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Shopping Trolley with Automated Billing System using Arduino

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ABSTRACT: The project intends to introduce a robotic shopping trolley with Bluetooth control and RFID technologies, revolutionising the conventional shopping experience. The system streamlines the shopping experience by automating the processes of item recognition and pricing calculation through the integration of an Arduino Uno microcontroller and an RFID reader. With a specific smartphone application, users may remotely manage the trolley's movement and receive real-time updates on the entire bill. Furthermore, a buy restriction feature alerts consumers when their expenditure exceeds a certain threshold, helping to prevent overspending. With the integration of Bluetooth control for trolley navigation, RFID technology for item identification, and real-time monitoring through a mobile application, the project provides improved financial management capabilities, efficiency, and convenience for both shoppers and retailers. This creative fix demonstrates.

KEYWORDS: RFID reader, Bluetooth control, trolley navigation

I. INTRODUCTION

The traditional retail shopping experience has always been defined by human procedures and a low level of automation. Consumers use handwritten lists or mental calculations to guide them around aisles, choose products, and keep track of their purchases. But this method lacks real-time monitoring capabilities and can be laborious and error-prone. This idea offers a novel way to overcome these obstacles: a robotic shopping cart with Bluetooth control and RFID technology. by bringing previously unobtainable levels of convenience efficiency and control the integration of cutting-edge technologies promises to completely transform the shopping experience the system automates the laborious operations of item identification and pricing calculation by utilizing an RFID reader and an Arduino uno microcontroller because each product has an RFID tag attached to it the system can identify it as soon as it is inserted into the trolley by doing away with the requirement for barcode or manual scanning this simplifies the checkout procedure and lowers the possibility of mistakes.

Not only that, but a special smartphone application for the shopping trolley allows users to operate it remotely thanks to Bluetooth control. Customers may easily move the trolley in all directions—left, right, The traditional retail shopping experience has always been defined by human procedures and a low level of automation. Consumers use handwritten lists or mental calculations to guide them around aisles, choose products, and keep track of their purchases. But this method lacks real-time monitoring capabilities and can be laborious and error-prone. This idea offers a novel way to overcome these obstacles: a robotic shopping cart with Bluetooth control and RFID technology. by bringing previously unobtainable levels of convenience efficiency and control the integration of cutting-edge technologies promises to completely transform the shopping experience the system automates the laborious operations of item identification and pricing calculation by utilizing an RFID reader and an Arduino uno microcontroller because each product has an RFID tag attached to it the system can identify it as soon as it is inserted into the trolley by doing away with the requirement for barcode or manual scanning this simplifies the checkout procedure and lowers the possibility of mistakes. Not only that, but a special smartphone application for the shopping trolley allows users to operate it remotely thanks to Bluetooth control. Customers may easily move the trolley in all directions—left, right,

II. RELATED WORKS

By looking at some earlier relevant works, a new working model is offered, taking into account the difficulties individuals are experiencing with the present purchase system. In the paper of Prasiddhi [1], An item has been detected using an RFID reader, therefore in addition to automatically paying, certain products are recommended based on

current promotions. In the study [2], RFID and Zigbee connectivity are employed in an automated payment method. Every item at the mall will have an RFID tag attached to it in order to identify it. An EEPROM is being installed within the cart to preserve item data and transmit it via a Zigbee module to the main billing system. In the study referred from paper [3], a novel idea was presented by them this involves identifying the product with an RFID tag reader after which the shopping trolleys LCD shows the updated bill. In paper [4], It saves the buyer the duration that it takes to scan each item at the counter. It lessens human mistake. XBee modules and an Arduino-based system were utilised in this model. Regarding wireless communication, these two are employed. In the paper [5], by Ruinian li is an RFID-reader enabled smart trolley. Additionally, this trolley can direct clients towards the things they want. The quantity of things sold has been updated on the central server through the use of sensors. In the paper [6], A UHF RFID system-based cart has been suggested by them. Irrespective of the product's size, shape, or position, the card reader will recognise its label according to the UHF RFID system.

III. BLOCK DIAGRAM AND METHODOLOGY

A motor driver, battery, Bluetooth module, Arduino Uno microcontroller, RFID reader, and smart shopping trolley including automated billing system are used to facilitate the trolley's motion.

The smartphone application that uses the Bluetooth component to connect will provide real-time updates about the things bought and the bills that need to be paid.

