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Preparation of papers for International journal of Smart Shopping Cart

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ABSTRACT: Retailers are frequently inspired by ease components to keep up stocks just as for following items. What's more, shoplifting is another worry confronted due to the absence of viability in item following procedure, for example, "standardized tag" utilized in retail grocery stores. 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. Different highlights remember a live absolute of all things for the cart, having the option to see every day in-store specials and prepared for get. This makes simple organization and more customized shopping experience for the two retailers and buyer. The key thought here is to help an individual in regular shopping as far as diminished time spent while buying an item and furthermore for looking for maintaing stocks.

Key words – RFID, LCD display

I. INTRODUCTION

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.

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 data capture (AIDC).

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.

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

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. he main objective of proposed system is to provide a technology oriented, easily scalable, and rugged system for assisting shopping in person. The RFID powered electronic shopping cart is built to enhance the overall shopping experience for electronics store consumers. [2] If a consumer is not sure of the physical location of an item, they will be able to search for the item and view a direct map of the store to find it. 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.The Smart

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Shopping Cart using RFID tags is simplifying the billing system. The billing details will be displayed in LCD of the smart cart .The Zigbee is a wireless communication technology is used to locate or track the product to the registered customers.

II. TECHNOLOGY

Radio Frequency Identification (RFID) is becoming preferable technology as an alternative to barcode systems. RFID systems provide an automatic identification method, relying on storing and remotely retrieving data using RFID tags or transponders. An RFID tag is an object that can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Chip-based RFID tags contain silicon chips and antennae. In this paper, we have developed a smart shopping cart system that allows customers to manage their shopping list while shopping and only pay the bill at the checkout counter.

The 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.

III. MODULES AND METHODOLOGY

A. Automatic Billing

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.

Methodology:

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.

B. Viewing history

Once the customer login to the cart using their loyalty card, they can view their purchase history item according to the previous purchase.

Methodology:

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 when they press “View previous purchase” button, the correspondent purchase history is sent back to the Zigbee in the cart. And so the information is displayed in the LCD screen.

C. Daily in store offers

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.

Methodology:

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 Zigbee communication.

D. Smart Shelving

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.

Methodology:

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.

E. Monitoring Stocks

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

Methodology :

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 an intimation to the supervisor to restock the products.

IV. COMPONENTS

Our proposed smart shopping cart consists of the following components.

1) Server: All items are registered to the server before moved to the shelves. The server stores all items’ information, such as location and price, in a database. The server communicates with all the other entities in the smart shopping system through Zig-Bee.

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2) Smart Cart: the following components are equipped on the smart cart.
a) Microcontroller: Coordinates with the RFID reader, Zig-Bee adapter, weight scanner, and LCD touchscreen to perform computing functions.
b) Zig-Bee Adapter: Zig-Bee is a low-cost and lowpower protocol that costs much less energy than Wi-Fi.
c) RFID Reader: We use a UHF RFID reader which allows a reading range up to 10 m. By tuning the transmission power of the reader, we can control its reading range.
d) User Interface (LCD Display): Displays product information, possible navigation choices, billing information, and etc.
3) Smart Shelves: Installed with RFID readers that monitor the status of the items.

TABLE I
A Comparison Matrix Contrast Between Barcode And RFID Technology

S.No	Barcode	RFID
1.	Individual is required to read barcode on item.	Automated reading of RFID tag from item.
2.	Line of sight required to a read barcode.	No line of sight required to peruse RFID.
3.	The coherence of barcode can be debilitated by soil, dampness, scraped area, or packaging contours.	RFID labels are not influenced by such conditions.
4.	Short reading extent. Barcode does not have READ and WRITE ability	Long reading extent. RFID tag having READ and WRITE capacity.

Table 1 depicts a comprehensive analysis Barcode and Radio Frequency Technology, the propose to show this comparison is to depict the drawbacks of the barcode system and how the new and proposed RFID Technology is providing advantageous to overcome the problems faced in the Barcode Technology.

