SMART SHOPPING CART

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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ABSTRACT

Retailers are often interested in low cost mechanisms to maintain stocks as well as for tracing products. In addition, shoplifting is another concern faced because of the lack of effectiveness in product tracing technique such as “barcode” used in retail super markets. This makes the purchaser to wait in the long queue during billing. Everybody loves shopping, but long queue makes them uncomfortable. The main objective of proposed system is to provide a technology oriented, easily scalable system for assisting person while shopping. The RFID(Radio Frequency Identification) powered electronic shopping cart is built to enhance the overall shopping experience for the consumers. If a consumer is not sure of the physical location of an item, they can access the map available in the LCD display. Other features include a live total of all items in the cart, being able to view the daily in-store specials and ready for pick up. This makes easy administration and more personalized shopping experience for both retailers and purchaser. The key idea here is to assist a person in everyday shopping in terms of reduced time spent while purchasing a product and also for maintaining stocks.

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CHAPTER 1

CHAPTER 1
INTRODUCTION

1.1 INTERNET OF THINGS

Internet of Things (IoT) provides the infrastructure that is used to connect different devices and to communicate among the devices and to communicate among the devices. IoT is an ecosystem of connected physical objects that are accessible through the internet. When devices/objects can represent themselves digitally, they can be controlled from anywhere. The connectivity helps us to capture more data from more places, ensuring to increase the efficiency and to improve safety and IoT security.

1.2 INTRODUCTION TO THETECHNIQUES

A. RFIDTechnology

Radio-frequency identification (**RFID**) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tags don't need to be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method of automatic identification and datacapture(AIDC).

- **RFIDTag**

  A radio-frequency identification system uses tags, labels attached to the objects to be identified.A Radio Frequency Identification Tag (RFID tag) transferring information to an RFID transceiver.RFID tags can be passive, active or battery-assisted passive.A RFID tag is also known as a RFID chip.

- **RFIDReader**

  An RFID reader's function is to interrogate RFID tags.The means of interrogation is wireless and because the distance is relatively short.A reader contains an RF module, which acts as both a transmitter and receiver of radio frequency signals.The transmitter consists of an oscillator to create the carrier frequency.The receiver has a demodulator to extract thereturned

data and also contains an amplifier to strengthen the signal for processing.

B. ZigbeeTechnology

ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power Digital Radios.ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or more general wireless networking such as WIFI.

1.3 SOCIALIMPACT

It reduces the shopper waiting time in the billing section. It reduces man power and there is no need of any staff for billing. It provides accurate details about the product, reducing the error in data. It gets the product information easily and no extra time needed. It helps the stock admin to control and maintain their stocks. It helps in managing the quality of goods. It avoids the theft and misplacement ofgoods.

1.4 CHALLENGES ASSOCIATED WITHRFID

Though RFID technology has made a great brunt on industrial sectors, it also has some restraints due to its functional characteristics. It is necessary to address the challenges mentioned below:

- In contrast with bar codes, RFID base4d solution isexpensive.
- Establishment of RFID based setup iscomplicated.
- Single RFID tag is not apt for all applications and thus it is applicationspecific.
- There is a possibility that multiple tags may respond at the same time, which leads to inaccurateresults.
- In metallic inventories, there is a possibility that RF signals may get affected, which decreases the systemreliability.
- There is a chance of electrostatic charge caused by friction during manufacturing, processing andpackaging.

- A passive tag has less accessibilityrange.

1.5 LIMITATIONS

- In large super market, an RFID reader can scan all tags within its range, which does not work well if you're only trying to scan items in a certain location on thefloor.
- The RFID reader cannot identify the misplacement of item, if the item is misplaced in the sameshelf.

1.6 ORGANIZATION REPORT

This project report is organized as

Chapter 1 Deals with the introduction to the techniques used in the applications in the brief manner. The objective of the project and problem description are include. The social impact of the project and the challenges in developing the application isdescribed.

Chapter 2 Includes the literature survey of the proposed project. Then the methodology used in the system is described. The merits of the existing system is included.

Chapter 3 Deals with the requirement specifications. Then the hardware and software requirement of the project are listed. The dataset details are also included.

Chapter 4 Deals with the system design. Each module of the application is described and represented in the diagramway.

Chapter 5 Deals with the system implementation. The modules of the application have been discussed in a brief manner.

