SMART SHOPPING TROLLEY WITH AUTOMATED BILLING USING ARDUINO

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Abstract—
The way people live is changing because of the Internet of Things (IOT), which connects basic household items. Shopping in huge malls is part of everyday life in modern metropolises. On days with predetermined discounts and on holidays, one can observe a huge rush in shopping malls. People buy various things, put them on shopping carts and then go to the checkout to pay. In order to have their goods scanned with an RFID reader and a barcode scanner and pay for their purchases, they have to wait in a long line. The only way to change this is to make smart choices when shopping in malls. Each individual item is tagged with an RFID tag that can be read instantly by a cat with an RFID reader when placed in a smart shopping cart, allowing billing to occur directly from the cart. With this technology, customers can avoid standing in line at checkout counters. In this solution, additional smart shelves are available with an RFID reader that can track inventory and update the main server. This server can be installed and also knows the status of products in a shop. Inventory management is also facilitated by the fact that all goods can be read automatically by an RFID reader instead of being scanned manually by employees.

Keywords— IOT, RFID, barcode scanning, inventory control and smart shopping carts

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I. INTRODUCTION

Recent developments in Internet of Things (IOT) technology have enabled new applications and sectors. The rapid development of IoT technology and the proliferation of supermarkets and shopping malls, among other things, have led to the creation of many smart systems that help customers shop. Shopping is easy, but standing in line to buy something can be tiring and uninteresting. Long lines are due to two things: high traffic volumes and the time it takes for the cashier to create the bill using a barcode scanner.

The main component of this clever invention is an automatic billing system that can be integrated into the shopping cart. The RFID reader for this automatic payment system is controlled by Arduino. Each time a customer places an item in the shopping cart, the RFID module recognises the item and displays the price next to it at LCD. The module detects each item the customer adds and makes the price increase proportionally. If the customer decides not to add a product to the shopping cart, the cost is immediately deducted again. The customer clicks a button to complete their purchase, and when they do, all items and associated costs are totaled. This determines the total debt. This approach can be used in supermarkets, for example, as it reduces the need for labour while improving the shopping experience for customers.

II. LITERATURE SURVEY

• ***Smart shopping cart***

The authors of the study "Smart Shopping Cart" published in 2017 are S. Balaji and S. Balamurugan. [4] developed a unique mechanism attached to the shopping cart specifically for shopping malls. Each item is RFID tagged and the system is no different. The billing process is automatically performed by the streetcar itself. Information about the product, including name and price, is displayed on the screen LCD. The invoice amount is settled at the checkout.

• ***Innovative shopping cart***

A “Innovative shopping cart” was developed by the authors of this paper, Prasiddhi K. Khairnar and Dhanashri H. Gawali [5]. This system was developed for a shopping mall where an RFID tag is replaced by a barcode scanner. A Zigbee transmitter, a LCD display and an RFID reader form this smart shopping cart. As each item is placed in the cart and stored in the microcontroller's memory, the final total bill is calculated. The distance limitation enforced by Zigbee is the only shortcoming of this technology.

• ***Smart Trolley Using Arduino***

Authors Mr. Gupta and Mr. Kumar of "Smart Trolley using Arduino" [6] developed a system employing an ARM7 processor, RFID, a display, a switch, two IR sensors, a power source, and Visual Basic. RFID and barcode readers were also a part of the system. The principle of serial communication is employed to carry out the purchase process, where the bill is delivered to the billing counter and then a hard copy of the same is produced. An advantage is that customers can pay using cards or other means. This system has a fundamental problem in that it becomes more complicated when RFID and barcode scanners are used.

III.METHODOLOGY

A customer is provided with a shopping cart upon entering a shopping Centre. On this shopping cart there is an RFID tag and a reader. With our "Smart Shopping Cart" project, we are investigating ways to further develop this technology". In the proposed system, each product is tagged with a unique RFID tag. The tag contains the name of the item, the production date and expiration date, and the price of the product. The Arduino board receives this data from the RFID reader and processes it further. Arduino performs a series of activities on the RFID tag attached to a product using the information received from RFID reader. Before the price and the "Added Product" are displayed, the customer must scan the item and add it to the cart. The buyer must scan each item they're purchasing and payment is completed immediately in the cart. This saves a lot of time and eliminates long waiting times.

