IOT Based Advanced Smart Shopping Cart Using Arduino and RFID

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[1]International Journal for Multidisciplinary Research(IJFMR) E-ISSN, Dept. of Avionics, Indian Institute of Space Science and Technology

September 26, 2022

International Journal for Multidisciplinary Research(IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com● Email: editor@ijfmr.com

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Abstract
India is one of the world's most rapidly growing economies and is aiming to develop into a $5 trillion economy. E-commerce has certainly spread and a great deal of progress has taken place. The working class and the majority of our community prefer to go to shopping centres or supermarkets. Even if E Commerce has grown exponentially in recent years, retail sales still account for about 85% of total sales. One of the difficulties facing customers is a line-up that follows the payment process in a queue.The advanced era of technology in which the majority of customers have to wait for their shopping in the supermarket, because it takes very long time. Due to the barcode-based billing method, a significant throng on the supermarket during discount bids or weekends finds themselves in long lineups.Instead of waiting long time in a queue, the proposed method is to let the client process products directly and charge them in the trolley. After a quick scan in the carriage, customers need to add the product and when they are finished, the amount is shown in the carriage. In addition, the client can log in to the app that shows the list and amount of all the added products. The customer can pay digitally via the application once done. Thus the time spent elsewhere in long queues is reduced and they are relieved of the tediosity with bar codes scanned.

Key words: Internet of Things (IoT), Arduino, Android Application, Bluetooth, Wi-Fi Module, RFID

INTRODUCTION

The IoT is a platform that brings together hardware and soft-ware to create an integrated system environment connected to each other. The embedded hardware system includes sensors, processors or controls, and software system software provides Internet APIs and protocols. This interconnected environment allows for the creation of a communication web and connections between multiple devices, platforms and networks.

The human lifestyle of one day is now changing and becoming hectic. Because people don't have much time to shop, which is unavoidable. They therefore prefer to shop in malls, so that all products can be obtained in one place. This saves them from going to various shops to buy just a limited product type. While shopping in shopping centres can save people time, they can only visit shopping malls at weekends.

The technology of RFID has developed rapidly in recent times and we can see its applications in a range of industries, from office ID scanning to book publishing in libraries. RFID means the identification of radio frequencies where information is digitally encoded in tags that can be used to identify a product.

In general, RFID tags are captured by radio waves and data collected stored in a database. RFID (Radio frequency identification) is a versatile and user-friendly IoT technology. RFID tags are routinely used to identify products using their radio waves. Due to efficient operation and faster scanning and detection RFID sensors are highly popular. It has a huge benefit over bar code scanning because, unlike bar code scanners, no line-of-view is given to RFID while an object is being scanned when it is just positioned on a sighting track. The distance of RFID scanning is adjustable as per requirements.

It aims to build a system that combines comfort of RFID tags and wireless sensing with an easy and simple tracking system that allows customers without having to wait in queues to buy their products. The customer must simply put an item in the trolley and allow the reader to scan the product for information. With an LCD that allows the trolley to display product information, it also provides us with a workable system that provides the customer with all information, such as the manufacturing date, expiry date, price, etc.

In order to establish a linked environment, this smart shop system should contain the RFID tags, readers, LCDs, the WLAN-Computer and Bluetooth protocols. RFID tags, read-ers, Bluetooth and Wi-Fi have been employed for automated invoicing operations, while product details have been shown in LCD.The Bluetooth and Wi-Fi make it possible to update the cart on mobile app. This approach saves customers time and the difficult purchasing process. The automatic payment method here reduces the waiting on the account counter and clients shopping time. On completion of the customer's shopping, he/she clicks on the button on the trolley to lock it using a servo engine installed in the trolley, to provide safety, to prevent theft and to generate the final bill.

DETAILED DESCRIPTION : SMART SYSTEM

A. Functions of the Smart Shopping Cart

The Smart Shopping Cart's features are stated below:

1) The essential job of calculating client bill and upgrading it when and when the things purchased are placed in the basket.
2) The consumer may additionally monitor on the monitor attached to this cart for the information of the goods purchased and the current bill amount.
3) It also contains the handling of the following unique scenarios in addition to the preceding features, which ensures that the system is fair in all respects. The system detects all cases listed below.
    a) Attempt to steal the things without scanning their bar codes, just keeping them in your cart.
    b) Try scanning a product, but insert several products in the cart.
    c) Try to take away higher cost goods by scanning another lower price product's RFID Tag.
    d) If the client scans a product, he does not keep it in his cart.
    e) Because consumers are likely to alter their minds, our solution enables any item already placed in the cart to be removed without assistance from our employees.
4) Features an admin can utilise on the application:
    a) The user database can at any time be checked by an admin.
    b) Admin may either add, delete or alter people from the database.
    c) The admin can monitor and track the payment method by checking the total bill created by all users.
    d) Admin may track purchases and carts as well.
5) Features a client can use in the application:

a) Before making a decision to purchase an item a consumer can see the product information on the app.
b) By adding or removing products and their costs, the user can change the cart from the total cart value.
c) Before the user generates the bill, the user can see the complete cart amount on the app.
d) The user can either go cashless or pay the bill on a typical basis through the counter so that the need for waits is eliminated.

