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Rfid Based Shopping Cart Using Iot

Abstract: - In this living environment, technology is constantly advancing in a variety of domains, including artificial intelligence, machine learning, virtual reality, touch commerce, the Internet of Things, and many more. The primary objective of the project is to concentrate on the requirements and objectives of the customers, as time is of greater significance to all individuals in the actual world. On the other hand, consumers spend more time in the grocery store. It is common practice for customers to use a shopping cart to purchase a variety of things when they are at the supermarket. After making a purchase, consumers are confronted with several challenges, such as standing in a lengthy queue at the billing area and being unaware of the computation of the things that they have purchased. As a result, we may take into consideration these issues in order to discover solutions that are referred to as "IoT- Based Smart shopping trolley with automated billing." As a result, the typical product scanning that takes place at the counter is eliminated, which speeds up the overall shopping experience. In addition, the consumer will be aware of the entire amount that is owed on their account, allowing them to plan their shopping appropriately, ensuring that they only buy the necessities, so boosting their savings. Because every step of the billing process is automated, the possibility of making a mistake due to human intervention is drastically decreased. In order to further enhance the shopping experience of the consumer, the system also includes a function that gives the user the ability to remove the goods that have been scanned

Keywords: Automated billing; IoT-based; Shopping Cart; Scanning; Technology; Super market; Purchase.

1. INTRODUCTION

Smart shopping trolleys not only revolutionize the process of checking out for customers, but they also fundamentally improve the entire retail experience. They provide a wide range of benefits that go far beyond the efficiency of transactions alone. These cutting-edge gadgets serve as dynamic hubs of convenience, intelligence, and engagement, merging cutting-edge technology in a seamless manner to alter the way in which customers interact with physical establishments.

Rather than just enabling transactions, smart trolleys function as customized shopping assistants. They do this by utilizing complex algorithms and data analytics to provide recommendations and promotions that are targeted to the individual in real time. Customers are able to make more educated judgments and discover new items that are in line with their specific likes and lifestyles thanks to these carts, which analyze previous purchases, preferences, and even dietary restrictions.

Additionally, the use of RFID technology not only boosts the efficiency of the billing process but also improves the safety precautions that are taken to safeguard both the product and the faith of the customers. By continuously monitoring and automatically detecting suspicious actions, such as the removal of items without authorization or tampering with them, these trolleys offer a solid defense against theft and loss, therefore reinforcing the entire integrity of the retail environment. Whenever the customer loads their shopping cart, this scenario takes place. As a result of the fact that the module is able to identify each and every one of the products, the price will gradually climb as the customer continues to add more of them to their cart.

Additionally, the data that is created by smart trolleys acts as a treasure trove of insights for shops, providing them with vital visibility into the behavior, preferences, and trends of customers (Kumar et al., 2017; Jagtap, A. et al., 2018). Retailers may acquire actionable knowledge to enhance inventory management, pricing strategies, and marketing campaigns by embracing the power of big data analytics. This will allow them to drive operational efficiency and revenue growth in an extremely competitive market landscape.

In addition, the modular architecture of these trolleys makes it possible to integrate new features and capabilities

in a fluid manner,which ensures scalability and flexibility to the ever-changing technological developments and the expectations of consumers (S. Kowshika et al., 2021; M. Jaishree et al., 2021). In the retail industry, smart trolleys provide a diverse platform for innovation and distinction, whether it be via the incorporation of future technologies like as augmented reality to create immersive shopping experiences or through the implementation of sustainability efforts to lessen the impact on the environment.

According to M. Shahroz et al.'s research from 2020, smart shopping trolleys represent a paradigm shift in the way that we view and interact with physical retail locations. These disruptive gadgets enable retailers to provide amazing customer experiences whilesimultaneously driving operational excellence and competitive advantage in a world that is becoming increasingly digital and networked. They accomplish this by mixing convenience, customization, and security in a seamless manner

2. Methods

2.1. Proposed system

This technology provides a means of accelerating the rate at which things are purchased as well as alternatives for making payments more quickly. For this particular configuration, the RFID reader, the Raspberry Pi, and the LCD were all positioned appropriately within the shopping cart. RFID tags are attached to every part of the product. The information about the goods is scanned by an RFID reader before the item is entered into the shopping basket. Whenever customers scan the goods, the LCD display shows not only the cost of the product but also the total number of items as well as the total cost of the products as a whole. The customer thenpresses the delete button, scans the item, which immediately results in a reduction in the overall price of the item and removes it from the list of items in the basket. In order to expedite the process of making a purchase, it is necessary for the buyer to be informedof the total quantity of things before moving on to the billing section. In conjunction with the final bill for the shopping trip, a QR code is generated. On the trolley, customers are able to pay their bills immediately. When it comes to the billing counters, the proprietors of shopping malls also decrease consumer spending.

