar panel and provide to various components For running specific function.

D. Bluetooth module (HC-05)

The **HC-05** is a very cool module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop.

E. DC Motor

DC motor is an electrical machine that utilizes electric power resulting in mechanical power output. Normally the motor output is a rotational motion of the shaft. The input may be direct current supply or alternating supply. But in case of DC motor direct current is used.

F. Motor Driver IC (L293D)

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal.

This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits.

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G. RFID Reader Module

EM-18 RFID scanner module uses an RFID reader which will read a hundred twenty-five kilohertz tags. So, it will be known as a low-frequency RFID reader. It offers out a serial output and contains a range of 8- 12 cm. They convert radio waves returned from the RFID tag into a type of signal that will be passed on to Controllers, which can make use of it. RFID tags and readers need to be tuned to a similar frequency for communication.

H. RFID Tag

An RFID reader is a device used to gather data from an RFID tag that is employed to trace individual objects. Radio waves are used to transfer signals from the tag to a reader. The RFID tag should be among the range of an RFID reader, which ranges from three to a few hundred feet, so on be scan. RFID tags haven't replaced bar codes thanks to their price and therefore they have to singly determine each item.

V. RESULTS AND DISCUSSION

After the Bluetooth pairing with shopping trolly, the control command is passed from the android Bluetooth controller app to the Arduino. For example, if the person wants to navigate to trolly from his smartphone, it can easily navigate. After the trolley navigates to expected session the person can start purchasing. When the tag on the product is placed on the RFID reader the amount of the respective product is added to the total amount of purchased products. If the person wishes to remove product from the trolley he can again scan the product on the RFID reader so that the amount of the removed product will be deducted from the total amount of purchase. This project “Smart Cart Using RFID Technology” provides ease for shopping for the customers. It also consume less time when compared to regular billing technique. Customer need not want to wait in a long queue. Stock management can be monitored easily. Customer can purchase items with in their wallet balance as the total bill is displayed in the LCD display. This system is more reliable, also it doesn’t require special training. This system reduce the number of salesmen. It accomplishes both customers and shopkeeper demand.

VI. ADVANTAGES

1) *Improved Shopping Experience:* The system enhances the shopping experience by eliminating the need for manual scanning and providing real-time updates on the total cost of items in the trolley.
2) *Operational Efficiency:* By automating item tracking, cost calculation, and checkout processes, the system improves operational efficiency for retailers, reducing waiting times for customers and streamlining operations.
3) *Real-time Inventory Management:* The integration with the store's inventory management system allows for real-time tracking of stock levels and helps retailers manage their inventory more effectively.
4) *Personalized Promotions:* The system offers personalized promotions and recommendations based on customers shopping history, increasing customer engagement and loyalty.
5) *Data Security:* Robust security measures protect customer information stored in the system, ensuring data security and privacy.

VII. CONCLUSION

The "Smart Shopping Trolley Using RFID Data Module and Bluetooth technology" project represents a significant advancement in retail technology, aiming to enhance the shopping experience for customers and improve operational efficiency for retailers. By leveraging RFID technology, the system automates key aspects of the shopping process, including item tracking, cost calculation, and checkout, leading to a more convenient and efficient shopping experience. It also consume less time when compared to regular billing technique. This system is more reliable, also it doesn’t require special training. This system reduce the number of salesmen. It accomplishes both customers and shopkeeper demand.

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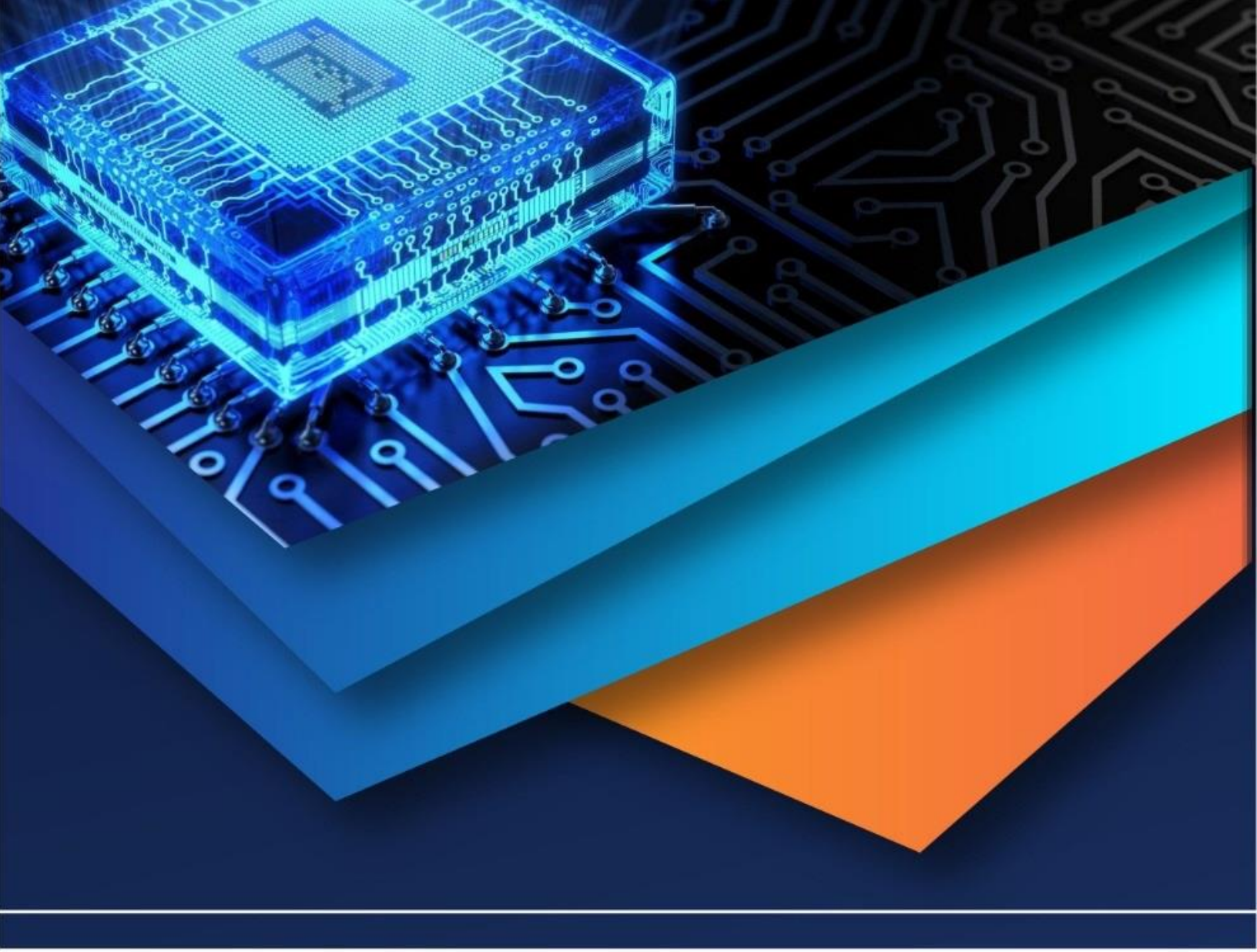

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