B. The Basic Design of Idea

The design was designed to address all the above eventual-ities. Since automation is the purpose of the Smart Shopping System, a RFID Reader must be attached to every cart. Thus, a camera barcode scanner that is mounted to the cart is included with this design.In order to determine the price of a product from the database, the RFID Reader must include the corresponding information on all products. Our database is stored in the Base Station at the payment counter in our design. Included in the database are some information per product, like its bar code, its name, price and weight.

In order to detect fraud, the weight attribute of a product has been selected for double-checking the product identity. As a weight sensor a load-cell was configured. In the decision-making process on the cart, the load cell output is used. When the weight of a product estimated by the load cell is not the same as that of the product, the mismatch is interpreted. The design contains a third level of control, so that the decision-making process using image processing is significantly improved. The product RFID Tag is scanned and the camera as the barcode scanner takes an image of the product. It's after scanning the RFID Tag that a person wishes to exchange this product with a costlier one. There is a sheet attached to the top of the cart that is intended to place the products in the cart when it is used, instead of having the buyer put the items himself into the cart.After the scanning is finished, the person sets the merchandise on this sheet. Just before the shopper puts the product into the cart, another image is taken. In the system present at the cart both photos are kept locally. These two photos have an image comparison algorithm to determine whether the products are the same. It is considered as a case of divergence if they are not determined to be identical. After collecting the results from the algorithm, both photos are erased from the memory of the system so that memory consumption on the cart is limited.

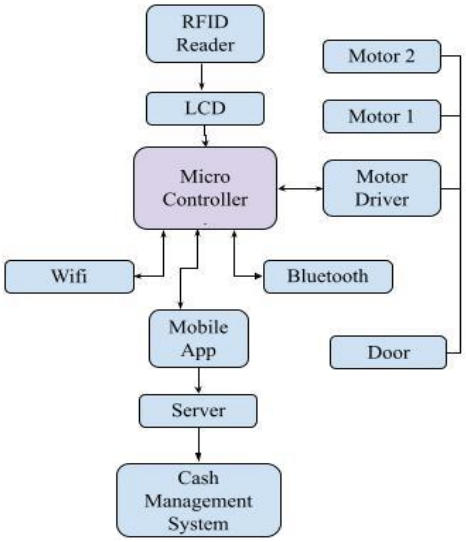

Fig. 1.Overview of the System

Instead of transmitting the image for each product to a base station for comparison, processing is performed locally in order to reduce the overhead on the wireless communication, which makes it energy efficient. This assures furthermore that even with many consumers, the system delivers the same performance simultaneously in stores.

To secure our payment procedure with the Dummy Bank Account, we shall use the newest 256-bit encryption tech-nology. Encryption with 256 bits means that any hacker or intruder must attempt to breach the encrypted bank transaction information with 2^{256} codes. This is the latest cryptography algorithm in the latest technologies and security protocols, including SSL and AES protocols.

C. Smart Shopping System Operation

A consumer walks into the Smart Shopping Centre. When he or she enters, the first thing he or she does is select a Smart Shopping Trolley. Each trolley is assigned a unique ID, and each customer is correlated with the trolley's ID.

When customers collect a product they like to purchase, they scan the product RFID Tag first using the RFID reader and then put it on the cart panel, which is intended to play the role of inserting the products within the cart when triggered.

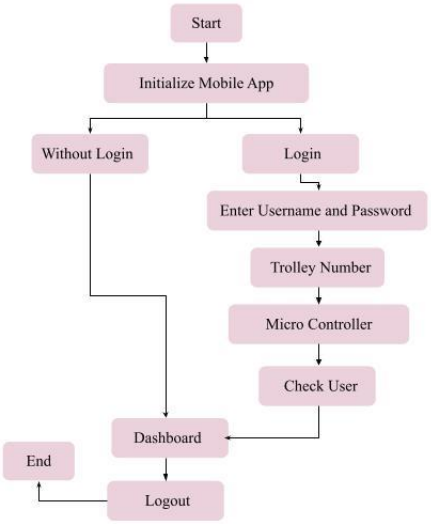

Fig. 2.Mobile Application Interface

After the consumer picks the product to know the product details, the RFID tag is employed, which includes information such as true cost, discount, date of production and the product expiry time. Then the RFID tag comes close to the RFID reader and the RFID reader attached to the car and handed the trolley. These tags are read by the RFID reader. The product details are now shown on the LCD. The clients therefore learn about the details of the product.

The goods is placed within the trolley once the product details have been scanned. The trolley consists of a security door locking system and the servo motor may open it. The door is opened with the switch here. When the button is pressed, the switch opens and closes automatically after 10 seconds. Then the customer can open the door again after scanning. An ultrasonic sensor is held inside the carriage to count the entire product. Therefore if a person mistakenly retains unscanned stuff, he will alert the customer via Wi-Fi protocol about the unscanned product.