It's important to remember that RFID technology can also be used to track a customer's location within a shop and provide them with a more personalized shopping experience.

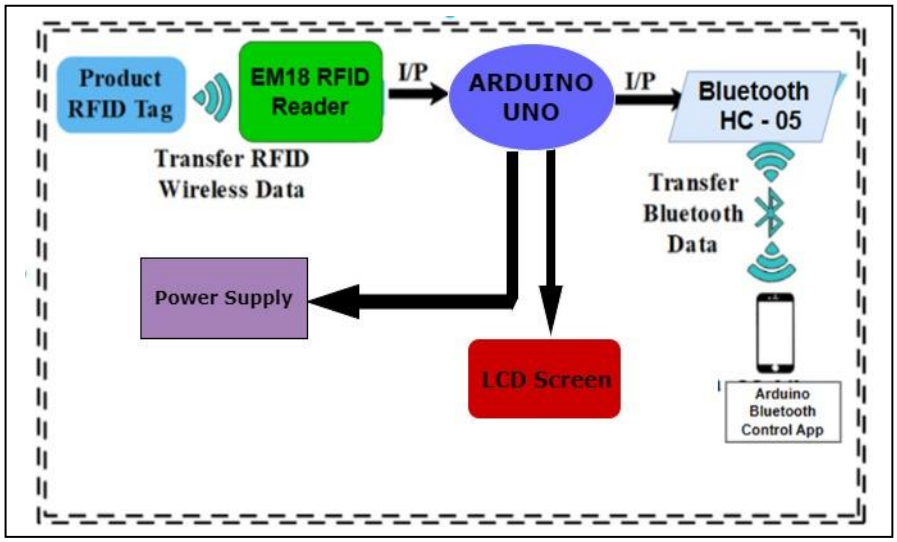

Figure-1. Architecture Diagram of smart shopping trolley with automated billing using Arduino

In order for the RFID reader in the shopping cart to scan the passive RFID tag associated with each product, the customer must add the item to the cart in the current time frame. On the screen LCD, which is connected to the shopping cart, relevant information about the purchased items is displayed to the shopper. The customers can easily deal with the interface and use the numerous services of the system. Using the suggested services, the customer can select the least expensive item, add it to the shopping cart, and have the cost added to the final bill. After payment, the invoice and transaction data are downloaded to the Arduino Bluetooth control app of the customer's mobile device.

- EM-18 Reader module: EM-18 Reader module is used to read RFID tags affixed to the goods put in the trolley. It is a small module that can read tags up to 10 cm away. When a tag is recognized, the modules internal LED illuminates. Popular passive RFID (Radio Frequency Identification) reader module, the EM-18 reader module works at a frequency of 125 kHz. It is a small and simple module that may be used to read RFID tags in a variety of projects.

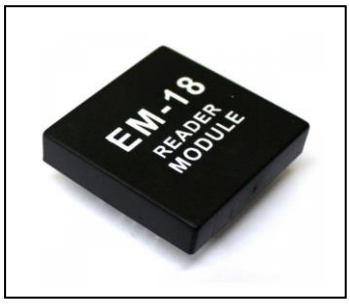

Figure-2. EM-18 Reader Module

- RFID tag: Radio Frequency Identification (RFID) uses electromagnetic fields to automatically detect and locate tags attached to objects. An RFID system consists of a transmitter, a receiver, and a small radio transponder. When activated by an electromagnetic interrogation pulse from a nearby RFID reader, the tag sends digital data, often an inventory number for identification, back to the reader. Passive tags are powered by radio waves from the RFID reader. Because they are battery-powered, active tags can be read by an RFID reader hundreds of feet away. Since the tag does not have to be in the line of sight of the reader like a barcode, it can be embedded in the object being tracked.

Figure-3. RFID tag

- 16*2 Alphanumeric LCD: 16*2 Alphanumeric LCD is used to display data such as the number of things in the cart and the total cost of items in the cart. In a 16x2 LCD there are 2 lines, each of which can display 16 characters. Each character on this LCD is displayed in a 5x7 pixel matrix. The 224 different characters and symbols that can be displayed on the 16x2 intelligent alphanumeric dot matrix display. LCDs can display customized and even bespoke characters, animations and other things without limitations

because they are cheap, easily programmable and programmable. The command register contains the commands that have been transmitted to the LCD. A LCD device receives a command when someone tells it to do something, such as initialize it, clean its screen, move the pointer, manage the display, etc. The data register stores the information that is displayed on the LCD.

