

Smart Shopping Trolley System Using IOT

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Abstract: Today's world has a fast growing population with a wide range of demand from a variety of domains. Customers who need to purchase different products in supermarkets need lots of time and patience in coordinating among themselves for successful shopping. We need to address this problem by efficiently using our technologies. In the advancement of technologies, the world is getting automated in many aspects. In this paper, we depict a reasonable and cost-effective Smart Shopping Cart utilizing IoT (Internet of Things) innovations. Such a framework is appropriate for use in spots such as supermarkets, where it can help in lessening work and in making a superior shopping knowledge for the clients. Rather than influencing the clients to sit tight in a long line for looking at their shopped things, this framework helps in mechanizing the easy and comfortable billing process. Our proposed system provides the location to pick up the items present in different racks of the supermarket. These features save time and make shopping easy. Along with these abilities, this system design is also capable of detecting theft by shoplifters. In addition, the supermarket management will be able to analyze the shopping behaviors of various customers' businesses. These will be very beneficial for the retail stores. Accordingly, the management team will have the sales of all individual products and make the stock available based on the ongoing customer requirements. Overall, this system will ensure that the customers will have the best shopping experience and very often, they visit the supermarket for the shop.

Keywords: RFID, IOT, XBEE, ARDUINO.

I. INTRODUCTION

The increasing reliability and cost effectiveness of Internet of Things (IoT)[1] based connected smart things in the field of consumer applications, it makes better sense to ensure such technologies are put to use in addressing the day today concerns of the common man. In this framework, we portray the execution of a dependable, reasonable and cost effective Smart Shopping Cart. Such a framework is reasonable for use in any shopping spots, for example, general stores, where it can help in diminishing work and in making a superior shopping background for its clients. Rather than influencing the clients to sit tight in a long line for looking at their shopped things, the framework helps in mechanizing the charging procedure. Supermarket at long last end the disappointment of not having the capacity to locate on your shopping list and ending up totally dumb founded the second you set foot in one of their stores.

It could incorporate with a shopping list on your telephone, for instance, so you could be taken appropriate to the things you have purchased. The brilliant shopping cart will be an across the board shopping cart. It will enable the client to monitor the aggregate cost also, when things are added to the shopping cart. The client will be aware of his budget. The client make easy payments through the mobile phone. This new framework would diminish the long hold up times at the checkout counters, increment the productivity of the checkout which makes the entire experience more helpful required at billing counters hence, reducing the amount spent on the labor. This framework addresses one of the common issues that clients face in the existing system such as unable to find the items in the inventory or employee for any help. The application will help the clients to find items at the right inventory by providing the information about the items in the list along with a location of items in the super market thereby providing new experience to the clients.

This paper aims to outline a framework which peruses the standardized tag on everything that is put in the shopping cart and updates the item data which is accessible to the customer. This RFID card[2] has all the data about the item. This information is at that point organized and exhibited to the client for survey and affirmation on a LCD screen. New things in the shopping cart will be recognized. RFID sensors will be utilized to recognize when things are expelled from the

shopping cart. A program will be executed to the expulsion from the customers shopping basket. Another program will be executed to function as an against theft in shops which helps system to keep the customer from leaving without an effective installment.

The framework assists the store administration with a pro-grammed refresh of the stock on each buy of a thing Intelligent shopping basket (proposed framework) can possibly make shopping more pleasurable and effective for the customer and the stock control less demanding for the store administration. Clever shopping basket (proposed framework) can possibly make shopping more pleasurable and effective for the cus-tomer and the stock control less demanding for the store administration.

II. LITERATURE REVIEW

Smart checkouts where customer convenience has been im-proved drastically.In Fig.1, self-check outs have been popular since then due to low overhead cost however, the shoplifting and lower operating efficiencies are considered as major drawbacks in the retail environment.

In 2005, Fujitsu, a Japanese company has demonstrated a shopping trolley[7] with an inbuilt barcode scanner as shown in Fig.2 The barcode scanner[12] was used to scan both products and loyalty cards in real time. However, this shopping trolley does not fully solve issues such as in store stock management and shoplifting. Amazon has recently come up with a smart retail store concept AmazonGo where the customer pick a product from the product gets tracked and self-checked. The AmazonGo[8] system uses image processing, neural networks and deep learning algorithms to forecast



Fig. 1: Smart checkouts.



