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IoT Based Shopping Cart Using RFID

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ABSTRACT

The main objective involved in this plan is to implement a smart shopping cart with the help of RFID technology for improvising purchasing. The plan is to employ the RFID related surveillance implementation practice in the purchasing cart. In this plan RFID card is utilized as protection entry for acquiring of commodities in the shopping malls. If the commodity has been placed in the shopping cart the price of the product appears and accordingly the total amount will be shown and if we wish to remove the product from the trolley, you can take away the product and the amount of that specific product gets deducted from total amount. In this, the technology used is for obtaining the products thereby which boosts security performance and speed while purchasing in shopping complexes. The technological objective for our presented problem in shopping complexes is the practice of RFID technology for the instinctive recognition of commodity in the interior of the purchasing cart thereby annihilating shopper intervening in the task of commodity purchase and for payment. In this project we are using Arduino controller, RFID technology and LCD to implement the RFID based shopping cart. And all the list of products added in the cart and their cost will sent to the cash counter webpage through WI-FI module.

KEYWORDS: Annihilating, Surveillance, WI-FI module, commodity, Arduino controller.

1. INTRODUCTION

The dynamic growth and the advent of new and exciting development in the field of IOT (Internet of Things) have paved the way for unique ways of using technology in a lot of fields. Wireless communication combined with radio and frequency sensing gives a whole new dimension to the way people interact with devices and use them in their daily routine. Nowadays, supermarkets and shopping complexes have become so common that they are no longer a luxury afforded only by urban cities. They have expanded beyond the domain of big cities and ventured into rural areas as well. Anybody can go to these stores and buy products that they need, but they are not entirely convenient, especially when a customer must wait for hours in queues on busy days.

In recent times, RFID technology has been developing rapidly and we're seeing its applications in a variety of industries, from employee ID cards being scanned in the office to the issuing of books in libraries. RFID stands for Radio-Frequency Identification, where information is digitally encoded into tags which can be used to uniquely identify a product. RFID tags are generally captured using radio waves and the captured data is stored into a database. The RFID tags are somewhat similar to the traditional barcodes in their purpose and functionality, as they are used for data processing. However, there are a few key differences

between the two. Barcode usually requires a barcode reader to visually register the code in order to obtain information, while in the case of RFID, the use of radio waves as a means of recording data means that no line of sight is required. RFID has automatic tracking enabled and allows new information to be updated from time to time while barcode scanning requires one to manually track the data and has no provision for updating records. RFID overcomes the drawbacks posed by barcode system which also include durability issues. The aim here is to create a system that combines the convenience of RFID tags and wireless sensing with a simple and easy tracking system that allows customers to purchase products without the hassle of waiting in queues. The customer simply has to put a product in the trolley and let the reader scan the product for information. By fitting the trolley with a touch-enabled LCD that can display product information, it also gives us a feasible system of providing the customer with all the information like manufacturing date, expiry date, price, etc. which proves to be useful when making the decision to buy an article. The system allows a customer to scan the items and the trolley automatically updates the total cost and bills the customer. It also has the provision of setting a budget, which when exceeded, sounds an alarm, as well as the removal of products and their cost from the total bill if a person deems it unnecessary

The system is built such that billing information is sent to a central server in real-time using the ESP8266 Wi-Fi module which tracks all the shopping trolleys and allows the client to log into the integrated app to track purchase and make payments digitally on the spot. The ease of functionality, versatility, and adaptability of the RFID enabled shopping cart makes it a state-of-the-art system for shopping. On completion of the customer's shopping, he/she will press the button present on the trolley, which will lock it through the help of a servo motor installed on the trolley to provide security and prevent theft and the final bill will be generated.

2. LITERATURE SURVEY

In [1], the authors have developed a smart shopping cart fitted with facial recognition and information retrieval features. They have also used an automated billing system to avoid queues during checkouts to provide a comfortable shopping experience with the integration of the Internet of Things into the cart for a smart system that assists the customers.

In [2], the authors succeeded in implementing a low budget, smart and fully functional system to make the experience of shopping convenient and comfortable for customers. They made use of RFID technology because of its efficient tracking capabilities and security features. The system deployed features like setting a budget, product addition, and removal, recommendation, as well as addition and deduction of the cost of the product depending upon its presence in the cart.

The authors of [3] devised a smart shopping trolley by installing RFID readers on the trolley which were connected to a centralized server using a mode of wireless communication known as ZigBee. It facilitated automatic bill generation on scanning the products, which were transmitted to a central department for billing. The drawback of this system was that it only allowed payments over the counter, which compromised user experience.

In [4], the authors created a concept model which made use of RFID tags fitted on the products as well as ZigBee to transmit bills to a central server. The drawback here is again the lack of alternative options for payment of bills as opposed to the traditional counter payments. The worker is supposed to collect the bill once the customer is identified, which leads to the customer waiting in queues.

