Secure Smart shopping system using RFID Technology

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Abstract-- **Shopping behavior data is of great importance in understanding the effectiveness of the marketing and merchandising campaigns. We have designed a RFID BASED SHOPPING TROLLEY SYSTEM to provide hustle free shopping and to implement an automated billing scheme. We know that there exist a huge crowd in malls especially in metrocities. People usually purchase different items and put them in trolley and get it billed in billing counter. Due to this there exist a more delay to avoid this time consuming process we have developed a system called 'Futuristic Billing System'. Here we are using a RFID enabled automated billing device. In our system, we are using two RF ID readers one is to send a appropriate ID to microcontroller where the corresponding item is appended to bill and bill amount is displayed in LCD and other is to send the product ID which is removed from the trolley. Finally the result of these two process is being updated to the remote PC where the final bill is to be printed. In addition to this, we have also proposed an automated billing scheme for blind people using voice ICAPR33 . Atlast, it avoids queuing and gives us a pleasant shopping experience in the shop owner's view and also it reduces the needs for surveillance.**

Keywords: Internet of Things; RFID Technology; RFID Tag; RFID Reader

I. INTRODUCTION

Internet of Things is the network of physical devices, vehicles ,home appliances and other items embedded with electronics, software, actuators and connectivity which enables each objects to connect and exchange data. Everyday objects can now be equipped with computing power and communication functionalities, allowing objects everywhere to be connected. This has brought new revolution in industrial, financial and environmental systems and triggered great challenges in data management, wireless communications, and real-time decision making. Additionally, many security and privacy issues have emerged and light weight cryptographic methods are high demand of it in with IoT applications. Enormous amount of advancement in the field of Wireless Communicationhas given way to several new technologies and fields altogether. One such upcoming field is Wireless Sensor Networks (WSN), which is maturing at a very fast pace because of its suitability in a wide range of application areas.[9]

Context aware computing for pervasive environment is an application used to detect the environmental changes and process them with supplying plenty of information and respond them by altering context. The purpose of this application is to emphasize the contact between user and the technology. The main aim of this proposal is to grant the remainder in the real-time suitable situations. Programmers build up software applications everyday in order to augment efficiency and productivity in a mixture of situations. A system is a way of working, organizing or doing one or many tasks according to a fixed plan, program, or set of rules. A system is also an arrangement in which all its units assemble and work together according to the plan or program. An embedded system is one that has computer-hardware with software embedded in it as one of its most important component. It is a dedicated computer-based system for an application(s) or product. When developing embedded software for these, an editor, assembler

and cross assembler, specific to the microcontroller or processor used, are the main programming tools. Usually, 'C' is used for developing these systems. There has been a great deal of IoT research on different applications, such as smart homes, e-health systems, wearable devices, etc. In this paper, we focus on a smart shopping system based on Radio Frequency Identification (RFID) technology , which has not been well-studied in the past. RFID stands for Radio-Frequency Identification. The acronym refers to small electronic devices that consist of a small chip and an antenna. The chip can carry 2,000 bytes of data or less. Same function for RFID device and Bar Code or a Magnetic Strip on the back of a credit card and ATM card; it provides a unique identifier for that object. The RFID device must be scanned to retrieve the identifying information likebarcode and magnetic strip device. Significant advantage of RFID devices over the others mentioned above advantage is that the RFID device does not need to be positioned precisely relative to the scanner. Every time this is very difficult to check the store checkout clerk that all barcode is scanned or not. ATM machine and credit card use special reader. RFIDdevices will work within 20 feet for high frequency device.

The World Health Organization calculated that there are 285 million visually impaired people worldwide, mainly in developing places. Visually impaired persons mean those people who have low visual capacity . VIP can be blind or partially sighted people.Visually impaired people are unable to do visual task in day today life. Visually impairment makes life difficult for people with who have this health problem. Mostly VIP uses white cane to go anywhere to find way. In this case they face many problems while the travel in crowded places. But using many technologies, their life becomes easy, independent and comfortable. These technologies includes Electronic Travel Aid (ETA), navigation systems etc. these technologies have some drawback. Some VIP is use guide dog which requires many years to guide and they are very costly. Some system gives only indoor navigation, some provides only outdoor navigation which are not able to use in big industries where VIP want indoor as well as outdoor navigation. Everyday people visit many
places like shopping mall, industries etc. If that places are unknown then they follow map which are present at entry. People can see that map visually but Visually Impaired People (VIP) cannot see that map. This project is solution for visually impaired people.

II. RELATED WORKS

[5] proposed a secure smart shopping system that utilize RFID technology and UHF RFID is employed in enhancing shopping experiences and security issues. This paper also build a prototype to test its functions and also design a secure communication protocol and present security analysis.

