

SMART SHOPPING TROLLEY

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Abstract - The advanced time of innovation in which a large portion of the client needs to stand by in the store for shopping, since it's anything but an exceptionally tedious cycle. A gigantic group in the store at the season of markdown offers or ends of the week raises hell to stand by in long lines as a result of a standardized tag-based charging measure. In such manner, the Internet of Things (IoT) based Smart Shopping Cart is proposed which comprises Radio Frequency Identification (RFID) sensors, Arduino microcontroller, Bluetooth module, and Versatile application. RFID sensors rely upon remote correspondence. One section is the RFID tag connected to every item and the other is an RFID per user that peruses the item data effectively. After this, each item data shows in the Mobile application. The client effectively deals with the shopping list in Versatile application as per inclinations. Then, at that point shopping data ships off the worker remotely what's more, consequently produces charging. This test model is intended to dispose of tedious shopping interaction and nature of administrations issues. The proposed framework can without much of a stretch be executed and tried at a business scale under the genuine situation later on. That is the reason the proposed model is more serious when contrasted with others.

Keywords – RFID, IoT, Arduino UNO, Bluetooth, Wi-Fi

1. INTRODUCTION

There are many researches on the Internet of Things (IoT) in various applications such as smart homes, electronic health frameworks, and wearable devices [1]-[3]. This introduces digital tags connected to character objects. When those tags emerge as withinside the variety of reader it reads the saved records of item wirelessly that is referred to as RFID technology [4]-[6]. RFID performs a necessary position withinside the packages of IoT. It includes 3 additives which include RFID tags connected to the item that include identification or information approximately an item, RFID reader that study the information from the tags and valuable processing device that carry out conversation in among RFID device to different digital devices [7].

Many people show off their efforts to revolutionize traditional shopping from time to time. Many supermarkets use barcode technology mobile applications, Zigbee, Arduino microcontrollers, RFID and wireless sensors. Barcode technology has been implemented and used in many supermarkets. A barcode is a continuous black vertical stripe used to store information about an object. There is a smart trolley in which the user can scan each product independently using ultrasonic sensors. The product identification is stored in a printed bar code strip linked to the internal database. There is a barcode scanner that can scan when you see the printed barcode. This is a slower process than RFID sensor systems. Consumers or cashiers need to scan each barcode to generate invoices and check ingredients or product specifications. The barcode can only be read, not rewritten. The scanner can only read one barcode at a time, and the barcode contains very little information. This type of printed barcode is easily damaged by bad weather conditions. It is easy to be invaded by external users because it does not support the encrypted form of data. The cumbersome process leads to long lines. In 2009, the University of Arkansas completed a study to determine the commercial value of RFID to large retailers. This proves that RFID performance is better than barcode system. According to research, inventory control accuracy has increased by 27%, low inventory has increased by 21%, and the backlog has increased by 6%. Barcode scanners scan 10,000 articles in 53 hours, while RFID scans in 2 hours [8].

In this article, we focus on an excellent procurement structure based on radio frequency identification (RFID) [9] innovations that have been largely ignored. This instinctively has the following advantages:

- 1) You can read carefully the items in the smart shopping cart (with RFID identification), and you can also call the loading data in the enthusiast truck. Customers don't have to line up at checkout.
- 2) The store can easily manage inventory because everything can be read naturally and written efficiently.

We recommend using ultra-high frequency (UHF) RFID technology [10] for smart shopping, because passive UHF tags have a larger range of 1 to 12 meters. Low/high frequency RFID [9] has insufficient range to allow customers to manually scan products using RFID scanners. In the system we provide, each smart trolley is equipped with UHF RFID reader, microcontroller, LCD touch screen, Zig-Bee adapter and weight sensor. Smart Cart can automatically read the items placed in the shopping cart through an RFID reader. The trolley is equipped with a microcontroller and LCD touch screen for data processing. In order to allow the smart cart to communicate with the server, we chose Zig-Bee technology because it is both energy-efficient and economical. Carry out a security check. When an attacker removes an RFID tag from an item and puts it in a shopping cart, it usually adds additional, undetected weight. When the buyer completes the purchase, he will use the payment information created in the smart shopping cart to make the payment at the checkout. We also placed an RFID reader in front of the exit door to ensure that all items in the shopping cart have been paid for.

This paper is a pioneer work in the plan of secure brilliant shopping framework. We list our commitments as follows.