In [5], the authors conceptualized an advanced shopping trolley, wherein each trolley had an RFID reader and RFID tags were present for each product. Once the product is scanned, the information is displayed on the LCD screen to show all product related information to the consumer. The aim was to help customers evade long queues, but it also posed the disadvantage of possible thefts as well as collisions. The authors of [6] accomplished in creating a centralized system for automatic billing. Every trolley was fitted with a Product Identification Device (PID) containing an RFID reader, LCD, EEPROM, a microcontroller and ZigBee Module for wireless transmission. The biggest advantage of this system was that it enabled the customer to go cashless, thus, successfully implementing a method to avoid queues.

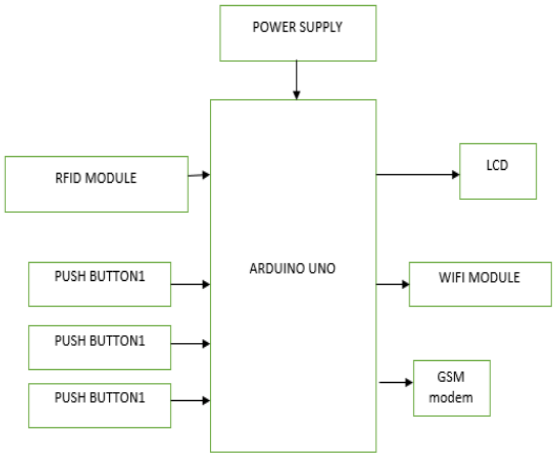
3. METHODOLOGY

A. Existing System

The current system involves a large amount of manual handling on the part of the customer. It helps in tracking and identification of trolleys, which is useful for the management of the shop but does nothing for the customer. It does not provide a feasible solution to reduce the time spent by the customer in the store, mainly while standing in line for billing and payment. This is because of a lack of alternative modes of payments and collision issues as signals are easily intercepted. The main drawback is the lack of satisfaction and ease of use on the part of the customer

B. Proposed System

The aim here is to create a system that combines the convenience of RFID tags and wireless sensing with a simple and easy tracking system that allows customers to purchase products without the hassle of waiting in queues. The customer simply must put a product in the trolley and let the reader scan the product for information. The system allows a customer to scan the items and the trolley automatically updates the total cost and bills the customer. It also has the provision of setting a budget, which when exceeded, sounds an alarm, as well as the removal of products and their cost from the total bill if a person deems it unnecessary. The system is built such that billing information is sent to a central server in real-time using the ESP8266 Wi-Fi module which tracks all the shopping trolleys and allows the client to log into the integrated app to track purchase and make payments digitally on the spot. The ease of functionality, versatility, and adaptability of the RFID enabled shopping cart makes it a state-of-the-art system for shopping. On completion of the customer's shopping, he/she will press the button present on the trolley, the final bill will be generated.



Block Diagram of shopping car

4. HARDWARE DESCRIPTION

C. Arduino Uno Board

The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontrollers. In order to get started, they are simply connected to a computer with a USB cable or with an AC-to-DC adapter or battery. Arduino Uno Board varies from all other boards, and they will not use the FTDI USB-to-serial driver chip in them. It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

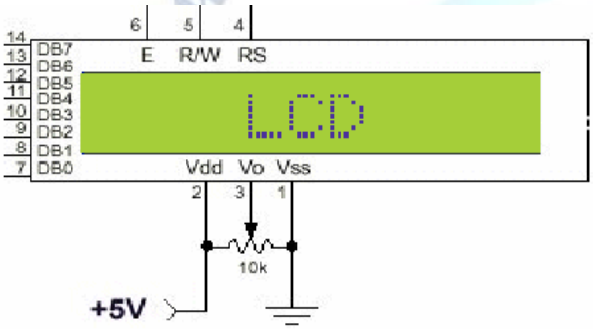
Arduino Uno Board

D. Liquid Cristal Display

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are

perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the controllers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.



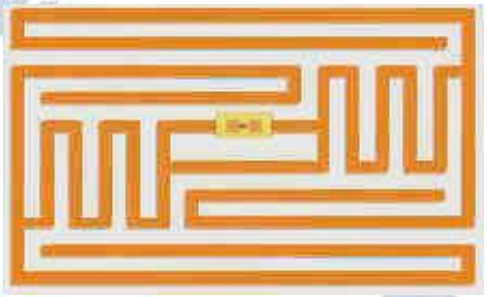
Pin Diagram of 1x16 lines LCD

E. Global System for Mobile Communications

GSM (Global System for Mobile communications) is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas use the 850 MHz and 1900 MHz bands because the 900 and 1800 MHz frequency bands were already allocated. The rarer 400 and 450 MHz frequency bands are assigned in some countries, where these frequencies were previously used for first-generation systems.