V. BUILDING FUNCTIONAL SMART CART

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 accidently. We are also able to test how to set an RFID reader at the checkout point so that the items in the cart can be accurately read.

VI. SYSTEM MODEL

The 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. We adopt a combination of symmetric and asymmetric cryptographic systems.

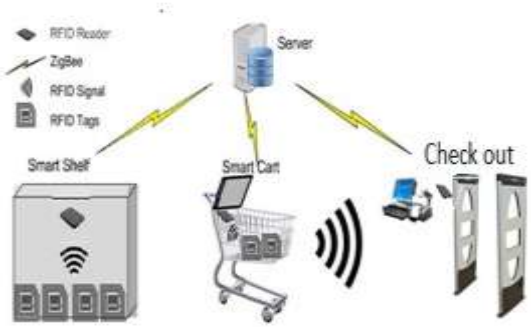

Fig 1 : System model

The server is assigned with a pair of asymmetric keys Ps and Ss. Each smart cart is assigned a unique ID i and a pair of asymmetric keys Pi and Si. Each checkout point is assigned a unique ID j and a pair of asymmetric keys Pj and Sj. For asymmetric encryption and decryption, we denote the encryption to ciphertext c of data d with public key P by c=EP(d), and decryption of ciphertext c with private key S by d =DS(c). For symmetric encryption and decryption, we denote the encryption to ciphertext c of data d with key s by c=Es(d), and decryption of ciphertext c with key s by d =Ds(c).

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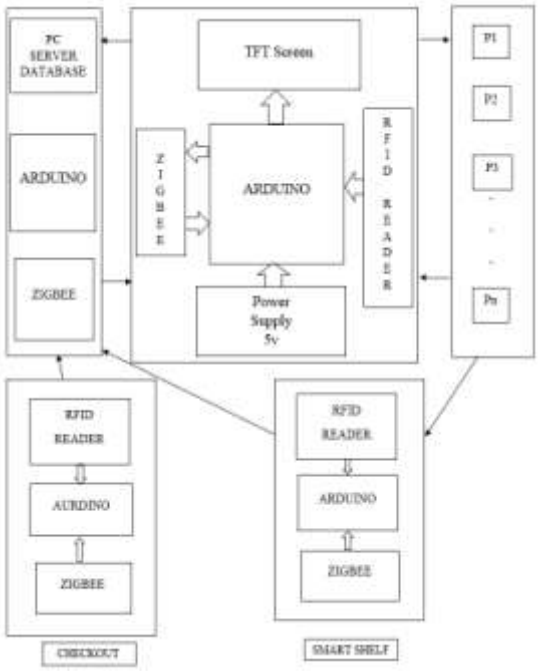

Fig 2 : System Architecture

VII. SYSTEM DEVELOPMENT

As the passive UHF RFID tags are not inbuilt with a power source, the readability of the tag purely based on the transmitted power from UHF RFID reader through the transmission antenna to the tag. Such a signal in real time application travels two times along the path of the signal. Friss has explained this scenario by considering the power received by the UHF RFID reader (PR) once it is transmitted and backscattered by the UHF RFID passive tag along with RSSI (Return Signal Strength Indicator) measurement can be deduced.RSSI measurement plays a significant role in this smart trolley application as RSSI measurement indicates the directional gains that are needed for the antenna development. Furthermore, CSL486 RFID reader capable of providing derived measurement such as the "Geiger count" which indicates average RSSI value as a % of transmitted signal power. A higher number will stand for a closer tag reading [17] and "0" will represent that the tag is not reachable at all. Geiger count can also be used to change transmitted power on demand, in order to increase the chances of tag readability. Even though the RSSI is heavily dependent on distance, it is a well-known factor in the state of the art. It is also known that RSSI is heavily dependent on environmental conditions. Metal objects, liquids and human interference can greatly alter the RSSI measurement. RSSI value can also be dependent on the tag orientation [18]. The distance vs RSSI measurement also plays a critical role when considering the dimensions of the shopping trolley because a given antenna system should only consider reading items in the trolley at a given time but not items located outside the trolley boundaries. On the other hand, the beam pattern of the antenna should cover the full internal area of the trolley, in order to reach each tag attached to the products. Furthermore, it was decided to develop an antenna system that can cover the full range of UHF; therefore, it can cover global UHF standards (850 - 960 MHz) [19] enabling the use of developed system implementation across any country without a limitation. CP antenna has a shorter reading range compared to linear polarized (LP) antenna; however, CP antennas are capable of reading tags in different orientations. On the other hand, CP antenna should ideally have a wider beam width with lower gain. This helps to scan more items in near field as well as to avoid reading items beyond the trolley. Therefore, considering above facts, the CP antenna was selected for the application along with the hybrid coupler which aids CP antenna to provide circular polarized behavior.

