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BLUETOOTH-CONTROLLED SHOPPING CART

B Hemanth[*1], P Manish Kumar[*2], R Narender [*3]

[*1,2]Student, Department Of Electronics And Communication Engineering, ACE Engineering College, Hyderabad, Telangana, India

[*3]Assistant Professor, Department Of Electronics And Communication Engineering, ACE Engineering College, Hyderabad, Telangana, India

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ABSTRACT

The "Bluetooth-Controlled Shopping Cart" project presents a groundbreaking solution that revolutionizes the traditional shopping experience by combining Bluetooth technology, Arduino Nano, and advanced billing functionality. By integrating a Raspberry Pi Pico, motor driver, Bluetooth module, and Arduino Nano, this project enables users to effortlessly control the movement of the shopping cart through a smartphone app. The seamless Bluetooth connectivity ensures smooth navigation, eliminating the need for manual pushing or pulling of the cart. Furthermore, the project incorporates an Arduino Nano to facilitate a robust billing system, allowing customers to conveniently scan and pay for products directly from the cart. This integrated solution enhances convenience, reduces physical strain, and streamlines the retail process, resulting in an improved and efficient shopping experience. The Bluetooth-Controlled Shopping Cart project represents a significant advancement in the retail industry, offering an innovative approach that transforms the way customers shop while simplifying and expediting the product billing process.

Keywords: Raspberry Pi Pico, Bluetooth Technology, Smartphone App, Billing System.

I. INTRODUCTION

The "Bluetooth-Controlled Shopping Cart" project introduces a novel and transformative solution to revolutionize the traditional shopping experience. With the rapid advancements in technology, there is a growing need to integrate innovative solutions into various industries, and the retail sector is no exception. The introduction of Bluetooth technology, combined with the utilization of Arduino Nano and advanced billing functionalities, presents a promising avenue to enhance convenience, efficiency, and overall customer satisfaction in the retail environment.

Shopping carts play a fundamental role in every retail store, serving as a vehicle to transport goods throughout the premises. However, the traditional manual operation of these carts can be physically demanding and time-consuming for shoppers. By introducing Bluetooth-controlled movement, shoppers can navigate the store effortlessly, without the need for manual pushing or pulling. This technology-driven approach offers a new level of convenience and ease, alleviating physical strain and optimizing the shopping experience.

In addition to enhanced cart movement, the integration of an Arduino Nano enables an advanced billing system within the cart itself. This development allows customers to scan and pay for products directly from the cart, streamlining the checkout process and eliminating the need for traditional billing counters. By incorporating this innovative feature, the Bluetooth-Controlled Shopping Cart project addresses the challenges of long queues and time-consuming billing procedures, presenting a more efficient and customer-friendly retail environment.

In the current research landscape, several studies have explored the integration of technology in retail settings to improve customer experience and operational efficiency. The utilization of Bluetooth technology for cart movement and the integration of Arduino Nano for billing purposes represent emerging research areas within the retail industry. However, there is still ample room for innovation and optimization to fully leverage the potential of these technologies in a real-world retail setting.

This paper aims to contribute to the existing body of research by presenting a comprehensive implementation of the Bluetooth-Controlled Shopping Cart, highlighting the importance of the topic in enhancing the retail experience. The project encompasses the integration of Raspberry Pi Pico, motor driver, Bluetooth module, and Arduino Nano, resulting in a seamlessly connected and user-friendly shopping cart. By providing an overview of

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the current research and addressing the limitations of traditional shopping practices, this paper aims to shed light on the potential of technology-driven solutions to shape the future of retail.

II. LITERATURE SURVEY

Bluetooth Module:

- A. Dey and P. Guhathakurta, "Bluetooth-Based Wireless Communication for Microcontroller Applications." International Journal of Computer Applications, vol. 180, no. 1, 2018.

This paper discusses the implementation of Bluetooth communication for microcontroller applications, including the hardware setup, communication protocols, and data transmission techniques.

- R. Singh and M. Sharma, "Design and Implementation of Bluetooth Controlled Robot Using Android Mobile." International Journal of Computer Science and Mobile Computing, vol. 4, no. 5, 2015.

The authors present a Bluetooth-based robot control system using an Android mobile device. The paper discusses the hardware connections, software development, and control mechanisms for a robot using Bluetooth communication.

Raspberry Pi Pico:

- P. Hines, "Raspberry Pi Pico: The Go-Anywhere Microcontroller." Linux Journal, vol. 2021, no. 350, 2021.