This proposed structure has the total number of components which are shown in **Fig.1**

2.2. Hard ware Description

2.2.1 Arduino Un

Both the Arduino software and the Arduino Uno are compatible with one another for the purposes of programming. The Arduino Uno comes with a microcontroller called an ATmega328, which already has a bootloader installed on it. In order to eliminate the requirement for an external hardware programmer, this bootloader makes it possible to upload fresh code to the microcontroller. According to the C header files, the system communicates via the original STK500 protocol. This is demonstrated by the application. It is possible to get around the bootloader, and the microcontroller may be programmed using the ICSP header, which stands for "In Circuit Serial Programming." To obtain further information, kindly refer to the directions that have been provided. The source codefor the firmware that runs on the ATmega16U2 (or 8U2 on the rev1 and rev2 boards) is available for download. The ATmega16U2/8U2 microcontroller comes with a DFU bootloader that may be activated by the following steps: connecting the solder jumper on the back of the Rev1 boards, locating it close to the map of Italy, and then resetting the 8U2 microcontroller. A resistor is provided on Rev2 and subsequent boards in order to assist the grounding of the 8U2/16U2 HWB line. This, in turn, makesthe process of changing into DFU mode more straightforward. It is possible to load a new firmware by utilizing the FLIP software developed by Atmel for Windows or the DFU programmer, which is available for Mac OS X and Linux. There is also the possibility of using the ISP header in combination with an external application in order to replace the DFU bootloader.

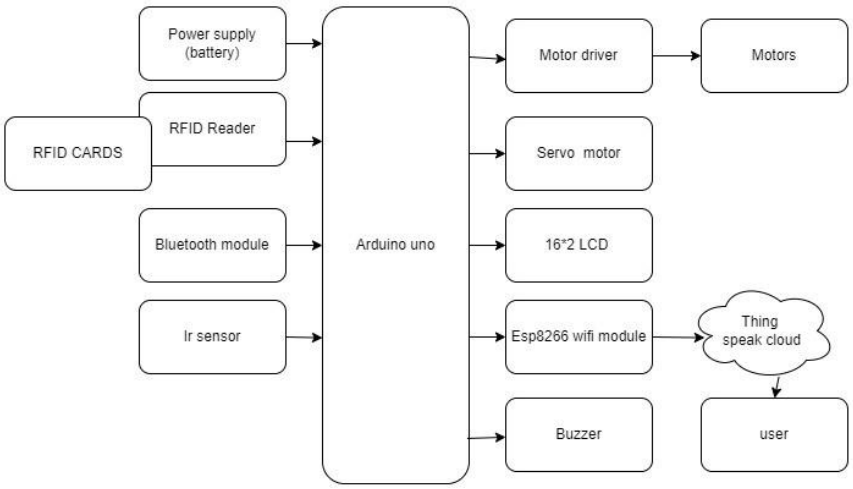

Figure 1 Block diagram of the proposed system

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2.2.2 LCD 16 x 2

In today's technologically advanced world, LCDs are widely used in a wide range of electronic products, including digital watches, computers, CD players, and many more. Compared to conventional cathode ray tubes (CRTs), liquid crystal displays (LCDs) have several benefits, especially with regard to energy efficiency because of their significantly reduced power consumption.The main reasons for the switch from CRTs to LCDs are their smaller size and lower power consumption, which make them the standard option in the display business.

The capacity of the LCD 16x2 display to selectively block light instead of letting it spread out freely is the basic idea behind its operation. The objective of this article is to present a thorough analysis of the pin layout of the LCD 16x2 and explore its working mechanisms, clarifying the complex procedures that control its functioning.

2.2.3 Active Passive Buzzer

A buzzer is a compact yet effective component that enhances the auditory capabilities of our project or system. The 2-pin structure of this component is tiny and compact, making it suitable for usage on breadboards, Perf

Boards, and PCBs. As a result, it is frequently utilized in many electronic applications.

There exist two generally accessible varieties of buzzers. The displayed device is a basic buzzer that emits a continuous Beeeep sound when activated. Another kind is referred to as a pre-assembled buzzer, which is larger in size but still produces a Beep sound. Audible. Audible. The auditory perception resulting from the presence of an internal oscillating circuit. However, the one depicted here is extensively utilized due to its adaptability through the integration of various circuits, allowing for seamless integration into our specific application.