As soon as the customer gets a trolley and enters the app or registers, he/she can begin to scan products into his/her trolley. Each product being scanned is sent by Micro Controller to the server and the application and if the customer decides to delete the product, it may be re-scanned and removed both from the server and from the cart of their app.

When you shop, the consumer can push the integrated payment button on the trolley to ensure safety, so more goods cannot be added during the payment process. The app will now provide you with the overview of the things you have bought, the price of the things you have bought and the offers you will redirect you with a debit card to online payment. Now the customer can head directly to the exit doors to get removed there RFID tags and reuse them.

LITERATURE REVIEW

A. ”Development of customer-oriented shopping carts”, H. H. Chiang et al

Smart shopping cart with facial recognition and information recovery functions have been created by the authors. They also employ an automated billing system to avoid lines of queue when checking out, to deliver the Internet of Things for an inteligent customer-assisted system with a comfortable shopping experience.

B. ”innovative shopping cart for smart cities”, K. Prasiddhi, Dhanashri H. Gawali

The authors have successfully implemented a budget-saving, intelligent and fully functional system to make the shopping experience simple and convenient to customers. Due to its effective tracking and security advantages, they have used RFID technology. The system has functionality such as budgeting, product addition, removal, recommendation and addition and cost deduction, based on the cart.

C. ”Automatic trolley shopping with sensors”, Deepali Pan-dita, Ashwini Chauthe, Nikhil Jadhav

The automatic trolley for shopping was designed using sensors to facilitate autonomous trolley movement. The IR sensors in the carriage are employed here to detect the customers. If the consumer stops at the location to take the things, the trolley will stop at a distance specified into the microcontroller.

In addition, the automatic billing system was also introduced to avoid the length of the billing counter. A barcode reader is provided in the trolley and each product has an RFID tag. If the consumer wants the merchandise, he can scan the product mark and put it into a chariot. On scanning the product, the LCD display displays the cost of each product in the trolleys and shows the total amount of shopping to avoid queuing at the counter. The trolley stops if another customer breaks off, and there is plenty of misunderstanding and conflict because there are no obstacles.

D. ”Manufacture of electronic automated trolley”, Nayak Madhukara, Karunakara and Kamath Karthik

The trolley was invented to increase the trolley’s autonomous mobility. The chariot has a communication and control system. The system also contains a sensor at the target and load positions. In this regard, the ultrasonic system sensor is used and the IR emission and transmitter tag have been designed for client monitoring. The trolley system provides beep if the signal between the IR and transmitters is interrupted by another client. When the customer leaves the route, the trolley follows the customer again.

The IR tag must be affixed to the sleeve of the client, and the consumer may suffer from a discomfort or may miss the IR emitter tag.

E. ”Smart Supermarket Trolley System Using RFID”, S. Aishwarya, D. Gomathi Shankari, R. Ilakkiya, S. Prasanth and S. SriHeera

An automated smart cart billing system that consists of an RFID reader that reads products that include RFID tags in a smart cart to ensure that the customer may be self-billed and payed via the mobile application. Radio Frequency employs signals for signal identification and the identification of objects. It reads long-distance information because there is no sight line, therefore no physical interaction is necessary. Tag creates a disruption that the decoder reacts to. A distant antenna is connected to an RFID tag using a capacitive coupling. When the reader of the RFID antenna propagates RF, capacitive coupling occurs. There are now two types of RFID that is passive and active. There is no internal power source in passive tags when active tags are working on battery. In two sectors - near and far field - the electromagnetic field around RFID antenna is divided.

INFERENCES AND CONCLUSION

The planned system design for shopping automation by combining several technologies, such as Arduino Uno, RFID and Android. The Electronics components and software com-ponents can be separated into two main categories. Arduino Uno acts as a microcontroller for RFID and Built technol-ogy intermediary control, connecting RFID technology with mobile android software components, using the electronics components Bluetooth module. In software components there is an android mobile application, where clients connect to the suggested system with numerous suggested approaches that secure customer privacy. In addition, there is a server as a supermarket data centre that is also linked to the smart shopping cart. When clients utilise an RFID card for customer login verification or product information extraction by a mo-bile Android app, the mobile app can wirelessly communicate with the server.The consumer can roam freely and readily communicate with product information in every section of the store by the wireless removal capability. These technologies are planned for working together to most efficiently entertain the customer. By searching for and effectively obtaining the highest quality goods using offered technologies customers. In order to support the purchasing process through automation of the cart, a method described can be simply deployed in real-life circumstances.

ACKNOWLEDGEMENT

I'd want to convey my heartfelt gratitude to Professor Dr. Manoj B.S., Ph.D., who provided ongoing guidance and motivation during the research. Without his consistent direction and assistance, it would have been practically difficult to produce this work with great understanding in such a short period of time.

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