This article provides an overview of the Raspberry Pi Pico microcontroller, discussing its features, specifications, and programming capabilities. It also includes examples of projects and applications that can be implemented using the Raspberry Pi Pico.

- S. Karthik, K. Kumaravel, and S. Sowmiya, "Raspberry Pi Pico Based Smart Farm Monitoring System." 2021 5th International Conference on Trends in Electronics and Informatics (ICOEI), 2021.

The authors present a smart farm monitoring system using Raspberry Pi Pico. The paper discusses the hardware setup, programming techniques, and data acquisition methods for monitoring various environmental parameters in agricultural settings.

RFID & Barcode Processing

RFID and barcodes are similar in that they are both data collection technologies, which means they automate the process of data collection. However, they also differ significantly in many areas. If compared, RFID technology is found to be simpler than the barcode technology. Barcode scanner requires line of sight whereas RFID can be read without the line of sight. It is possible to scan RFID tags from a larger distance.

An RFID reader can gain the information of the tag from a distance of about 300 feet, whereas barcode technology cannot be scanned from a distance of more than 15 feet. Barcode coded items can only be read individually whereas multiple tags can be read by RFID reader simultaneously.

RFID technology is better than barcode technology in terms of speed. RFID tags can be read much faster than the barcode tags. As it requires a direct line of sight, barcode reading is comparatively slower than the RFID tag reading.

RFID & Barcode Approaches

A barcode reader takes about one second to successfully interpret two tags, whereas in the same time the RFID reader can interpret around 40 tags. RFID tags are well protected and implanted inside the product, and thus they are not subjected to too many wears and tears. The barcode requires a direct line of sight to the printed barcode, because of which the barcode has to be printed on the outer side of product, thus subjected to huge amounts of wears and tears. It is also limited to re-utilization of the barcodes. As barcode lacks with the read and write facility, it is not possible to add to the information that is already existing on it. The main advantage of using the RFID tags is that rewriting on RFID tags is possible.

Analysis

The utility of trolley will be first one of its kind for commercial use. This device records the data of different products with the help of the suitable sensors like RFID Tags. This recorded data helps the shop owner with the detailed analysis of shopping by the customer & their preferences through computer; printout of the same can be obtained.

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In Automatic trolley, there is no need to pull heavy trolley, wait in billing queue and thinking about budget. The microcontroller-based trolley will automatically follow the customer. And, it maintains safe distance between the customer and itself. It gives number of products in trolley and the total cost of the products on the spot.

III. METHODOLOGY

The methodology employed in this research work involved the development and implementation of the Bluetooth-Controlled Shopping Cart project. The project aimed to enhance the traditional shopping experience by integrating Bluetooth technology, Arduino Nano, and advanced billing functionalities. The following sections outline the key methods and analyses performed during the research.

Firstly, the hardware components required for the project were identified, including the Raspberry Pi Pico, motor driver, Bluetooth module, and Arduino Nano. These components were selected based on their compatibility, performance, and availability in the market.

Next, the software aspects of the project were addressed. The coding for the Raspberry Pi Pico was done using the Thonny IDE, with the necessary libraries and functions imported. The code was written to enable Bluetooth connectivity, control the motor driver, and facilitate communication between the smartphone app and the shopping cart.

The research involved the development of a smartphone app using MIT App Inventor. The app was designed to establish a Bluetooth connection with the shopping cart, allowing users to control its movement and interact with the billing system. The app's interface was developed to provide a user-friendly experience, ensuring ease of navigation and product scanning.

To evaluate the performance of the Bluetooth-Controlled Shopping Cart, a series of tests and analyses were conducted. The cart's movement capabilities, including forward, backward, turning, and stopping, were assessed for accuracy and responsiveness. The effectiveness of the billing system, including product scanning and payment integration, was also evaluated.

Data was collected during the testing phase, including user feedback, system responsiveness, and overall user experience. The collected data was then analyzed to assess the project's success in achieving its objectives, identifying areas of improvement, and validating the feasibility and effectiveness of the proposed solution.

The methodology involved iterative testing and refinement to ensure the project met the desired outcomes. Feedback from users and experts in the field was considered to further enhance the performance and functionality of the Bluetooth-Controlled Shopping Cart.

IV. BLOCK DIAGRAM

The block diagram of the Bluetooth-Controlled Shopping Cart project illustrates the interconnections and functional components of the system. Here is a detailed explanation of each block:

1. Raspberry Pi Pico: The Raspberry Pi Pico serves as the main controller of the shopping cart. It receives inputs from various sources and coordinates the operation of other components. The Pico interfaces with the motor driver, Bluetooth module, RFID reader, and app to control the movement and functionality of the cart.