F. Radio Frequency Identifier

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. Most RFID tags contain least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal. Chip less RFID allows for discrete identification of tags without an integrated circuit, thereby allowing tags to be printed directly onto assets at a lower cost than traditional tags.



RFID T ag

G.RFID Reader

An RFID reader typically contains a module (transmitter and receiver), a control unit and a coupling element (antenna).

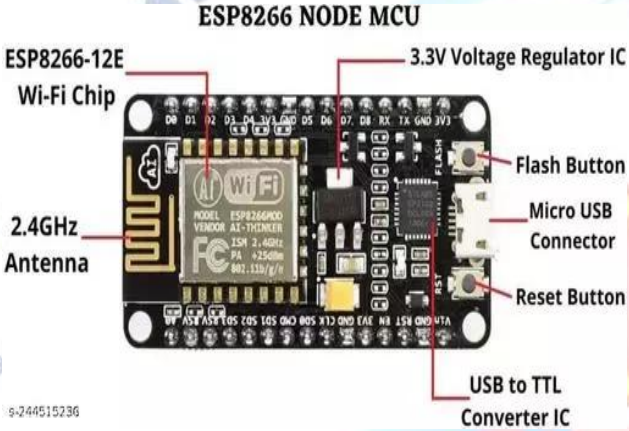
The reader has three main functions: energizing, demodulating and decoding. In addition, readers can be fitted with an additional interface that converts the radio waves returned from the RFID tag into a form that can then be passed on to another system, like a computer or any programmable logic controller. Anti-Collision algorithms permit the simultaneous reading of large numbers of tagged objects, while ensuring that each tag is read only once.

RFID operates in several frequency bands. The exact frequency is controlled by the Radio Regulatory body in each country.

RFID Reader

H. WIFI Module

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

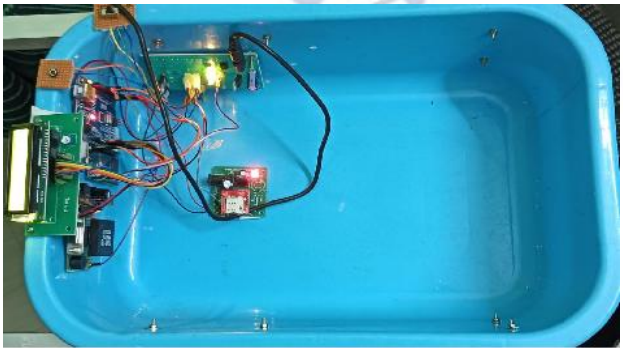


WI FI Module

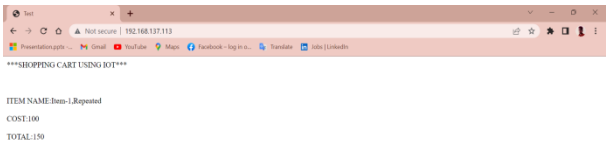
I. Arduino Software

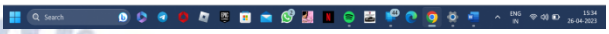
The Arduino Integrated Development Environment or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuine hardware to upload programs and communicate with them.

5. RESULT



Shopping Cart kit





Web page after check out

Message after check out in mobile

6. CONCLUSION

A system based on RFID technology that could replace the traditional barcode system was successfully established. The barcode system had various drawbacks including the strict requirements online of sight and its need to be placed in one boundary while scanning, not to mention the issues concerning its durability and inability to update information. The only constraint that RFID scanning is known to have been the distance and range coverage. RFID tags are durable and allow constant update of information as well as a rewrite of data to account for changes. They can also operate in extreme temperature conditions and are not susceptible to physical wear and tear or damage under water. This makes the process reliable, flexible and adaptive. The door fixed along with servo motor ensures that until the payment is done, no unscanned product is placed inside the trolley. The availability of multiple modes of payment through digital wallets or bank accounts ensures that every single penny is paid for and prevents the occurrence of penny scams. The proposed project is feasible as it is built on technology that already exists. We have improved it by eliminating the long waiting

time of queue at the time of billing, secured it by locking after completion of shopping and made the app available to all customers using the ionic framework. The only drawback would be that it would fail if the server is down for any reason.

FUTURE SCOPE

Development of project can be done in many ways, where RFID tags can be replaced by RFID stickers which are small, low cost.

Security can be improved by counting the number of items or placing weight sensors within the cart for tallying the weight and getting all the types of product names when cart is passed through a particular aisle using camera module.

Multiple RFID tags can be read using a single RFID reader for a greater number of products which are added in the cart.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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