Fig. 2: Trolley with barcode reader.

which item is picked by the consumers.The system accuracy largely depends on consumers historical purchased patterns. In the given Fig.3,AmazonGo also uses sensor fusion techniques to process multiple images taken from cameras around the retail store to predict best estimate of an item picked by the consumer in realtime. Panasonic, another Japanese company



Fig. 3: Amazon Go

has come up with a RFID based shopping basket where each item is tagged using UHF RFID[10] (ranging from 916-924MHz). In Fig.4, Panasonic has revealed that this smart basket is part of cashier free convenient store concept where customers can drop items into the basket and each product gets scanned through a self-serving kiosk. Higher capital cost as well as the limited size of the basket have been identified as the major drawbacks of this implementation.



Fig. 4: RFID based shopping trolley

For instance, RF signals transmitted by RFID tags operating in UHF and MW frequencies hardly penetrate water containing bodies, thus, they work poorly near human tissue. However, the reading distance and data rate of these tags are the largest. On the other hand, LF and HF signals easily penetrate water environments, but RFID tags transmitting in these frequencies have lowest reading ranges and much less data rates than UHF and MW systems. However, 13.56 MHz HF RFID tags have pretty acceptable data rates and reading distances and their signals easily penetrate humid environments. Moreover, this frequency band gained high popularity and standardized in many countries. There is a wide variety of commercial RFID tags working in 13.56 MHz frequency. Therefore, 13.56 MHz RFID tags and reader were chosen in this paper. Differences between the RFID technology[17] and the existing system of barcode scanning. In another comparison, there are several UHF RFID[18] based smart container applications have emerged in recent times. Most of these applications discuss the development of RFID with xbee system to establish the wireless communication between main server and each smart container.

III. DESIGN AND IMPLEMENTATION

The Smart Trolley design consists of the following components.

Smart Trolley [7] design and user interface.

Connection to the store database.

Wireless access.

Network.

Scanning

product. Power.

Payment methods and generation of receipt.

The Smart Trolley should be easy to move around. Each Smart Trolley should be fitted with security tracking device to stop people taking it out of the retailers premises. It should be fitted with a RFID Scanner[15] and a screen device (shopping

tablet) to display all the scanned product and prices. Shopping tablet should be user friendly, touchscreen, easy to use, fitted to the trolley and has dynamic low power saving mode and Wireless enabled. The smart device should be able to link or connect with the store database for product search and item browsing. The trolley should be designed with four wheels and easy to handle. After shopping the device has the capability to send a receipt via text message to our android phone[20]. It Requires power supply for all attached devices. To achieve the desired functionality for this product, multiple input and applications are needed, such as network connection (Wireless, database, security, payment method, etc...) The components of the Smart Trolley design are[7]:

LCD screen

Xbee

RFID reader

RFID cards

Payment button

Telegram app

SQL database

Aurdino board

Smart checkout points

LCD screen: Displays product information such as product name, cost of the item purchased and total amount as shown in Fig.5.

Xbee: XBee is a low cost and low power protocol that costs



Fig. 5: LCD Screen

much less energy than WiFi as shown in Fig.6.

RFID reader: We use an ultra-high frequency (UHF) RFID reader Fig.7 which allows a reading range up to 10 meters. By tuning the transmission power of the reader, we can control its reading range.

Payment button: Customer can press the payment button Fig.8 after purchase so that bill will be displayed on the smart phone. Telegram app: Used to link the customer to the bank and to the shop.

SQL database: Used for both shop and bank.