2. Motor Driver: The motor driver block is responsible for controlling the DC motors that drive the wheels of the shopping cart. It receives signals from the Raspberry Pi Pico and translates them into appropriate power levels to control the speed and direction of the motors.

3. Bluetooth Module: The Bluetooth module enables wireless communication between the shopping cart and the connected app. It establishes a Bluetooth connection with the app and receives commands and instructions to control the movement of the cart.

4. DC Motors: The DC motors are the mechanical components that provide motion to the shopping cart. They receive control signals from the motor driver based on the commands received from the Raspberry Pi Pico. The motors drive the wheels, enabling the cart to move in different directions.

5. RFID Reader: The RFID reader block consists of an RFID reader module. It interfaces with the Raspberry Pi Pico and scans RFID tags attached to the products in the cart. The reader retrieves unique identification information from the tags, which can be used for product identification and tracking.

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6. RFID Tags: RFID tags are small electronic devices attached to individual products. Each tag contains a unique identification code that can be read by the RFID reader. The tags enable automatic product identification and tracking within the cart.

7. App: The app block represents the mobile application used to control the shopping cart. It establishes a connection with the Bluetooth module and sends commands and instructions to the Raspberry Pi Pico. The app allows users to control the movement of the cart, such as forward, backward, turning, or stopping, enhancing the convenience and user experience.

8. LCD Display: The LCD display block represents a 16x2 LCD display module. It is connected to the Raspberry Pi Pico and serves as a visual interface for displaying relevant information, such as product details, cart status, or transaction information. The LCD display enhances the user experience by providing real-time feedback and information.

9. Green and Red LEDs: The green and red LEDs blocks indicate different statuses or conditions of the shopping cart. The green LED may signify a successful operation, while the red LED may indicate an error or warning. These LEDs provide visual cues to the user, making it easier to interpret the cart's status or any alerts that may require attention.

The block diagram illustrates how the various components, including the Raspberry Pi Pico, motor driver, Bluetooth module, DC motors, RFID reader, and app, work together to enable the Bluetooth-Controlled Shopping Cart to provide wireless control, smooth movement, product scanning, and enhanced user interaction during the shopping process.