[3] proposed a work that uses a LCD in this trolley make it user friendly. Automatic billing is done in trolley so it save the time of customer and reduce the rush at billing counter. It also reduce the man power.

[7] proposed a system that will help user as for outdoor navigation using GPS receiver, indoor navigation by using RFID and obstacle detection by ultrasonic sensor by giving audio instruction. This system will work according to map of location. [2] With the usage of Li-Fi technology, the billing process takes place automatically and payment is also enhanced using mobile banking. If any product is unbilled, a buzzer sound will be produced. Automatic billing system with a credit/debit card facility in the trolley itself will further reduce the human effort. Indoor mapping technology along with IoT can be used to locate the commodities in large Supermarkets. [1] proposed an Ambient Assisted

Living system. Smart phones can be replaced by any other devices and the information of items above and below the currently detected item will be played in the user's smart phone. [8] design an innovative indoor navigation and information system for any places, like shopping malls based on existing technologies. This will be a comfortable and helpful system forblind person in shopping malls. This proposal system is based on user"s smart phone and wireless sensors. [9] designed the system which provides information using audio signal. This system does VIP confidant and self-dependent. Blind guide software application can be entered into the app after a successful login by the user using speech recognition security. [11] designed a wearable system for visually impaired users which allows them to detect and avoid obstacles. [10] gives a navigation and location determination system for the VIP using an RFID. Each RFID tagged is programmed after installation with spatial coordinates and information describing the nearby places.

III. PROPOSED METHOD

In this paper, we have include both hardware and software and the working principles of those parameters are mentioned below:

A. HARDWARE IMPLEMENTATION

Hardware modules for the device is attached to shopping cart of supermarket. It consists of a microcontroller, display unit (LCD), an EEPROM, RFID reader, ZigBee transceiver and a battery power source. The battery power source increases the mobility of the device. A liquid crystal display is special thin flat panels that can let light go through it, or can block the light. Each block is filled with liquid crystals that can be made clear or solid, by changing the electric current to that block. Liquid crystal displays are often abbreviated LCDs.

B. RFID MODULE

RF module consists of RF transmitter and RF receiver. It is a small electronic circuit used to transmit and receive radio signal. It selects one out of a number of carrier frequencies. Types of RF module are: 1) Transmitter module 2) Receiver module 3) Tran receiver module In this project we have used Tran receiver type RF module. It is a small PCB sub assembly and is capable of transmitting and modulating a radio wave that carries data. Transmitter modules are implemented alongside a micro controller which will provide data that can be transmitted to the module.

C. RFID TAGS

Tags are of two types: passive tags which have no battery life and active tags which have battery life. RFID tags released for automatically identifying a person, a package or an items. These are transponders that transmit information. RFID tag contains two parts. One is integrated circuit for modulating, storing and processing information and demodulating radio frequency (RF) signal. The second is an antenna for receiving and transmitting signal.

D. RFID READER

RFID reader consists of an RF module that acts as a transmitter and receiver of radio frequency signal. Transmitter consists of an oscillator to create the carrier frequency and a modulator to make impact on data commands upon this carrier signal & a receiver that contains demodulator to extract the data returned. A RFID Reader is a device that uses radio-frequency waves to wirelessly transfer data between itself and a RFID tag/label in order to identify, categorize and track assets. When combined with the right RFID software, a RFID reader can identify objects quicker, more accurately, at a reduced overall cost, and at various points of the object's lifecycle. Our RFID Readers are offered in various form factors with many capabilities, such as laser, imager, handheld,fixed, Bluetooth, USB UH F, HF, iOS/Android Compatible, and more From warehousing to the office, Barcodes, Inc. has a RFID reader that can help you deliver accurate and reliable reading for any environment.

E. LCD DISPLAY

An LCD is a small low cost display. It is easy to interface with a micro-controller because of an embedded controller(the black blob on the back of the board).This controller is standard across many displays which means many micro-controllers have libraries that make displaying messages as easy as a single line of code.LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment. LCD has the ability to display numbers, characters &graphics. The display is interfaced to I/O port of micro controller (P0.0-P0.7). The display is in multiplexed mode i.e. only one display remains on at a time. Within 1/10th of a second the next display switches on. In this way sequentially on and off display will result in continuous display of count due to persistence of Vision.

F. ZIGBEE

ZigBee is expected to provide low cost and low power connectivity for equipment that needs battery life as long as several months to several years but does not require data transfer rates as high as those enabled by Bluetooth. ZigBee can be implemented in mesh networks larger 2 than is possible with Bluetooth. ZigBee compliant wireless devices are expected to transmit 10-75 meters ,depending on the RF environment and the power output consumption required for a given application, and will operate in the unlicensed RF worldwide (2.4GHz global, 915MHz Americas or 868 MHz Europe).The data rate is 250kbps at 2.4GHz, 40kbps at 915MHz and 20kbps at 868MHz.