- 1) We are quick to propose utilizing UHF RFID innovation to help associations in a keen shopping framework. Our framework is the principal framework to accomplish programmed perusing of the things with a legitimate reach.
- 2) We have constructed a model of the keen shopping framework also, significant capacities, like precise and programmed perusing, are accomplished.

3) We propose a total plan of the brilliant shopping framework, and we give a portrayal of the plans and comparing capacities exhaustively.

2. LITERATURE SURVEY

In 2003, several attempts by Shanmuqapriyan et al. They proposed a basic design using RFID and barcode reader for product identification and Zig-Bee for communication [11]. Kumar et al. They are the first physical implementations using RFID and ZigBee [12]. Gupta et al. An unconventional smart car design, they are one of the earliest examples of solving the anti-theft problem [13]. Its design is similar to a mailbox-a bowl where objects are inserted and scanned, and then dumped into a closed room. There is a door at the top of the cell, which can only be opened when the user pays for the item. The design indirectly prevents wireless security threats by not allowing wireless communication. When the user finishes shopping, the shopping cart is physically connected to the point of sale for payment. Ali et al. developed an intelligent navigation vehicle [14]. Its design includes smart shelves, which can detect when the smart trolley enters the aisle (using infrared sensors) and transmit product information to the trolley. More designs in this area have appeared in the past three years.[15]-[17], but none of them contained new ideas. In all previous projects, customers had to manually scan articles one by one, which was troublesome. In addition, none of the previous papers studied security issues. RFID technology has been extensively studied in recent years and is an important technology used in IoT applications. Amendola and others. Wellborn et al. developed an RFID ecosystem with a series of web applications and user-level tools. Most stores currently use barcodes for food marketing, but they have reason to believe that RFID instead of barcodes is the general trend, because RFID can realize remote reading, intelligently link your own Internet of Things, and link all the products in the store together.

3. EXISTING SYSTEM

We are currently using this method in shopping malls that use barcode scanners. Suppliers use barcode scanners to scan merchandise. This is a slow process and customers have to wait in long lines. People want to leave the mall and wait for long lines to buy some products. In order to avoid this situation, we want to buy more products. In recent years, new technologies have been introduced that require buyers to put goods in a smart shopping cart, each with its own identifier.

4. PROPOSED SYSTEM

The smart shopping system we propose should achieve the following main goals:

- 1) Read products: It must be able to accurately read the products added to or removed from the shopping cart.
- 2) Payment control: We recommend installing an RFID reader in front of the exit door, which can scan all the goods in the smart trolley and check with the server whether all the goods are in it. If an unethical customer tries to leave the store without paying, the verification will fail. Coupons and advertising recommendations can be easily added to the smart shopping cart function, and navigation can be accessed through the Zig-Bee gateway to locate the shopping cart using triangulation technology [18].

A. Components:

a. RFID Reader - RFID can read and write Mifare's tags and are available in various online stores. Microcontroller and card reader use SPI to communicate. The reader and tag interact with the 13.56 MHz electromagnetic field. The working principle of the RFID reader is the induction of electromagnetic waves. The RFID reader emits electromagnetic waves through the built-in antenna and reads the measured value of the RFID tag within a certain range of 0-12m. Whenever a product enters the range of an RFID reader it reads data stored on RFID tags.



Fig 1. RFID Reader Module (EM18)

b. RFID Tags - RFID Tag provides memory for data storage. We use passive RFID tags that do not require battery power, so passive RFID tags are more efficient than active tags. When a passive RFID tag falls within the electromagnetic wave range generated by the RFID reader, the induction will generate current.



Fig 2. RFID Tags

c. Arduino Uno - Arduino Uno is a microcontroller board called Arduino Uno, which is based on the ATmega328 series of controllers. It provides developers and programmers with an integrated development environment in which various operations such as writing, compiling and downloading codes can be easily performed. Arduino Uno is an open-source prototyping platform based on user-friendly hardware and software. It has 14 digital input and output pins and 6 analog inputs for communication with sensors, switches, motors and other electronic components. It has a 16 MHz ceramic resonator, a USB connection, an external power connection and an in-circuit serial programmer (ICSP) connection, a reset button, GND pin as ground and a 5V pin to provide 5 voltages. The voltage is 5 V, and the input voltage is 7 to 12 V.

