International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 6 Issue: 2 185 - 188

Smart Follower Sensing Shopping Cart using Centralized Billing System

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Abstract: In the age of technological advancements, automation is essential to improve and streamline processes. Since last few decades,technology has transformed the landscape of industries and lifestyle .The proposed system suggests implementing a smart cart using a touchscreen liquid crystal display (LCD) which will show the product details using Radio Frequency Identification (RFID).The LCD displays an overview of the entire supermarket showing all the different sections available helping the customer to find products. The system has a centralized billing system because of the customer need not wait in long queues for the final billing process which will eventually save his/her time. Machine automation has starting replacing human effort .With a view to accomplish this ,the customer does not have to move the cart ,instead the cart will follow the customer. A RF receiver is fixed inside the cart and the transmitter is given handed over to the customer . The information of the product added in the cart by the customer is stored in Electrically Erasable Programming Read Only Memory (EEPROM). Once the customer is done with shopping and clicks the finish button all the information will be transferred to the administrative system using Zigbee.

Keywords: *Cart, Touchscreen LCD Display,RFID,RF Transmitter and Receiver , EEPROM,Zigbee,Centralized billing system.*

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1. INTRODUCTION

A customer visits a supermarket to buy his day to day used commodities. So the number of products the customer buys and the total bill needs to be calculated. Cashier desks are placed at the exit points of the supermarket. To reduce human labour costs, many supermarket outlets are switching to automatic systems which will carry out the transactions with the customer. Eventually, the entire supermarket will have fewer employees who will be supervising the entire process.In customers view ,the cart will render a technological shopping experience. The cart will help the customer to easily see the available sections of products .The customer can also monitor the number and amount of products he adds to the cart.

Radio Frequency Identification (RFID) is a technology for wireless information exchange over short distances.The technology was invented 40 years ago by Charles Walton.It is a type of Automatic Identification system.Due to recent developments, low cost RFID devices are easily available.In future,application of RFID technology to consumer goods will become common , which will bring revolution in the present smart computing era.RFID consists of a tag,reader and controller/processor. RFIDs are basically used to identify objects through the tags attached to them using radio communication .It does not have any line of sight between the tag and the tag reader.Current applications of RFID include Item level inventory tracking,Logistics and supply chain visibility,material management.

The touchscreen input/output panel provides options like product details and deletion of products. All this data is stored using EEPROM.It also has a finish button to terminate the transaction after which the transaction details are send to the central billing system using ZIGBEE.

EEPROM stands for Electrically Erasable Programming Read Only Memory.It can be erased and reprogrammed repeatedly. An EEPROM can be used to store the transaction data and erase the same once the transaction is being terminated.

ZIGBEE is an IEEE 802.15.4 standard.It is used to transmit the data from the carts EEPROM to the centralized billing system.The distances that can be achieved using ZIGBEE can extend upto 70 meters.It is a low power,low data rate and low cost wireless networking protocol.

2. EASE OF USE

Nowadays, most of the people spend the lot of time in departmental stores. It has been found that a lot of time is being wasted particularly at the billing section. Here by this paper represents a new methodology of smart shopping cart which saves the lot of time. The cart has a sensor RFID tag to scan the product and an LCD module to display the final billing amount then and there on the cart and only pay the amount at the cash counter. This system overcomes the barcode technology which gets lot of problem during scanning. This proposed method is safe and secure. The cost of thesystem is also very low. This methodology helps both the customer as well as the authorities of the shopping mart.
The main goals of the proposed system are mentioned below:
Reducing the queues in shopping mall
Reducing time spent at billing counter
Making inventory management simpler and easier.

3.PROPOSED SYSTEM

To design the system we use different modules which are combined together. The main modules that are used are LCD, microcontroller ,RFID Tags, RFID Reader, RF Transmitter, RF Receiver, Zigbee and EEPROM. All these modules will need a good power supply which will be provided by a power supply unit.All these modules are individually programmed and then integrated together.

A. RFID Tag

It contains a microchip or an Integrated Circuit(IC) and an Antenna. The data is stored in the tag electronically. There are two types of RFID tags-Active Tags and Passive Tags.

	Active Tags	Passive Tags
Power	Internal Power source	No Internal Power source
Range of Communication	1-100 meter	1-10 meter
Frequency Range	433 MHz – 2.45 GHz	125kHz – 960 MHz
Cost	Expensive	Cheap

B. RFID Reader

An RFID Reader is used to track the tag that is attached to the product.It uses radio waves to transfer information from tag to reader wirelessly.

C. RF Transciever

The transceiver is given to the customer.This transceiver sends signal to the receiver placed inside the cart.

D. RF Receiver

The receiver is placed inside the cart.It receives signal from the transceiver with the help of which it moves and follows the user.

E. DC Motor

DC motors are fixed on each wheel of the trolley.After receiving signal from the transceiver,the receiver sends electronic signals to all the motors attached to the trolley and then theyu start functioning.The trolley automatically moves with the help of this mechanism.

F. EEPROM

EEPROM is used to store the data about the products that the customer buys.EEPROM has a fixed size of memory. All the data gets aiutomatically erased once the customer terminates the transaction.

G. ZIGBEE

Zigbee is a low cost and low data rate transmission module. The maximum data rate for a ZigBee device is 250Kbps. It supports up to 65,000 nodes connected in a network. It has the following Frequency bands:
2.4GHz, 868MHz, 915MHz
Its bandwidth is 20–250Kbps.
Its range is 1–75meters.

H. Microcontroller

Here,ATmega32 microcontroller is used.It is a High-performance, Low-power Atmel®AVR® 8-bit Microcontroller.It has an Advanced RISC Architecture.It is used to control all the operations that the user performs on the shopping cart.