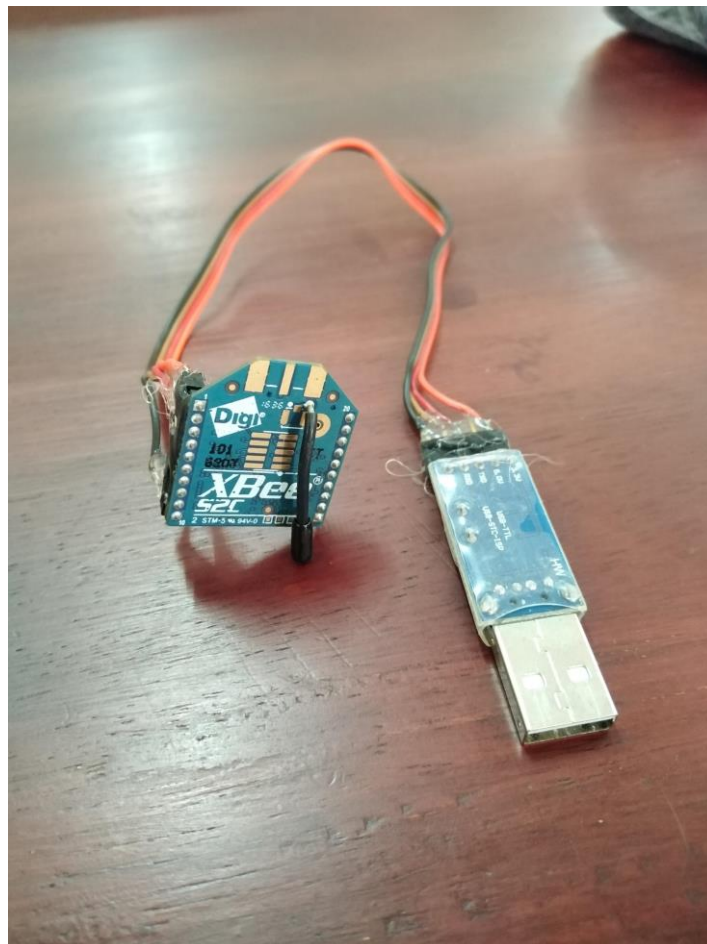


Fig. 6: XBEE

Arduino board: Arduino board Fig.9 designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

Smart checkout points: The checkout point[28] is installed with a Point of Sale (POS) for the customer to make a purchase. After making the payment, a customer has to go through a lane, where a RFID reader can read all the items in the cart, and check with the server if all the items have been purchased. Any overpay or underpay will trigger an alert.

According to our tests, when putting an item into the smart cart or removing an item from the cart, the smart cart is able to accurately read it. One surprising result is that, the metal outside the cart blocks the signal to a pretty high extent that, when the reader is inside the cart, no item outside the cart can be read. This clearly indicates that an item put into a smart cart will not be read by a nearby cart accidentally. We are also able to test how to set a RFID reader at the checkout point so that the items in the cart can be accurately read. The