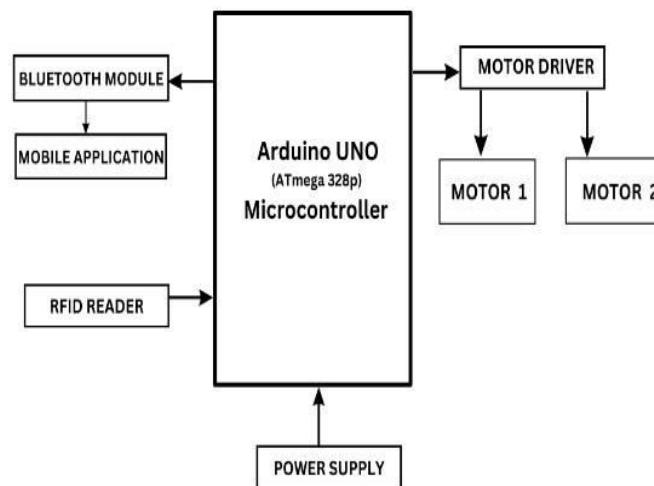


Fig 1: Block diagram

Fig 1 shows the block diagram of the proposed system.

To address the inefficiencies and difficulties inherent in conventional buying experiences, a robotic trolley outfitted with RFID tags and Bluetooth control is the centrepiece of the concept. The device integrates an RFID reader with an Arduino Uno micro-controller to automate the process of calculating prices and identifying items. An RFID sticker is attached to every object, making it easy to identify and add the total cost of the items as they are added to the cart. Through the use of a specialised smartphone utilisation, connectivity via Bluetooth enables users to remotely control the trolley's movement and move it towards any direction. In order to encourage responsible financial management, the system offers a buy limit function that sends users instant alerts when their spending exceeds a set threshold.

The microcontroller Arduino Uno was chosen as the key component because of its versatility, ease of programming, and interoperability with a variety of sensors and modules. The shopping cart can be controlled remotely thanks to the integration of a Bluetooth module with wireless communication with a mobile application and an RFID reader and tags for automatic product identification. The Arduino Uno sends commands to the motor drivers, which in turn regulate how the wheels of the trolley move.

The Arduino Uno acts as the main processing unit, communicating with the RFID reader, Bluetooth module, and motor drivers. The Arduino Uno processes the data to identify the object and get its pricing when an RFID-tagged product is

placed in the cart. The RFID reader reads the tag. The Arduino Uno then uses Bluetooth to connect to the smartphone application, where it receives commands to drive the trolley and sends real-time updates on the total bill.

The RFID scanning component identifies each item in the trolley by scanning the RFID tags connected to each object. In order to determine the appropriate product pricing and add it to the final bill, the scanned RFID data must be compared with a database. To allow remote control capability, the Bluetooth communication component entails connecting the Arduino Uno and the mobile application via Bluetooth. In order to manage the movement of the tram and get real-time updates on their total purchases, users must engage with the mobile application. In conclusion, the purchase limit monitoring feature keeps a close eye on the entire transaction and notifies consumers through the mobile application if they go over their pre-established purchase limit.

FLOW CHART

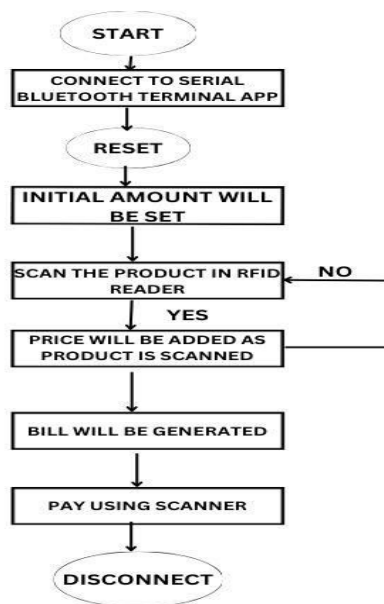


Fig: 2 flowchart of product purchasing

Figure 2 shows a flowchart of the purchasing procedure to help customers prevent overspending the system will have a buy limit function that lets them establish a maximum spending restriction real-time purchase tracking will stop transactions that exceed the budget and notify consumers when they are getting close to it in order to improve efficiency and expedite the checkout process users will also be able to monitor their spending while shopping and receive real-time updates on their final bill via a mobile app the system will calculate prices and identify items using radio-frequency identification or RFID every product will be equipped with an RFID tag that contains the price and a unique identity at checkout counters RFID readers will instantly recognize these tags.