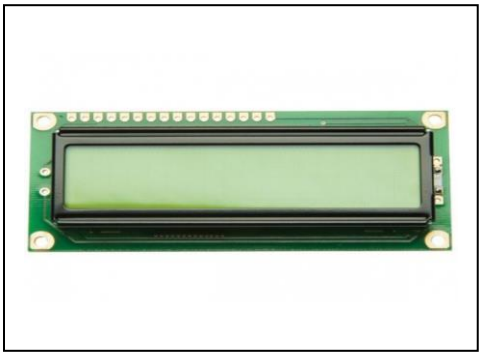

Figure-4. Liquid Crystal Display

• Arduino UNO: The ATmega328 series controller serves as the basis for the Arduino Uno microcontroller board. By sending a set of instructions to the board's microcontroller, you can control your board's actions.

It provides developers and programmers with an integrated development environment that makes it easy to perform various activities. Arduino Uno is an open-source prototyping platform based on easy-to-use hardware and software.

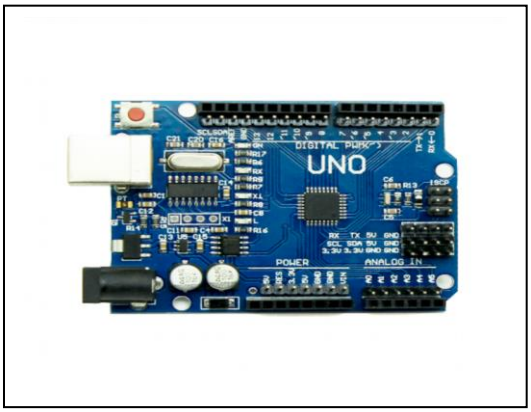

Figure-5. Arduino UNO board

• HC-05 Bluetooth module: A really cool module called HC-05 can provide a two-way (full duplex) wireless connection to your project. Any Bluetooth-enabled device, such as a phone or laptop, and two microcontrollers, such as an Arduino, can be connected to this module. The large number of Android apps already available helps considerably with this strategy. It already has a slave Bluetooth device configuration. Its operation becomes obvious to the user once it has been linked with a master Bluetooth device, such as a computer, smartphone, or tablet. It enables wireless command transmission to the Arduino UNO from the Android app.

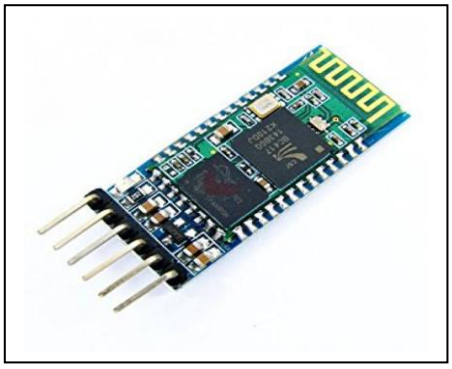

Figure-6. HC-05 Bluetooth Module

An electrical device, also known as a power supply, provides power to an electrical load such as a server, laptop, and other electronic devices. The main purpose of a power supply is to convert the electrical current from a source into the proper voltage, amperage, and frequency to power the load. RFID tags are attached to every item in the mall. As soon as something is placed in the shopping cart, the RFID scanner starts reading the card. Radio-frequency identification is referred to as RFID. It is a technology that uses radio waves from an RFID reader to decode digital data encoded in RFID tags. Because a tag's information is decoded by an RFID reader, RFID is similar to bar coding. RFID technology is used in various applications, such as inventory management, attendance systems, door locking systems, restricted area access, etc.

The Arduino Uno receives this code from the reader and, once read, transmits it to the cloud, where the product database can be accessed. Then, a sophisticated shopping cart app collects the data and displays it on a mobile device. Item information, including the name, price, and total cost of products added to the cart, is displayed in the mobile app. As we add things, the cost is subtracted from the total. Thus, the accounting is complete. In the smartphone app, all the information is displayed at the same time. Also, we can remove an inserted item from the cart by pressing the button and scanning again. The final amount displayed on the mobile app will be reduced by the cost of the deleted item. Each streetcar will have a different identification number. The smart cart will be able to automatically read the items placed in it by

scanning RFID. To signal the addition or removal of a product, a buzzer will be used.

