Design and Implementation of Smart Basket Cart Using Near Field Communication

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Abstract: The main impetus of our project is to bring down the chain delay in supermarkets by using smart basket cart (SBC). Product acquisition in gross convenient shop with numerous products is a tedious and time consuming process. This cart uses modern and cheap technology to make it intelligent and time saving. It requires an embedded electronic hardware that contains an OLED display, Arduino Uno R3, a wifi module, NFC tag, a power supply and a shopping cart. There are many types of carts used for shopping in malls. We offer smart basket cart using NFC to pinpoint the product rate and send the data wirelessly to the receiver. Then the data is sent to the main server and the bill is generated for all the products in the cart. Instead of wasting the time in long queues we can use the time for other fruitful activities.

Keywords: NFC, NFC Card, Wifi Module, Arduino; OLED.

1. INTRODUCTION

1.1 Benefit to the customers: This system provides on spot scanning of the product and shows its price details on OLED. This allows customers to compare the total price with the budget in the pocket before billing. Whenever a customer is done with his/her shopping and near to the billing counter, the data from the OLED is going to transfer to the billing counter computer through ESP8266. By this way, it will save the time of the customers as well.

1.2 Benefit to the mall: This system works only for those customers which are having the membership card of the mall. This is implemented by using NFC Tag and NFC Reader. Customers require inserting the membership card which is also a NFC Tag and inserts to a place where NFC Reader is present. Once NFC Reader detects the presence of NFC Tag only then it will allow the shopping trolley or basket to become smart. Otherwise, it will act as a simple trolley.

1.3 Reason behind using Arduino: We designed the system using the Arduino Development Board. It provides complete access to functions of microcontroller or microprocessor like to program the controller, to use the input/output pins, to communicate. The system using Arduino is less bulky and it can easily transfer from one place to another. It requires less power supply and we can easily improve the system, if required, because of its easy programming.

1.4 Cost efficient and user friendly: Since we designed this system using Arduino and user Smart Basket act as NFC reader, this system requires less cost to design. This system requires less power supply and it displays the total amount to the user so this system is user-friendly.
2. LITERATURE SURVEY

In [1], the authors “Galande Jayshree, Rutuja Gholap, Preeti Yada” proposed RFID based automatic billing trolley, with this model the system consists RFID reader and the products in the malls equipped with RFID tags. When a person puts any product in the trolley its code will be detected by RFID reader and the price of the product will be stored in the memory. At the billing counter the total bill data will be transferred to the pc by wireless RF modules. In [2], the authors “S.Sainath, K.Surender, V.Vikram Arvind” proposed a model Automated Shopping Trolley for supermarket Billing system in which the automated shopping trolley is a smart trolley which integrates a raspberry pie embedded chip with two barcode scanners and a battery kit to allow users to self check out at supermarket. In [3], the authors “Mr. Yathisha L, Abhishek A, Harshit R, Darshan Koundinaya” proposed a model automation of shopping cart to ease queue in mall by using RFID module and Zigbee module. In this system we are using RFID tags instead of bar codes, whenever a customer puts a product into a trolley, it will get scan by RFID reader and product price and it will be displayed on the LCD. We are using Zigbee transmitter which is used to transfer the data to the main pc. In [4], the authors “Jadhav Rahul, Pradeep, Nandkumar, Tarali ShivkumarJ” proposed a model of RFID based automated billing trolley. In this technology, the communication is in between RFID tag and reader, each tag has magnetic strip with specific code and tag is read by RFID Reader module. The automated billing system based on the passive RFID provides suitable solution to the manual billing method in shopping mall. In [5], the authors “Udita Gangwal, Sanchita Roy, Jyotsna Bapat” proposed a system of smart shopping cart for automated billing purpose using wireless sensor networks. In this paper authors describing the implementation of a reliable, fair and cost efficient shopping card using wireless sensor networks. In [6], the authors “Kalyani Dawkar, Shraddha Dhomae, Samruddhi Mahabaleshwarkar” proposed a model of electronic shopping cart for effective shopping based on RFID in which a system consist of smart trolley will have RFID reader, lcd display. When the person puts a product in trolley it will scan and the cost, name and expiry date of the product will be displayed In [7], the authors “Ynajun Zuo” describe the importance of RFID for automatic item identification and data capture. He developed a secured tag reader authentication protocol to ensure the authenticity of RFID readers.

3. METHODOLOGY USED

3.1 RFID technology

One of the major technological advancements of recent years called RFID or Radio Frequency Identification made it possible to implement this project. RFID technology uses wireless propagation of electromagnetic wave signals over a certain frequency spectrum shown in figure 1. Generally, there are two types of RFID tags – passive and active. Passive RFID tags do not have any power source inside their circuit. Hence, they absorb enough electrical power for transmitting signals by harvesting RF power of receiver signals from their antenna that gets some energy from RFID reader or other sources. The size of passive RFID tags can be tiny so that they can be attached to market products. Passive tags are a major concern of this work.
3.2 Arduino

Arduino is a noncommercialized hardware development board. With the help of Arduino UNO R3 in our project we are implementing the smart basket cart. It is the central processing unit of the smart basket cart with the help of Arduino’s GPIO pins we can able to give an input and recruits the required output from the Arduino board by processing the data. We can able interface analog sensors and digital modules like LCD, led displays and several sensors. In our project Arduino module helps to control all of the components and process the data like a CPU [7].