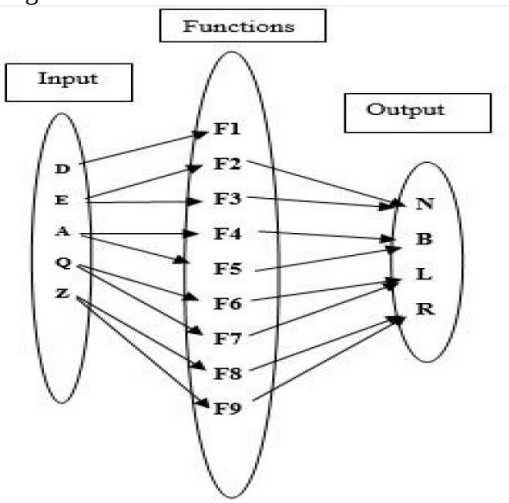
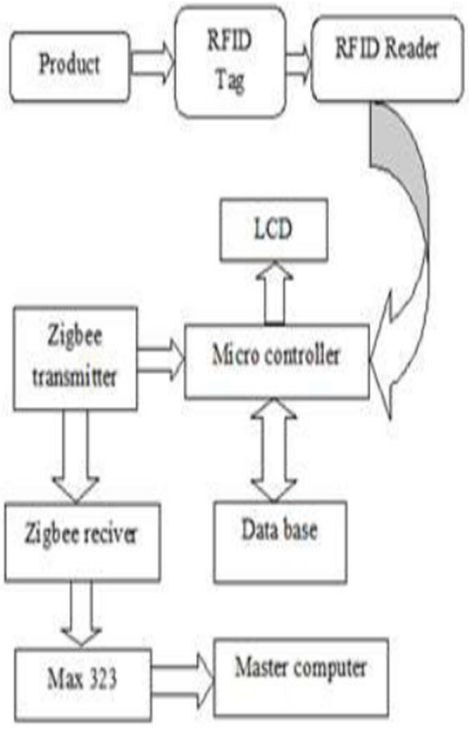


Fig.(1) Proposed Method Architecture.

3.4 Mathematical Model

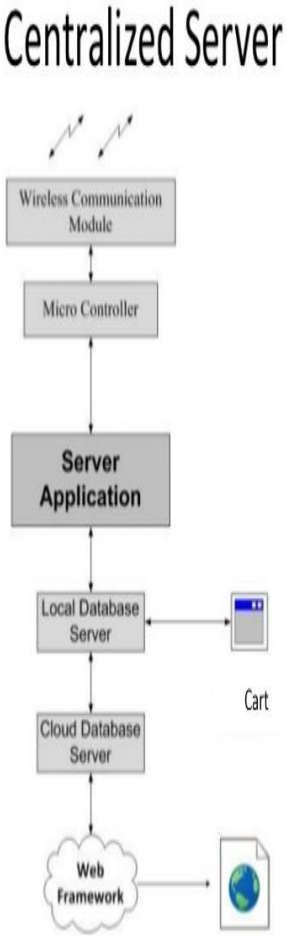
1) Let 'S' be the | Smart Shopping Cart using RFID and ZigBee as the final set, S = {……}
2) Identify the inputs as D, E, A, Q, Z . S = {D, E, A Q, Z…}, D = {D1, D2, D3, D4 …| 'D' given database updates}
   E = {E1, E2, E3, E4 …| 'E' given product details with price to register.}
   A = {A1, A2, A3, A4 …| 'A' given RFID Reader and ZigBee read Product tag.
   Q= {Q1, Q2, Q3 … | 'Q' gives product tag to remove product from cart}
   Z= {Z 1, Z 2, Z3 … | 'Z' given Bill to check all product at out time.}
3) Identify the outputs as O
   S = {D, E, A Q, Z, N, B, L, R …|Sample space}
   N = {N1, N2, N3, N4 …| 'N' is the Response as Generate RFID Tag to Product}
   B = { B 1, B 2, B 3, B 4, …| 'B' is the Response as add product in Bill}
   L = { L 1, L 2, L 3, L 4 …| 'L' Response as remove product in Bill}
   R= {R1, R2 …| 'R' is the Response bill validate}
4) Identify the functions as 'F'
   S = {D, E, A Q, Z, M, N, B, L, R, T, F…
   F = { F1(), F2(), F3(), F4(), F5() ,F6(),F7(),F8(),F9()}
   F1 (D): Update Database
   F2 (E): Process Requests on product details with price to register
   F3 (E): Respond as Generate RFID Tag to Product
   F4 (A): Process Requests on RFID Reader and ZigBee read Product tag
   F5 (A): Response as add product in Bill.

4. Block Diagram



5. CENTRALIZED BILLING SYSTEM

The centralized sytem is a server which monitors all the transactions that are being carried out on all the available carts.The data from the cart to this server is sent using the Zigbee Module.This server has a microcontroller, a server application and a local database server. The access of this server is given to the authorized persons of the Shopping mart.



6. FUTURE WORK

Project navigation can become a part of future work.
Each product can be traced and located using the product navigation feature.

7. CONCLUSION

The intended objectives were successfully achieved in the prototype model developed. The developed product is easy to use, economical and does not require any special training. Though the project showcases the proof of concept, there are a few aspects that can be included to make the smart shopping cart more robust. To begin with, in this project the latency time of the wireless communication with the server may need to be considered. Secondly, the communication is not very secure. Another ZigBee module operating at the same frequency can easily intercept the transmitted data. This issue will have to be resolved specifically with respect to billing to promote consumer confidence. Further, a more sophisticated micro-controller and larger display system can be used to provide better consumer experience.

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