Chapter 6 Deals with the result and discussion. The snapshots of the output is included anddicussed.

CHAPTER 2

CHAPTER 2
LITERATURE SURVEY

2.1 LITERATURE SURVEY

Literature survey is the work undertaken to study the existing work available on the subject matter interest. The following are the papers published on the subject matter. The inferences are shown below:

Monica et al..,[] proposed system in which every smart cart is outfitted with a RFID reader, a micro controller, an LCD display, a Wi-Fi Module. The clever cart is capable to robotically examine the items put into a cart with the aid of the RFID reader. A micro controller is established on the cart for facts processing and an LCD display and the usage of that android cellular utility can do QR reader payment through from our financial institution account. Then all the data's will be saved in our server. So admin can see all the important points about product what are the merchandise are offered out. As a result, customers do now not need to wait in long queues at checkout. When items turn out to be sold out, the server can notify personnel to restock. It will become convenient for the shop to do inventory management as all objects can be mechanically read and easilylogged.

Saurav Subedi et al..,[] proposed a method for locating and tracking an RFID reader that can achieve such accuracy in a complex propagation environment by exploiting received signal strength indicator (RSSI) measurements as the only form of observation obtained from multiple spatially distributed passive tags. There are three key contributions of this paper. First, they analyzed the effect of propagation impairments, non-isotropic radiation pattern of the tag antennas and multipath propagation, on RSSI measurements and the overall localization and tracking performance. Next, they compensate for the artifacts of multipath propagation and non-isotropic antenna pattern and obtain a maximum likelihood (ML) estimate of the RFID reader in a 2-D Cartesian space. The ML estimates of the reader position, together with its velocity, are then used as inputs to the Kalman filter for dynamical estimation of its trajectory. Finally, they present experimental results to demonstrate that the proposed method substantially improves the localization accuracy compared to other state-of-the-art methods for a given tag density.

Zeeshan Ali and Reena Sonkusare [] designed a shopping cart has the ability to calculate automatically and display the total prices of all the products inside it. This makes it easy for the customer to know how much he or she has to pay while shopping and not at the checkout counter. This way the customer can receive faster service at the checkout. The advantage for the shop owners is that they would need a less cashiers, which would result in a large cut in their costs. The smart shopping cart will help shorten the checkout lines thereby helping the customers at retail stores. The customers will be able to scan the items themselves and the LCD screen on the shopping cart will keep updating the total. This will turn out to be very beneficial for the retail stores as more people will enjoy the shopping experience and come more often to shop. As IR technology works on line of sight, it is important to ensure that there is no obstruction in the entrance or exit of eachaisle.

Raghav Chadha et al.., [] designed RFID based trolley that comprises of smart labels or RFID Tags which are used to transmit data to the interrogator that is the RFID Reader and wireless transmission of the data to the mobile application and simultaneous real-time inventory updates. The proposed system is easy to use, low-prized and efficient. As the entire framework is becoming smart, it will help profiting the both small and large scale retailers. With the utilization of mobile application technology the bill is wirelessly communicated to the server and when the customer comes at the billing section, the bill is generated saving the time and reducing the rush at the billingcounter.

Agarwal Isha Sanjay and Chawandke Manasi Prashant [] summarizes the implementation of electronics hardware system with Radio Frequency Identification Reader fitted in the trolley to avoid long queues at the billing desk. Radio Frequency Identification tag is attached to all the products available for sale. The Liquid Crystal Display that is fixed to the trolley displays the name of scanned product, product id, cost of that product and the total bill amount. The customer can set the price limit using the 4X4 matrix keypad. If the total bill amount exceeds the price limit set using keypad then the customer will be warned by the buzzer. Once the customer has completed shopping he can press a button on the keypad to send the bill wirelessly to the master computer for paying the bill through a wireless link using RF transceiver. PIC 18F4550 microcontroller is used for implementing hardware. Eagle software is used for making Printed Circuit Board and

hyper

terminal is used to display final bill on the computer. Thus, the system facilitates faster billing and reduces time.

Ashok Sutagundar et al.., [] proposed IoT based smart shopping mall. It consists of RFID tag, LCD display, android application, Wi-Fi and cloud. All products present in the shopping mall will be tagged with RFID. Customer's required products will be put in the trolley, where its code will be detected using RFID and name of the product and cost will be displayed on the LCD. Data is pushed to the Amazon cloud using Wi-Fi module ESP8266 and the data is sent to Android App of the Customers. Total billing is done by wireless modules. We are providing a searching option for the customers to know the availability and unavailability of products in the shoppingmall.