IV.RESULTS AND DISCUSSIONS

Start the Arduino IDE Enter the code in the menu of the tool. Choose a port and an Arduino UNO board. Install the "Arduino Bluetooth Control" app on an Android smartphone, pair the HC-05 Bluetooth device with it using the settings menu, and then connect using the default password 1234 to start communicating with the device.

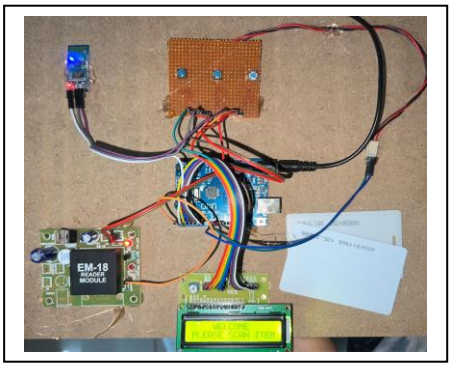

Figure-7. Smart Shopping System

The next step is to upload the code after you have selected the board and port. After you have uploaded the code, you can start testing the gadget. Swipe the board near the reader to test the gadget; a 12-digit code will then appear on the serial display. It is important to repeat this process for each RFID tag you use, and it is recommended that you write down each code for later use. This way, you can be sure that the system is able to accurately identify and monitor each RFID tag as it is used, giving you the data you need to effectively operate your inventory or tracking system. By following these steps, you can quickly and easily set up your RFID system and use it to improve your operations.

"WELCOME TO SMART SHOPPING" will be shown on the LCD display when the smart shopping system is first turned on. This notification confirms that the system is up and functioning and available for consumers to utilize. It is made to be simple to read and comprehend so that clients can easily and quickly begin their purchasing experience.

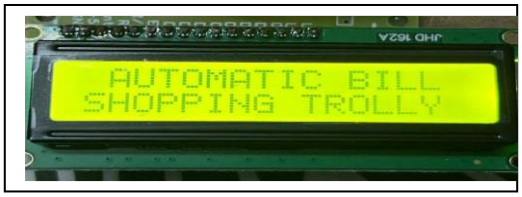

Figure-8. LCD display of Automatic bill shopping trolley

After that, customers can start selecting things and adding them to their shopping carts. The smart system then automatically tracks each item and shows the total cost on the display LCD. The smart shopping system makes it easy for customers to shop effectively and efficiently, and also improves the overall shopping experience for everyone through this simple and user-friendly interface.

Figure-9. LCD display of Product 1-Butter Added

Figure-10. LCD display of Product 2-Milk Added

The display of the intelligent system LCD clearly shows the words "ADD ITEM" when a consumer is ready to start shopping. The customer is prompted by this message to scan the RFID tags on each item they wish to purchase. The price of each new item scanned is automatically added to the total displayed on LCD.

Figure-11. LCD display of Total price of products

Simply hold down the reset button while scanning the item to remove it from the system and update the total price when a customer wants to remove an item from their cart.

Figure-12. LCD display of Milk Removed

Figure-13. LCD display of Requesting bill

The customer can view the final price of his purchase on the display of LCD and continue to pay when he has finished shopping and added all the desired items to the shopping cart. Finally, "REQUESTING BILL" is displayed on LCD when the button is touched. With the help of this practical approach, the customer's shopping experience is facilitated and waiting time and errors are reduced.

V. CONCLUSION

Science and technology are constantly and unceasingly evolving. The use of an automated customer billing system is a cutting-edge initiative that has been introduced in shopping malls. This concept involves the use of a shopping cart that contains a LCD screen that displays the total number of products purchased. Access to the goods is also granted via an RFID card. The goal of the project is to speed up the checkout process and give customers more time. The LCD page displays specific details such as the name and price of the product. Due to their compactness, effectiveness and promising performance, automated billing systems especially those based on RFID technology will undoubtedly become more common in the future.

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