VIII. PERFORMANCE OF CART

We test the robustness of the system with our prototype, and we find that the RFID reading is accurate and precise. According to our tests, the metal of the cart blocks the signal to a large extent and an item outside the cart cannot be read by the reader inside the cart. When a new item is put into the smart cart, it will be automatically read by the reader, which is continually scanning items within its range. After a product is read, its ID will be checked to see if it is a newly added item. If so, its information will be listed on the user interface. On the other hand, when an item is removed from the smart cart, the reader will no longer be able to scan its information. In this case, the smart cart determines that the item has been removed and will update the display correspondingly. We now evaluate the computational and communication overhead of our proposed protocol.

Algorithm1: Automated Billing
1. Begin
2. Initialize the system
3. Scan the RFID tag
4. If (RFID tag Matched?)
   Display the product detail
   Else
   Go to step3
   End if
6. Pass product details to cloud through Wi-Fi.
7. Product details will be stored in cloud
8. Installing android application

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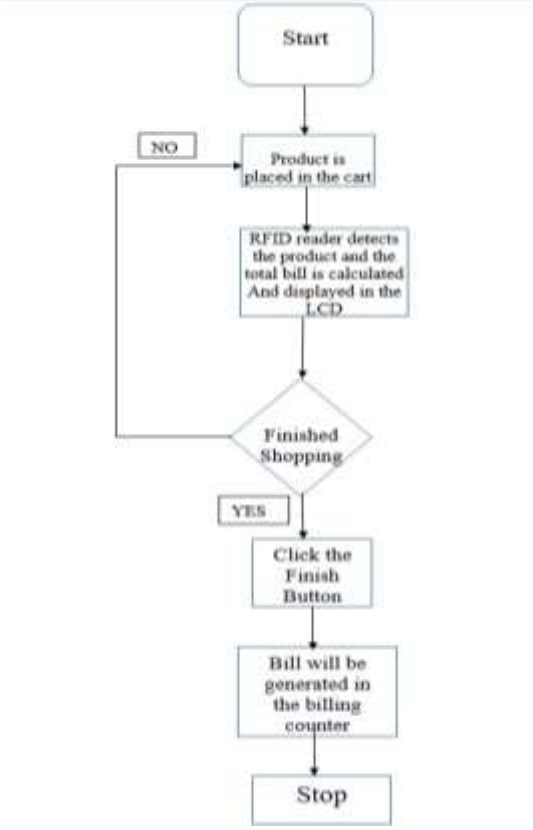
9. Home Screen contains in stock and out of stock details. 10. If (new user?)
Fill the registration details (new user)
Else
Login details (already member)
End if
11. Cloud sent the product details to app.
12. If (Online or cash payment?)
Fill the bank details by online
Else
Cash payment
End if
13. Total information is updated in cloud
14.stop.

IX. FLOW MODEL



X. CONCLUSION

we have designed the system for total billing and it gives the ease of shopping to the customer and also it is effective for the retailers to monitor their stock in their super market.

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