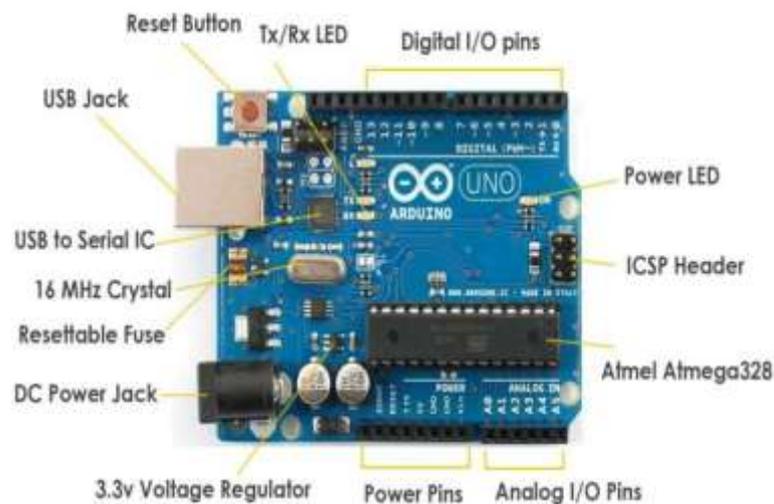


Fig 3. Arduino Uno

d. Weight Scanner - The weight scanner can weigh the items added to the shopping cart to ensure that the label matches the correct item. It can also help with security checks: if a malicious user removes the RFID tags before putting them on the cart, the cart can detect this because the weight is unrecognizable.

e. Bluetooth Module - Bluetooth module can conveniently provide serial wireless data transmission. Its operating frequency is one of the most popular 2.4 GHz ISM frequency bands. Adopt Bluetooth 2.0+EDR standard. Using Bluetooth 2.0, the transmission time of various devices is 0.5 seconds, which can significantly reduce the workload of the Bluetooth chip, and Bluetooth can save more standby time. The module is equipped with an easy-to-use serial interface and simplifies the entire design/development cycle. HC-06 is a Class 2 Bluetooth slave module designed for transparent wireless serial communication. After connecting with major Bluetooth devices such as PCs, smartphones, and tablets, the operation becomes transparent to users. The input signal is transmitted through the air immediately, and when the module receives radio data, it is sent through the serial interface exactly as received. HC-06 operates with a power supply voltage of 3.6 to 6 V DC, but the logic level of the RXD pin is 3.3 V and cannot withstand 5 V. It is recommended that you use a logic level converter to protect the sensor when connecting the sensor to 5V devices such as Arduino Uno and Arduino Mega.

B. Circuit Design of Electronic Component:

The electronic circuit is composed of Arduino Uno, RFID reader, RFID tag, Bluetooth module and display device. First connect the RFID reader to the Arduino Uno. The MOSI pin of the RFID reader is connected to the D11 pin of Arduino Uno, the MISO pin is connected to D12 of Arduino Uno, RST is connected to D9 of Arduino Uno, SDA is connected to Arduino Uno, D10 Arduino Uno, and SCK is connected to D13. The connector of the three-voltage RFID reader is connected to the 3.3 voltage of the Arduino Uno, and the GND connector is connected to the negative electrode of the battery.

Secondly, connect the Bluetooth module to the Arduino Uno. The TX data pin and RX pin of the Bluetooth module are connected to the D4 and D5 pins of the Arduino Uno. GND pin is connected to the negative pole of the battery, and VCC pin is connected to the power pin of Arduino Uno.

Step 1. Passive electronic RFID tags are attached to the product and store information about the product. When the product enters the range of the RFID reader module, it uses electromagnetic waves to read the RFID tag. Electromagnetic waves induce and power the RFID tag. In response, the RFID tag uses radio waves to wirelessly send data to the RFID reader.

Step 2. Electronic MFRC522 RFID reader module connected to Arduino Uno. After receiving the data from the RFID tag, the RFID reads the data into the Arduino Uno through the connected pins.

Step 3. Arduino Uno is an electronic interposer module, used to connect and control RFID readers and Bluetooth devices.

Step 4. The Bluetooth module connects the electronic circuit with the Android mobile phone application, which helps to communicate with each other. When the RFID reader reads data from the RFID tag, it comes from the Arduino. Arduino is responsible for data transmission between Android mobile application and Arduino Uno. The Bluetooth module enables Arduino to communicate with Android mobile applications.