Bo Gao and Matthew M. F. Yuen [] disclosed a new method using EBG material to insulate the UHF RFID tag from backside objects, so that the tag could still work on metallic surface. The design of EBG material for UHF RFID which operates at 915 MHz under federal communications commission regulation
was discussed in this paper. The simulation results showed that the EBG RFID tag can be read on metal. The measurement results indicated that the read range of RFID tag with EBG substrate is up to 9 m on metal surface.

Ruinian Li et al.., [] each smart cart is equipped with a UHF RFID reader, a micro controller, an LCD touch screen, a ZigBee adapter, and a weight sensor. The smart cart is able to automatically read the items put into a cart via the RFID reader.A micro controller is installed on the cart for data processing and an LCD touch screen is equipped as the user interface. In order for the smart cart to communicate with the server, we have chosen ZigBee technology as it is low-power and inexpensive. We also have a weight scanner installed on the smart cart for weighting items. The weight scanner can also help do a security check, for example, if a malicious user peels off one item's RFID tag and puts it into the cart, extra unaccounted weight will be added. When a customer finishes shopping, they pay at the checkout point using the generated billing information on the smart cart. We also set an RFID reader before the exit door to check that all the items in the cart have been paid for.

CHAPTER 3

CHAPTER 3
REQUIREMENTS

HARDWARE REQUIREMENTS

Processor : Intel Core i3 CPU 550 @ 3.20GHz *4
RAM : 7.4 GB
Kit : Arduino Mega 2560Microcontroller
Sensor : RadioFrequency
Modem :Zigbee
Others : RFID Tags, RFID Reader,LCD