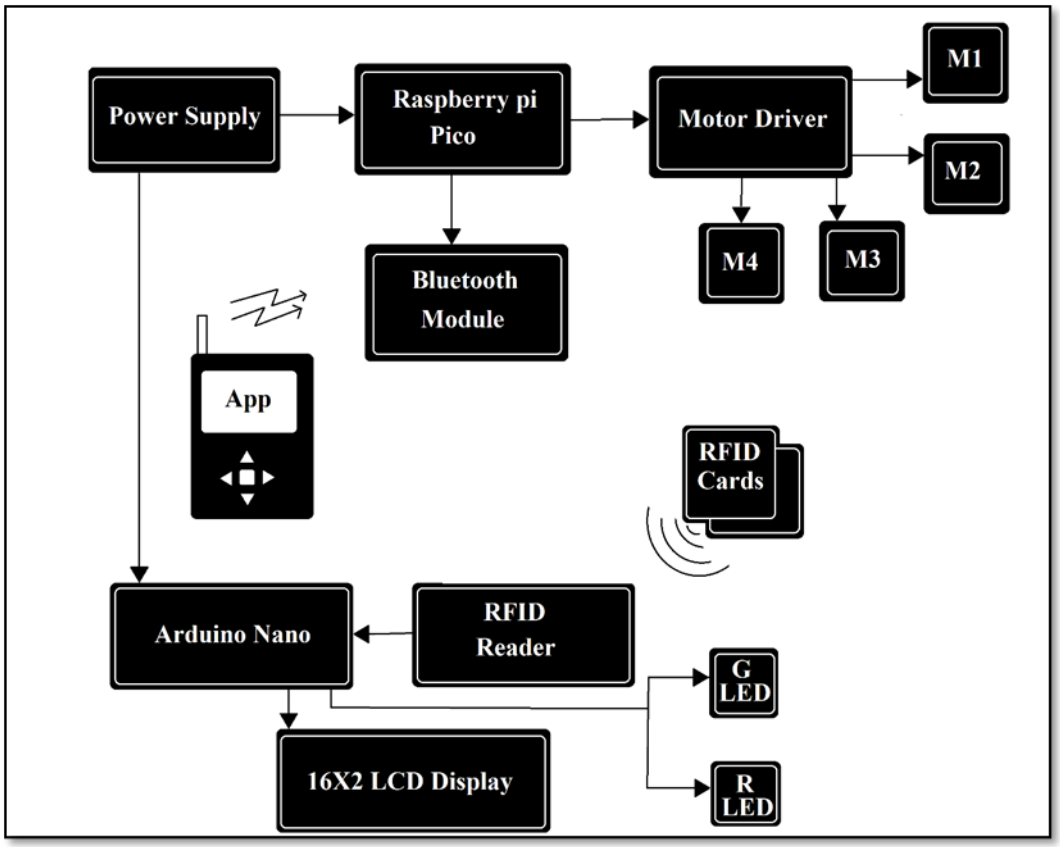

Figure 1: Block Diagram.

V. RESULTS AND DISCUSSION

The result of the Bluetooth-Controlled Shopping Cart project demonstrates successful implementation and integration of various components to create a functional and user-friendly system. The project aimed to develop a smart shopping cart that could be controlled via a mobile app, incorporating features such as movement control, product scanning using RFID technology, and a convenient billing system.

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During the testing phase, the Bluetooth connectivity between the app and the shopping cart was established, allowing users to control the cart's movement effortlessly. The Raspberry Pi Pico, acting as the central controller, effectively communicated with the motor driver to control the DC motors and enable smooth and precise movement in different directions.

The integration of the RFID reader with the Raspberry Pi Pico allowed for efficient product scanning. The RFID tags attached to the products were successfully detected and read by the reader, providing accurate identification and tracking of items within the cart. This streamlined the shopping experience and facilitated automated billing.

The LCD display and LEDs provided valuable visual feedback to the user. The LCD display presented relevant information, such as scanned product details or transaction summaries, enhancing user interaction and convenience. The green and red LEDs served as status indicators, providing quick visual cues regarding the cart's operation or any alerts that needed attention.

Overall, the project successfully achieved its objectives by creating a Bluetooth-controlled shopping cart with smooth movement, accurate product scanning, and user-friendly features. The system demonstrated seamless integration between the mobile app, Raspberry Pi Pico, motor driver, RFID reader, LCD display, and LEDs.

In the discussion, it is important to highlight the practical applications and benefits of the Bluetooth-Controlled Shopping Cart. The system has the potential to revolutionize the shopping experience by reducing waiting times at billing counters, eliminating the need for manual cart pushing, and facilitating efficient product tracking and management. It can enhance customer satisfaction, optimize shopping processes, and improve the overall efficiency of retail operations.

Figure 2: Working module Without Power Supply

Figure 3: Working module With Power Supply

VI. CONCLUSION

In conclusion, the Bluetooth-Controlled Shopping Cart project presented a novel and innovative approach to enhance the traditional shopping experience. By integrating Bluetooth technology, Arduino Nano, and advanced billing functionalities, the project aimed to optimize convenience, efficiency, and customer satisfaction in the retail environment.

Through the implementation of the Bluetooth-Controlled Shopping Cart, shoppers were able to navigate the store effortlessly, eliminating the need for manual pushing or pulling of heavy carts. The integration of

Raspberry Pi Pico and the motor driver facilitated seamless and precise cart movement, providing users with a convenient and comfortable shopping experience.

Furthermore, the inclusion of the Arduino Nano enabled an advanced billing system within the cart itself. Shoppers could scan and pay for products directly from the cart, streamlining the checkout process and reducing waiting times at billing counters. This innovative feature addressed the challenges associated with long queues and time-consuming billing procedures, enhancing overall customer convenience.

The project's methodology encompassed the development and implementation of the hardware and software components, as well as rigorous testing and analysis. The performance of the Bluetooth-Controlled Shopping Cart was evaluated through user feedback, system responsiveness, and overall user experience. The results demonstrated the successful integration of Bluetooth technology, Arduino Nano, and motor control, enabling precise cart movement and efficient billing functionalities.

The findings of this research work highlight the potential of technology-driven solutions in transforming the retail industry. The Bluetooth-Controlled Shopping Cart offers numerous advantages, including improved convenience, reduced physical strain on shoppers, and streamlined checkout processes. These benefits contribute to an enhanced overall shopping experience, leading to increased customer satisfaction and loyalty.

In conclusion, the Bluetooth-Controlled Shopping Cart project showcased the potential of integrating Bluetooth technology, Arduino Nano, and advanced billing functionalities to revolutionize the retail experience. The project's success in enabling seamless cart movement and efficient billing processes opens doors for further advancements in the retail industry, ultimately improving customer satisfaction and operational efficiency.

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