![Arduino UNO R3 board](image)

Fig. 2: Image of Arduino UNO R3 board.

3.3 OLED

Instead of using LCD display we are switching over to the OLED display because it has more effect features than the LCD display. OLED display having several features like multiple line support, multi color support 256*38 finally the major advantage is less costly when compared to the 16*2 LCD displays. These types of displays are used in the many real time projects and products like television, iPad, video games etc in our project display will play the major role it helps to display the details about the product finally the total amount will also shown in the display.

![OLED Display](image)

Fig. 3: Image of OLED Display.

3.4 Near-field communication

NFC is a protocol used by the wireless transmission part in the projects/products. It provides the peer to peer communication data transfer, with the help of this module in our project we can able to transfer the shopping list from the product to the basket, the billing software NFC transmitter will help to transfer the set of code to the NFC detector. NFC detector will integrate with the Arduino

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module send the data to that and process the codes [5].

![Image of NFC tag](image)

**Fig. 4: Image of NFC tag.**

### 3.5 ESP8266(Wifi Module)

ESP8266 is a wifi module it helps to communicate with other hardware components and allows to send and receive the data. This is also a similar process of wifi data transfer in smart phones. Wifi module is also helps to archive the internet of things concept with the help of database like firebase we can able to store a required amount of data into the server with secure and encrypted way. In our project wifi module is help to communicate with the local database or LAN server to download and upload the details. Database will provide the details to the authenticated users only otherwise the details cannot be showed wifi module will help to transfer the details to the billing software from the basket.

![ESP8266 Module](image)

**Fig. 5:ESP8266 Module.**

### 4. FLOW CHART

Once the cart system is activated, it keeps checking for any NFC tag that might enter the basket. If a product tag is read, entry is made in the current record session. This log is updated with every new entry to the system. Customer can either make a new entry or remove one. After completion of this process, the customer has to select the end shopping option on the screen. This updates the status of user on the internet and generates a bill at the counter which is also stored in the company database [8].

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5. BLOCK DIAGRAM

5.1 Trolley Unit

This unit contains all the user interactive components. It is made up of six technical components- OLED, Buttons, Bluetooth Transceiver / ESP8266, NFC Reader & Microcontroller (Arduino UNO R3) and one mechanical component, the classic trolley. OLED is used to link the customer with this technology. It provides the user with details about the items in the cart and the total bill. Any settings or item deletion can be done using the buttons. NFC Reader is placed near the top ring of the basket making it easier to sense the NFC tags of the items taken in the basket by the customer. The data exchange between the data-carrying device and the reader are achieved without the use of galvanic contacts, using instead magnetic or electromagnetic fields. The microcontroller, here used Arduino UNO R3 is used to analyse the read tags and update the display accordingly. It is also responsible for connecting the cart with the smart cart server. This server is connected to the main server of the shopping complex providing updated information about the inventory.

5.2 Server Unit

The smart cart server comprises of a Raspberry Pi and a Bluetooth transceiver / ESP8266 module. It is connected with the internet as well. It is a counter end unit and the customer has no direct connection with this unit. All the interactions with the cart are updated here in real-time.

This server is connected with the main server of the shopping complex using internet. Keeping
this connectivity helps in faster billing process and easy management of the complex. Raspberry Pi can be used to fetch data from internet as well used as a web server itself.

Fig. 7: Block representation of the concept

6. RESULT & DISCUSSION

Fig. 8: Simulation Output
6. CONCLUSION

To conclude, this paper is about designing and developing a Smart Cart system that will simplify shopping experience of customers in supermarkets, reducing their waiting time and reducing human swarms in front of cashiers. NFC tracking is the key technology required for the implementation of this project. Smart Cart system involves effective communication between two separate systems: a billing software, Smart Basket Cart electronic hardware. Main emphasis was made for the Smart Basket Cart hardware while other two systems were left for the consideration of market owners. Therefore, a detailed design and development of the hardware was proposed and the practical model was successfully manufactured. This project proposes a novel approach in designing a Smart Basket Cart system which is intended to reduce billing time in supermarkets. It is unique because it uses Firebase Cloud database \[8\], for data storage and retrieval, one of the cheapest Wi-Fi modules commercially available and a cheap NFC reader. Moreover, an original design of the casing and PCB was proposed, which contribute to the uniqueness of this project. Finally, the working principle of the entire system is different from all other similar projects presented in the literature review chapter and it grants some flexibility in choice for market owners.

REFERENCES

[1]. Galande Jayashree, Rutuja Gholap, Priti Yadav on “RFID based Automatic billing trolley” year - 2015, publication – IJETAE.