SOFTWARE REQIUREMENTS

Operatingsystem : CentOS 7
Developmenttools : Arduino IDE

CHAPTER 4

CHAPTER 4
SYSTEMDESIGN

4.1 ARCHITECTUREDIAGRAM

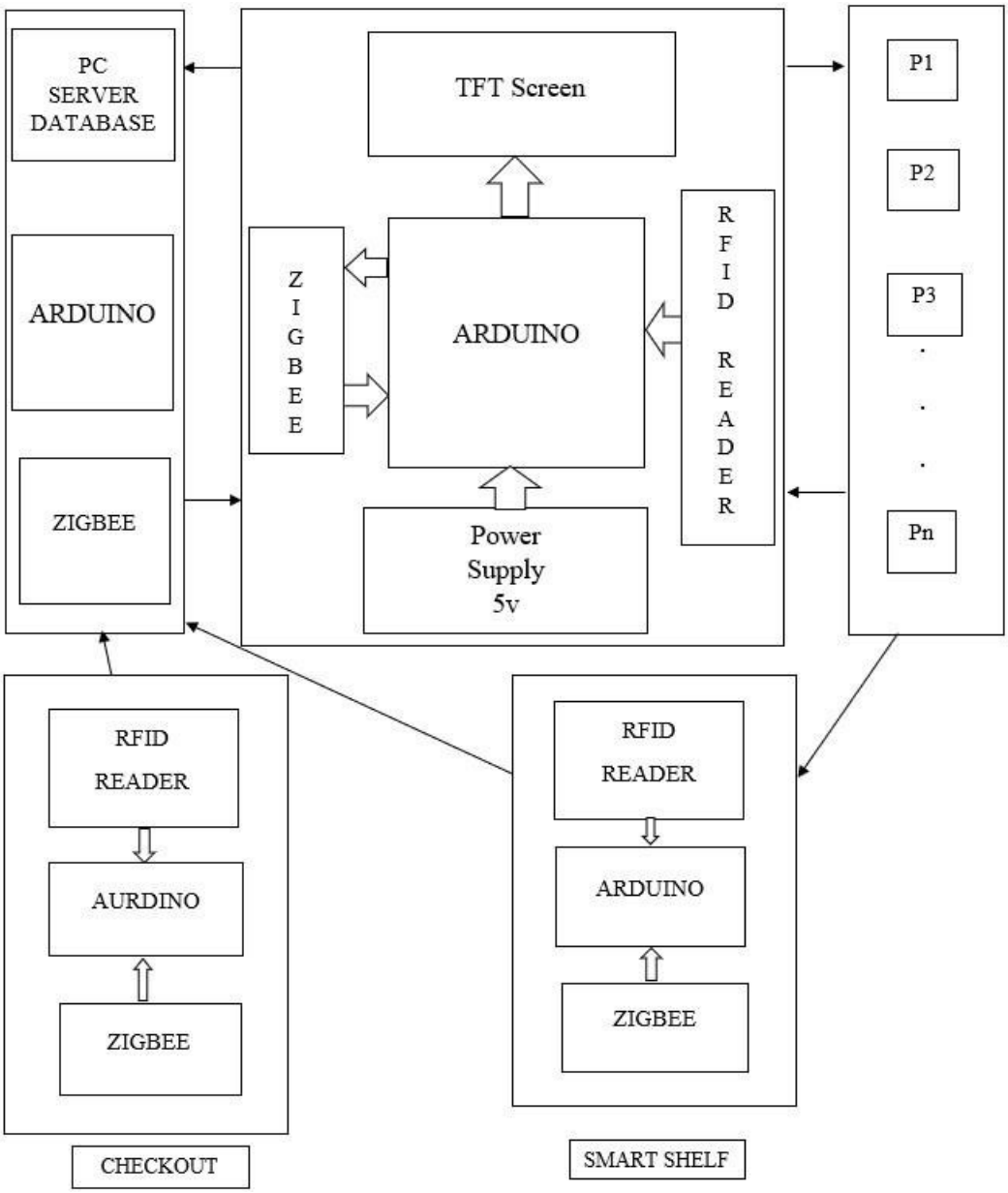

Fig 1 : Architecture Diagram

4.2 SYSTEMDESIGN

Fig 2 : System Design

4.3 MODULES

- Automaticbilling
- Viewing history
- Daily in storeoffers
- Smart shelving
- Monitoringstocks
- Payment Verification
- Checkout

4.3.1 AutomaticBilling

In this module, whenever the customer place the products in the cart, the product id, name and the amount will be displayed in the LCD. The amount of the product inside the cart will be added to the total bill. Whenever the products are taken from the cart, its amount will be removed from the total bill.

4.3.2 Viewinghistory

Once the customer login to the cart using their loyalty card, they can view their purchase history using the LCD in their cart. So that they can purchase the item according to the previouspurchase.

4.3.3 Daily in storeoffers

The super market provides the daily offers on a particular product daily/ weekly. In the LCD screen, the customer can view the daily in store offers. This allows the customers to be intimated on the offers.

4.3.4 SmartShelving

In this module, the misplacement of product in the shelf can be detected, so that the supervisor can arrange the product in their respective place.

4.3.5 Monitoring Stocks

When the stock in the rack go below 3 units, the Supervisor is alerted to restock the items in the shelf.

4.3.6 PaymentVerification

Since the total billing is calculated in the cart itself, the server in the billing counter can generate the bill and the customer can pay for the purchase.

4.3.7 Checkout

After the payment, any product which is not billed (ie.., shoplifting) can to identified using the checkout point. This can reduce the theft of products in thesupermarket.

CHAPTER 5

CHAPTER 5

IMPLEMENTATION METHODOLOGY

5.1 MODULES

- Automaticbilling
- Viewing history
- Daily in storeoffers
- Smart shelving
- Monitoringstocks
- Checkout
- Payment Verification

5.1.1 AutomaticBilling

Every product is tagged with a unique RFID label. The Arduino is connected with the RFID Reader , Zigbee and the LCD display. The RFID Reader reads the product and the total bill will be displayed in the LCD screen. This information will be send to the server using the ZIGBEE communication.

Pseudo code:

```
Serial.println("WELCOME TO CSE Super Market");


Serial.println(" ..... "
);
    Serial.println("Item\tCost");
    if(ID==133)
    {
      Serial.println("Bread\t20");
```



```
Serial.println(" ..... "
);
        Serial.println("Total Purchase\t");
        if(token==0)
        {
          Total=Total+20;
          Serial.print(Total);
          Serial.println("");
          Serial.println("");
          token=1;
        }
        else
        {
         Total=Total-20;
         Serial.println(Total);
         Serial.println("");
         Serial.println("");
        }
      }
```

5.1.2 Viewinghistory

The purchase history for each customer is stored in the database. The customer is logged into the cart using the loyalty card. This logging information is sent to the server using the Zigbee. The customer ID is noted and the correspondent purchase history is sent back to the Zigbee in the cart. And so the information is displayed in the LCDscreen.