2.2.4 DC Motor

A direct current (DC) motor is a type of motor that is only intended to operate with direct current (DC) electrical power. The homopolar motor, which was conceived of by Michael Faraday and is still less common today, and the ball bearing motor, which is a more recent creation, are two examples that stand out among the many types that have been developed. Nevertheless, the brushed and brushless versions of DC motors are the ones that are encountered the most frequently these days. Commutation is accomplished through two distinct mechanisms: brushless DC motors use external commutation, whilst brushed DC motors use internal commutation. Both types of DC motors work utilizing direct current (DC) power. In spite of the fact that they are classified as DC motors, both brushed and brushless variations produce an oscillating AC current from the DC power supply. This blurs the boundarybetween DC and AC machines in the context of these applications.

2.2.5. Bluetooth Module

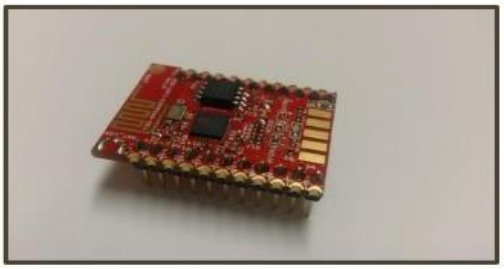
The technology known as Bluetooth makes it possible to create wireless personal area networks, which in turn makes it easier to transmit data between mobile and stationary devices over relatively small distances. The Bluetooth protocol was first created as a uniform digital wireless protocol. Its primary function is to solve synchronization problems by linking several devices in a smooth manner. Bluetooth is a wireless technology that utilizes a strong frequency hopping spread spectrum technology. This technology separates data into pieces and has the capability to send it across up to 75 frequencies. The Gaussian frequency shift keying modulation system is the one that is most commonly employed. This scheme enables a maximum gross data rate of one megabit persecond.

Mobile phones, laptops, personal computers, printers, GPS receivers, digital cameras, and video game consoles are just some of thedevices that can benefit from this adaptable technology's ability to permit smooth connection and data sharing among a broad variety of devices. Bluetooth, which operates inside the worldwide unlicensed ISM 2.4 GHz short-range radio frequency band, offers safe communication across a wide variety of electronic devices.

For the purpose of overseeing the development and standardization of Bluetooth technology, the Bluetooth Special Interest Group (SIG) is a consortium that includes firms that are involved in the fields of telecommunications, computer networking, and consumer electronics manufacturers. The Bluetooth Special Interest Group (SIG) continues to enhance and license Bluetooth standards via collaborative efforts. This ensures that Bluetooth standards are compatible and interoperable across a wide range of devices and applications. The OEM Bluetooth-Serial Module Parani-ESD Series uses Bluetooth technology. On-board installation integrates Parani-ESD Series with consumer devices. Built-in UART interface connects them to the device and Bluetooth devices.

Parani-ESD Series wirelessly connects RS232-based devices 30m-300m (ESD210-Class 2) or 100m-1000m (ESD110-Class 1). Parani-ESD100/200 features an on-board antenna and ESD110/210 includes an antenna connection. Bluetooth range may be extended by attaching external antenna to antenna connection. Users may customize the Parani-ESD Series using simple Windowsutility software or AT command set.

Multiple peripherals allow ESP8266 to interact with other modules in a conventional embedded manner. This section will solely discuss the communication link setup as the module handled the bit flow, which is of little immediate significance to this thesis. The sensor received data encoded and decoded using traditional UART. EM50 data logger can accomplish the same with its UART.Serial asynchronous communication does not require a common clock, but both devices must have the same baud rate (symbols per second) to effectively process data. ESP's UART component supports 9600 to 921600bps, but the EM50 defaults to 9600bps.



2.2.6. Wi-Fi Module (ESP8266)

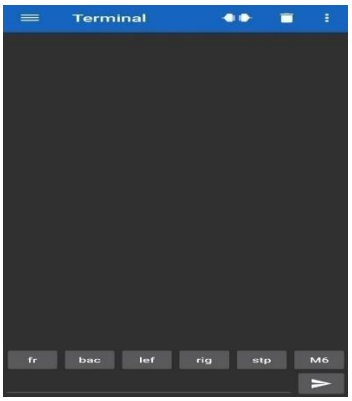
3. Results and Discussion

A. *Bluetooth Interface:*

A Bluetooth interface can improve the operation and usability of an RFID-based shopping cart utilizing IoT. The Bluetooth interfaceconnects the shopping cart to a smartphone or other Bluetooth-enabled device. The Bluetooth interface connects the RFID-based shopping cart to the user's device wirelessly. This link offers smooth interaction and communication, enabling more shopping cart system features.