Step 5. The Android mobile application has two main roles. The first mobile application receives product data from the Arduino Uno via Bluetooth. Secondly, based on these data, the Android mobile application receives the most detailed information about the product from the server computer and displays it to the customer.

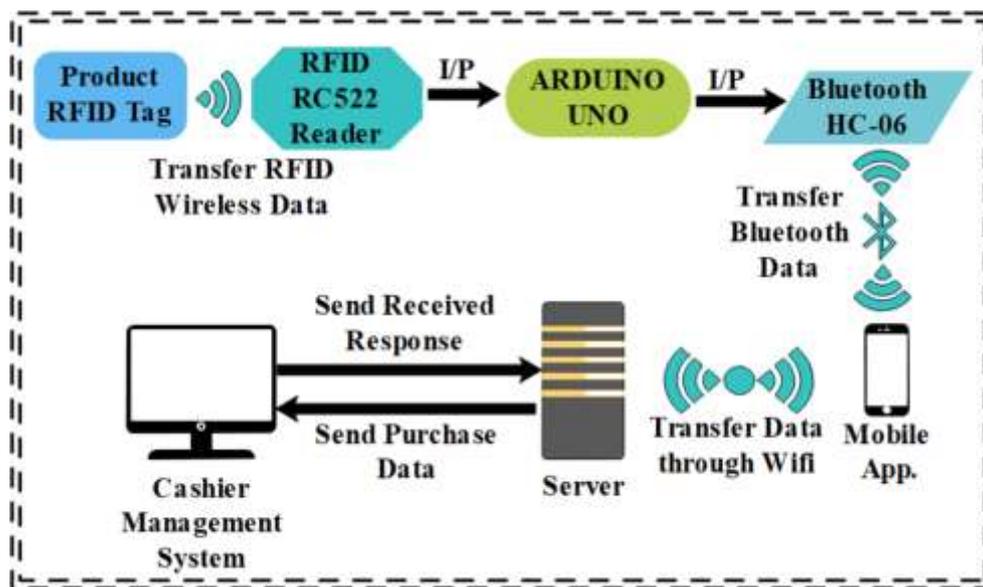


Fig 4. Architecture Design of Smart Shopping Trolley

5. COMPARISON OF EXISTING AND PROPOSED SYSTEM

We are using the Arduino Uno microcontroller, which helps to control the sensors of the electronic circuit controlled by the Android mobile application. It integrates various technologies such as RFID sensor, Arduino Uno, Bluetooth, Wi-Fi, supermarket management application and Android mobile application. These proposed model technologies have never been incorporated into the relevant system. Most supermarkets use barcode technology instead of RFID technology, which is a time-consuming process that requires scanning every product in sight. RFID technology is used in related industries, but it is not a customer-friendly environment. The ZigBee module is also used to track shopping carts. Multiple shopping carts exchange shopping information, which increases security risks and system costs. Wireless communication, providing a variety of software modules, allowing customers to use more reliable and flexible supermarket.

6. CONCLUSION AND FUTURE RESEARCH

In the above documents, the system design anticipates the automation of the procurement process by combining different technologies such as Arduino Uno, UHF RFID and Android mobile applications, which can be divided into two categories: electronic components and software components. UHF RFID is used for the first time to improve the shopping experience, and security aspects are discussed in the context of a smart shopping system. Arduino implements communication between RFID technology and software components (such as Android mobile applications) through a Bluetooth module. There is an Android mobile application in the software component. The proposed system prevents buyers from receiving outdated or unwanted products by providing a mobile application for Android. Buyers directly interact with product information. This information affects customers' preferences for products and helps them find suitable products better quality products. Shopping items can be displayed on the buyer's current shopping list, which helps buyers maintain their own shopping list according to their needs or budget. It also helps to remember the remaining products. There is also a server, such as a supermarket data centre, which is also connected to the smart shopping cart. When according to the customer's RFID card, the android mobile phone application needs to obtain data from the server to view the customer's login information or obtain information. You can efficiently search and sell the best quality products. As you study the course, the suggested system can be easily implemented in real scenarios to help the checkout process by automating the shopping cart. We firmly believe that future stores will be equipped with RFID technology, and our research is leading the development of smart shopping systems.

Future research can focus on improving existing systems, for example by reducing the computational cost of smart trolleys. A page about greater efficiency and how to improve communication efficiency while maintaining security attributes. Searching for

items in shopping malls can become easier through the search module based on mapping item locations on the map. Mobile Application can be developed by which customers can try various recommended products.

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