5.1.3 Daily in storeoffer

The server needs to update the daily/ weekly offers on the store. On Clicking the "View Offers" button in the LCD, the information updated in the server should be displayed through the Zigbeecommunication.

5.1.4 SmartShelving

Each shelf is equipped with the RFID reader and Zigbee. All the product in the shelf are under the surveillance of the RFID reader in that shelf. When a new product label is kept under that surveillance, (ie.., misplacement of the product) the alert will be sent to the server through the Zigbee . So that the supervisor will be intimated to place the product in the right place by the Server.

Pseudo code:

```
if (RC522.isCard())
   {
    RC522.readCardSerial();
    ID=RC522.serNum[0];
    ID1=RC522.serNum[1];
    if(ID==133)
    {
      Serial.println("Bread");
      Serial.println("Product in the Correct Shelf");
      Serial.println("");
    }
    else if(ID1=214)
    {
      Serial.println("Wheat");
```



```
      Serial.println("Product in the Wrong Shelf");
      Serial.println("");
    }
  }
```

5.1.5 Monitoring Stocks

Each product in the shelf is under the surveillance of the corresponding RFID reader. Once the reader recognizes that there are only 3 units of a particular product, an alert is sent to the server through the Zigbee. The server then sent intimation to the supervisor to restock theproducts.

Pseudo Code:

```
if(ID==133)
    {
     if((temp%2)!=0)
     {
       count=count+1;
       Serial.println("Number of Products in the self");
       Serial.println(count);
       temp=1;
     }
     else
     {
       count=count-1;
       Serial.println("Number of Products in the self");
       Serial.println(count);
```



```
        }
    }
```

5.1.6 PaymentVerification

Once the customer press “Finish Shopping” button in the LCD at the billing counter , the purchase details and the total bill is sent to the server. The server needs to get authentication from the customer (to ask really if they finish shopping) and the server need to generate the bill using a billing device. And the customer can pay for the purchase. Once the shopping is finished, the loyalty card is logged out automatically.

5.1.7 Checkout

After the payment verification, the cart and the customer are asked to pass to through the self-scanning checkout point. The product which were not billed are identified using the RFID reader equipped in the checkout point. This information will be sent to the server using the Zigbee. This reduces the shoplifting.

5.2 Experimental Setup

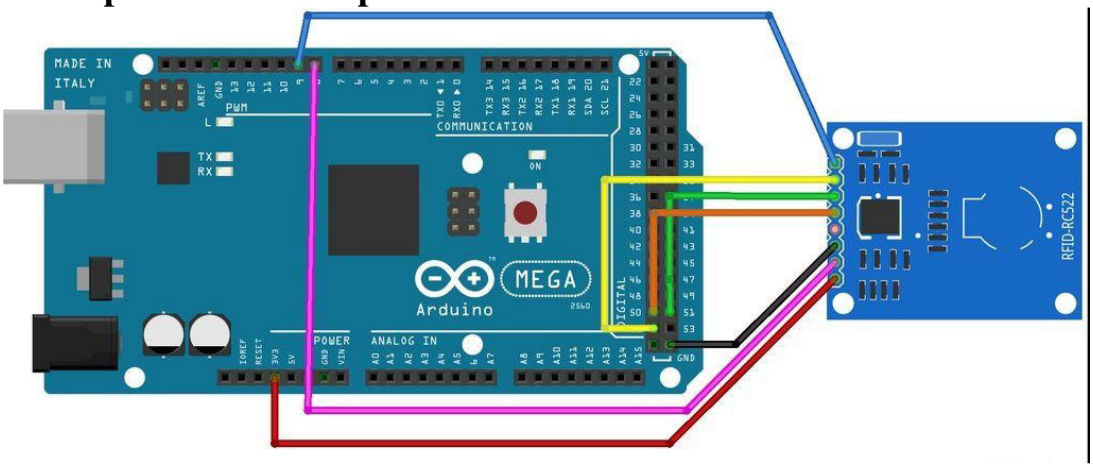

Fig 3 : Experimental setup

5.3 Snapshots

```
.....................................
Item    Cost
Bread   20
.....................................
Total Purchase
20

.....................................

.....................................
Item    Cost
Milk    50
.....................................
Total Purchase
70


.....................................

.....................................
Item    Cost
Bread   20
.....................................
Total Purchase
50


.....................................

.....................................
Item    Cost
Milk    50
.....................................
Total Purchase
0
```