Real-time shopping cart updates are one of the Bluetooth interface's main functionalities. Examples include scanning products withRFID tags and sending their information over Bluetooth to the user's smartphone, which displays a digital cart list. Users get quickfeedback on their purchases and may keep track of their shopping list using this function. The Bluetooth interface can also providetailored recommendations or promotions based on buying history or preferences. The shopping cart system may recommend relatedgoods or provide discounts by evaluating RFID tag data and sending it to the user's device, improving the shopping experience andconsumer satisfaction.

Additionally, the Bluetooth interface can offer retail navigation assistance, helping consumers find goods or departments. The device uses Bluetooth beacons to help customers traverse aisles and discover goods indoors. The Bluetooth interface enhances the RFID- based shopping cart system by providing real-time communication, tailored suggestions, and navigation help.



B. Thingspeak:

An open-source Internet of Things platform called ThingsBoard was created to make it easier to create, manage,

and implement Internet of Things (IoT) solutions and applications. ThingsBoard provides a stable and scalable platform for integrating devices, gathering data, and instantly displaying insights since it is built on contemporary technologies and frameworks.

ThingsBoard's ability to integrate with a variety of IoT devices and sensors is made possible by its support for several IoT protocols,such as MQTT, CoAP, and HTTP. This is one of the platform's primary characteristics. Because of this adaptability, developers may create Internet of Things applications for a wide range of use cases and sectors, including smart cities, agriculture, industrial automation, and healthcare.

ThingsBoard offers a wide range of features for processing data, managing devices, and visualizing the results. It provides an easy-to-use dashboard interface for handling device setups, tracking device status, and evaluating sensor data. Furthermore, the platform facilitates rule-based alerts and event processing, allowing automatic reactions to certain circumstances or occurrences in the Internet of Things. ThingsBoard's extensibility through plugins and custom widgets is another noteworthy feature. By adding new pluginsor connecting third-party services, developers may increase the platform's functionality and enable smooth connection with current workflows and systems.

To further guarantee the confidentiality, integrity, and availability of IoT data, ThingsBoard provides strong security features including role-based access control, data encryption, and secure communication protocols. All things considered, ThingsBoard offers an all-inclusive and adaptable platform for creating Internet of Things applications, enabling developers and enterprises to fully utilize IoT technology to spur creativity and address pressing issues.

The hardware system of the proposed project is shown in **Fig.4.** In the figure the trolley is fixed Iot circuit. And in the **Fig.5** the display is showing that to drop the product into trolley to scan and calculate the rate and we can also see the price that displayed onthe LCD display. After calculation the display in the **Fig.6** showing that Thank you for shopping after finishing the shopping.

Figure 4 Hardware of the proposed Iot Project

Figure 5 :Trolley display which is showing to drop the product. **Figure 6** :Trolley display which is showing thank you for shopping.

4. Conclusions

Shopping carts that are equipped with smart technology are becoming increasingly popular in supermarkets, therefore transforming the shopping experience for customers. These carts are designed to cut down on the amount of time spent waiting at the checkout counter, to simplify the shopping experience, and to providecustomers access to the whole amount of their transaction in real time.Additionally, the utilization of this technology helps to lessen the requirement for a big number of salesmen at the billing counter, which in turn helps to maximize the effectiveness of the operations. Featuring RFID scanners and tags attached to each and every item, the intelligent trolley system is designed to blend in seamlessly with the retail environment, hence providing advantages to both customeancompany owners.

These carts are designed to be modular and expandable, which makes it possible for any future improvements to be made to both the hardware and the software. Creating an application for mobile devices, namely smartphones, is a potentially fruitful path for advancement. This application has the potential to eliminate the need for a separate RFID scanner and payment system by capitalizing on the increasing usage of smartphones. This would result in the technology becoming more inexpensive and accessible.The program allows consumers to just type the name of the product they want to purchase on their Android device, and the trolley will then automatically direct them to the place within the shop where the goods is located. Furthermore, the incorporation of GPS capability into the trolley has the potential to significantly increase its usability and convenience for customers who are shopping

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