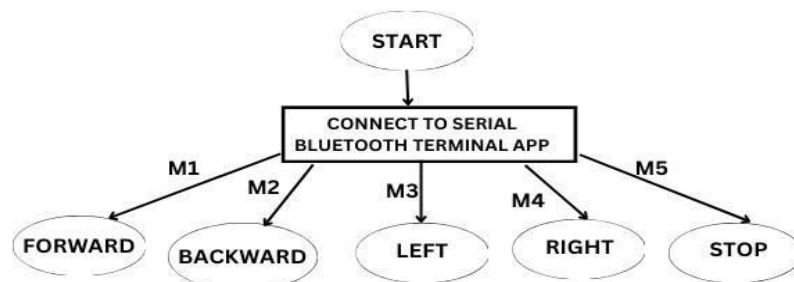
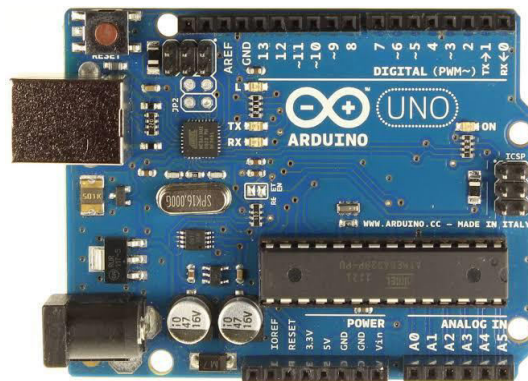


Fig: 3 flow chart of trolley control

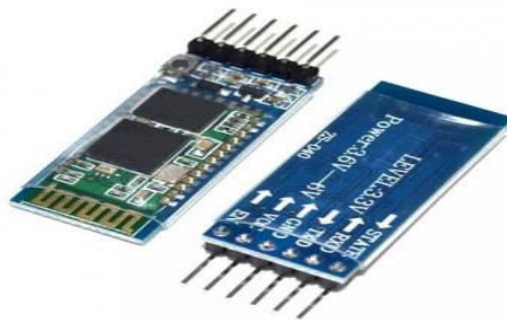
The following commands can be used to operate the trolley m1 proceed ahead m2 go in reverse m3 proceed to the left m4 take a right m5 put the trolley on hold there are various crucial elements involved in using a smartphone app with Bluetooth functionality to implement shopping cart remote control in order for the trolleys to interact with mobile devices Bluetooth modules must first be installed after downloading and installing the appropriate app users will be able to use Bluetooth to connect to the trolley using their smartphones users may control the trolleys direction speed and even lock or unlock it remotely via the app users have easy and effective control over their shopping experience because to these real-time commands that are transferred from the mobile device to the trolley.

IV. HARDWARE REQUIREMENTS

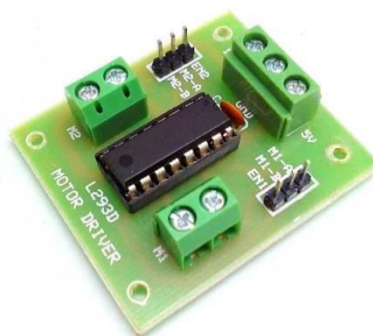
1. Arduino UNO Microcontroller



2. Bluetooth Module - HC06



3. L293D Motor Driver



4. DC Motors



5. RFID Reader



V. RESULT AND CONCLUSION

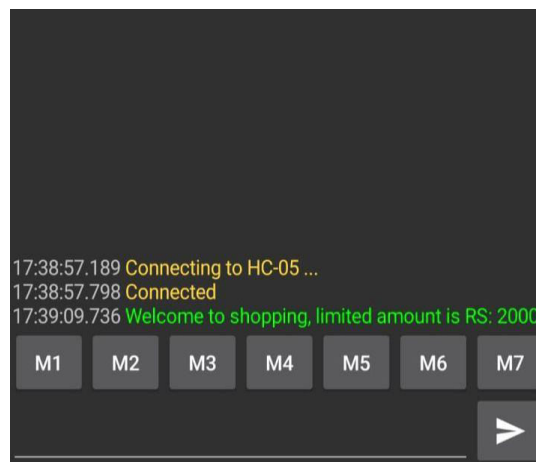


Fig: 4 initial amount to purchase the items has been set

Figure 4 illustrates the initial setup of the system which uses a third-party mobile application called serial terminal Bluetooth to connect a smartphone to the cart via Bluetooth this app acts as the control interface allowing users to navigate the cart by moving it forward backward left right or stopping it thus providing efficient navigation control.

Moreover, the system includes an RFID card reader to scan product RFID cards when a product is scanned the system updates the total count of scanned products in real-time enhancing inventory management by automatically adjusting the tally based on the scanned items.



Fig: 5 list of the items added

Figure 5 shows the process of adding things and displaying the total amount due moreover the system has a function that subtracts the entire cost of scanned products from an initial sum which is probably the users allotted cash or available budget this integrated system enhances productivity by permitting seamless control over cart movements and guaranteeing accurate tracking of scanned items and expenses which eventually helps optimize inventory management and resource utilizations it also lets users monitor their spending in real-time

Compared to conventional shopping techniques, the use of a robotic shopping trolley with RFID and Bluetooth control offers notable advantages. Customers and retailers Alike benefit from the system's increased efficiency and convenience as it automates price calculation, trolley movement and item identification. Purchase limitations are integrated to assist users in properly managing their spending. All things considered; the initiative shows how cutting-edge technology have the power to completely transform the purchasing experience.

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