Fig 4 : Automatic Billing

```
Bread
Product in the Correct Shelf

Wheat
Product in the Wrong Shelf

Wheat
Product in the Wrong Shelf

Bread
Product in the Correct Shelf

Bread
Product in the Correct Shelf

Wheat
Product in the Wrong Shelf
```

Fig 5 : Smart shelving

```
Number of Products in the self
1
Number of Products in the self
2
Number of Products in the self
1
Number of Products in the self
0
```

Fig 6 : Monitoring Stocks

CHAPTER 6

CHAPTER 6
RESULTS AND DISCUSSION

6.1 Results

- In Automatic billing, **t**he RFID Reader reads the product and the total bill was displayed in the LCD screen. This information has been send to the server using the ZIGBEE communication.

- In Smart shelving, when a new product label is kept under that surveillance, (i.e., misplacement of the product) the alert was sent to the server through the Zigbee.

- In monitoring stocks, each product in the shelf is under the surveillance of the corresponding RFID reader. Once the reader recognizes that there are only 3 units of a particular product, an alert has been sent to the server through the Zigbee.

6.2 Discussion

Based on our base paper we learnt a lot from the paper according to our results we analyzed that theupdated product is easy to use, is of low-cost and does not need much hard work.We have also estimated that the architecture of the system that can be used for smart and easy shopping in the malls to save time, energy and money and the new experience for the shoppers.

CHAPTER 7

CHAPTER 7
CONCLUSION AND FUTURE WORK

7.1Conclusion

Now-a-days, with the current shopping system, more time is required for the entire procedure. Keeping this in mind, the main aim of our project to reduce the time consumption has been fulfilled. Customers have been given authority to shop on their own without worrying about standing in long queues for scanning of each and every product at the billing section. Instead, the bill will be directly sent to the counter and the customer has to only pay at the billing section. RFID sensors clung to the exit gate will ensure that no product can be taken away without scanning. Thus, the electronic system provides hassle free and user friendly shopping system. The proposed model consumes less time, low cost and can easily be used by the customer and owner. It does not require any training. RFID helps us to detect the products easily compared to the barcode. Billing is done by automatic in an inventory updated manner. The requirement of manpower will be reduced. Simultaneously we can serve more number ofcustomers.

7.2FutureWork

- Study on IoT applications is a popular topic in recent years, but smart shopping systems have not been well-investigated. There are some research works being published in recent years regarding improving customers' shopping experience. In 2011, Klabjan and Pei [] proposed the idea of tracking a customer in the store and discovering customer's interests in order to offer personalizedcoupons.

- We have proposed the idea of tracking the location of the product. If

the customer is not sure about the location of the product, they can search for the product using the LCD screen in the cart. The product location will be displayed in the LCD screen. So that the customer can easily locate the product location. Each product rack will be labeled with a RFID Label. The RFID reader in the Shelf will be reading the tag. When the customer search for the product, its id will be identified and the tag that matches that id will be recognized. This information is sent via the Zigbee in the cart and the shelf. Now the location of that product will be displayed in the LCD,also shoplifting should be identified when the RFID labels areremoved.

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Department of Computer Science and Engineering

Vision of the institution

To make this Institution the unique of its kind in the field of Research and Development activities in this part of world.

Mission of the institution

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks through "Total Quality Education".

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To make the Department of Computer Science and Engineering the unique of its kind in the field of Research and Development activities in this part of world.

Mission of the Department

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks in Computer Science and Engineering through "Total

Quality Education".

Program Educational Objectives (PEO)

PEO 1: Apply the necessary mathematical tools and fundamental knowledge of computer science & engineering to solve variety of engineering problems.

PEO 2: Develop software based solutions for real life problems and be leaders in their profession with social and ethical responsibilities.

PEO 3: Pursue life-long learning and research in selected fields of computer science & engineering and contribute to the growth of those fields and society at large.

Program Specific Outcomes (PSO)

PSO1 : Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2 : Problem - Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

Program Outcomes (PO)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering

problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