Fig. 7: RFID reader

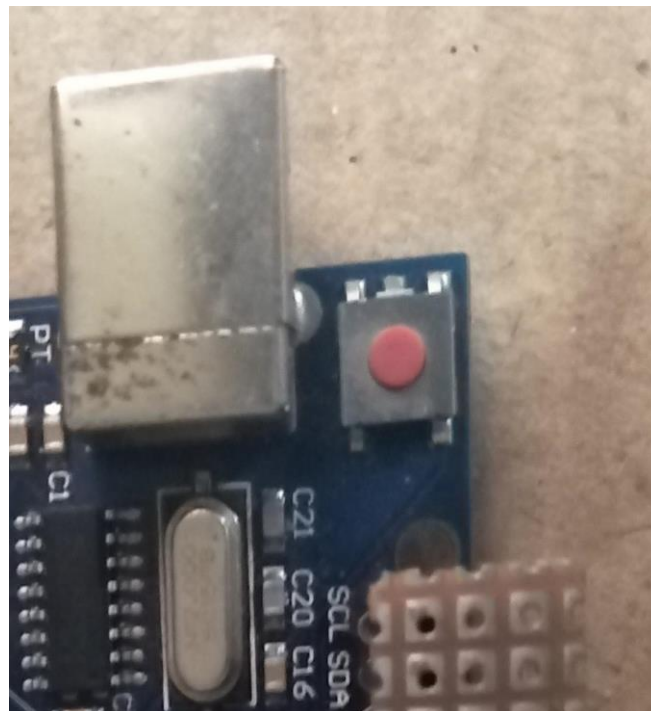


Fig. 8: Payment button

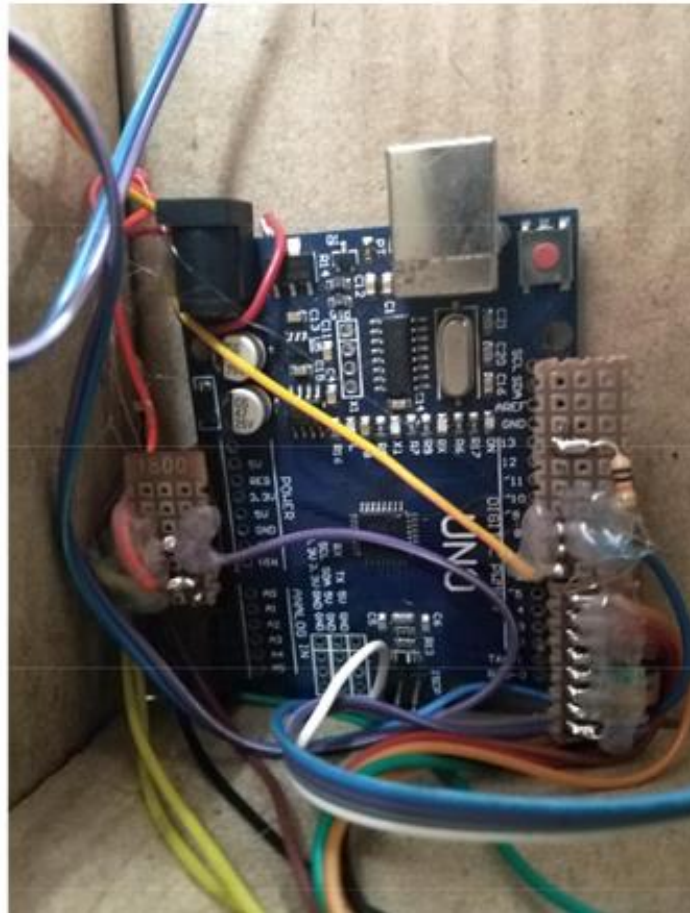


Fig. 9: AURDINO board

server communicates with the smart shelves, smart carts, and the checkout points. The smart shelves are able to monitor the items on the shelves by reading the RFID signals from the tags. The smart carts are able to read and retrieve information of the items inside the carts. Finally, the checkout points can validate the purchase made by a customer. When an item is put into a smart cart, the RFID reader on the smart cart should read the tag and then send the tag information to the micro controller that will then communicate with the server via XBee to request product information.

REGISTRATION

Before moving all items to the shelves, the store needs to register all of them. We give a design of the RFID tags. In our design, information such as price, location are stored in a database of the server, rather than in the tags, because such information might change over time, and it is more convenient for the server to manage them. We insist that the tags must be tamper proof, so that any action on taking off a tag or switching tags between items will lead to a failure.

PURCHASE

The customer can place the items in the cart by using RFID reader[15] and that items amount will be displayed in the screen along with the total price and location. If any of the items are placed without swiping then it gives a theft message and the bill will not be generated.

SECURITY MODEL

To make our security model[28] practical we have a smart checkout at the gateway so the item not listed will give the message as theft.

BILL GENERATION ON SMART PHONE

Once the customer after purchase press the payment button the bill will be automatically generated in the smart phone[23] along with the total amount of purchased items and balance.

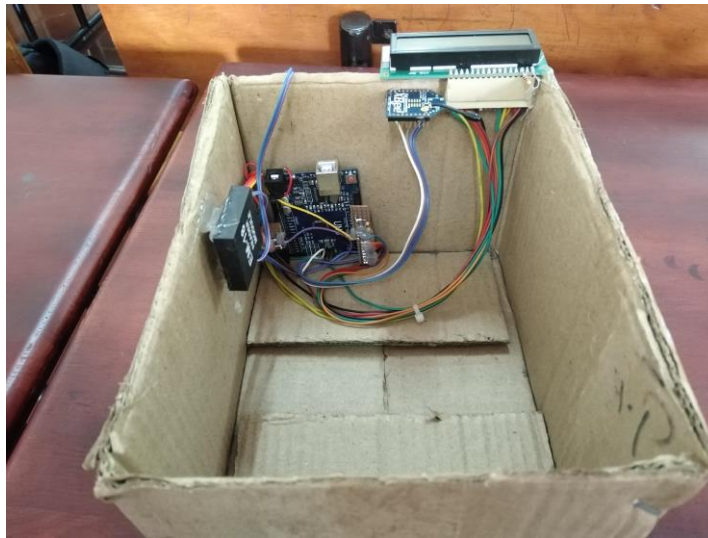


Fig. 10: Implemented Design

IV. CONCLUSION AND FUTURE WORK

We propose a secure smart shopping system utilizing RFID technology. We detail the design of a complete system and build a prototype to test its functions. We also design a secure communication protocol and present security analysis and performance evaluations. We believe that future stores will be covered with RFID technology and our research is a pioneer-ing one in the development of a smart shopping system. Our future research will focus on improving the current system, for example, by reducing the computational overhead at the smart cart side for higher efficiency, and how to improve the communication efficiency while preserving security prop-erties. This work aims to provide an insight into the RFID based production data analysis for production control in the IoT[11] enabled smart job shops. Thus the system creates the automatic bill of the purchased items from the trolley using trolley number. Also with this system the reward point system gets implemented using Android application. The trolley is designed to be highly efficient and fully synchronised with the retailers current system. A detailed market description and competitive analysis of the product market and its attributes were presented in this report.

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