G. *VOICE RECORDER APR33A*

The aPR33A series are powerful audio processor along with high performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs). The aPR33A series are a fully integrated solution offering high performance and unparalleled integration with analog input, digital processing and analog output functionality. The aPR33A series incorporates all the functionality required to perform demand in audio/voice applications. High quality audio/voice systems with lower bill-of-material costs can be implemented with the aPR33A series because of its integrated analog data converters and full suite of quality-enhancing features such as sample-rate convertor.

H. *MICROCONTROLLER PIC16F877A*

A PIC microcontroller is a processor with built in memory and RAM. This controller is convenient to use. The coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 Pins and there are 33 Pins for input and output. It also have many application in digital electronics circuits. It is used in remote sensors, Security and Safety devices, Home automation and in many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is very low and its handling is also easy.

I.*TROLLY UNIT*

In this unit the PIC processor is attached to a RFID reader and barcode reader. As the user puts the items in the trolley the reader on the trolley reads the tag and sends a signal to the PIC processor. The PIC processor then stores it in the memory and compares it with the lookup table. If it matches then it shows the name of item on LCD &also the total amount of items purchased.

J. *BILLING UNIT*

As soon as the shopping is over the user comes near the billing section .The total bill will display on the billing computer. AC supply is applied to 12V step down transformer. The transformer output is the 12V AC which is rectified using a diode bridge. The output of Diode Bridge of 12V DC is filtered by capacitors.

K. *SOFTWARE IMPLEMENTATION*

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PIC® and dsPIC® microcontrollers. MPLAB IDE runs as a 32-bit application on MS Windows®, is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.CCS compiler: The PCB, PCM, and PCH are separate compilers. PCB is for 12-bit opcodes, PCM is for 14-bit opcodes, and PCH is for 16-bit opcode PIC® microcontrollers. Due to many similarities, all three compilers are covered in this reference manual. Features and limitations that apply to only specific microcontrollers are indicated within. These compilers are specifically designed to meet the unique needs of the PIC® microcontroller. This allows developers to quickly design applications software in a more readable, high-level language.Proposed system uses separate RFID reader for each trolley and RFID Tag for each product. . Absence of human operators can potentially lead to inconvenience when the underlying technology fails. It can also lead to dishonest behavior of the customers. We propose and implement a solution that has redundancy built into it in order to reduce the probability of failure, and has three main benefits:

1) It creates a better shopping experience for the customers by saving their time.

2) It minimizes the man-power required at the shopping mall, as the checking-out process at the check-out counters is eliminate altogether.

3) It handles cases of deception if any, thereby making the system attractive not only to the customers, but also to the sellers. In this paper, the system design considerably minimizes the overhead of wireless communication among the devices involved in the system as almost every processing is done locally at each cart instead of transmitting packets to another node.

Every Shopping Cart is equipped with a sensor mote, a load-cell fitted at the base of the trolley and a system for local processing and display purposes. Every customer is identified by the ID of the cart she/he picks for shopping. The Base Station at the payment counter consists of a database that stores information of all the products, and a sensor mote to communicate with all the Smart Carts in the mall. When customer buys any product RFID reader reads the tag which is presenton the product. The cost of product and the total bill of shopping items can be displayed on 16*2 LCD.The product is wirelessly transmitted by the node to the Base Station using the IEEE 802.15.4 (ZigBee Protocol) over the ZigBee network. ZigBee is chosen along with theIEEE 802.15.4 compatible sensor motes because theyare easily available and mass produced. We have provide a additional handling device fitted with voice recorded APR33A for blind using the same procedure, shopping can be done easily by them without the help of others. Also if the product is expired one,it will give an alarm sound. After finishing of all purchase we need to press the bill button which is also fitted with the device to provide a cumulative bill amount.
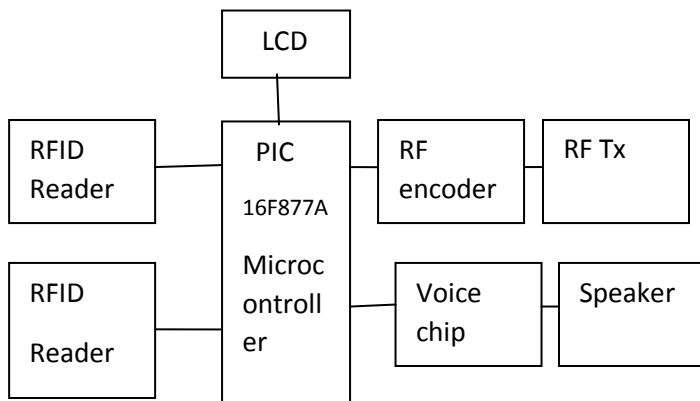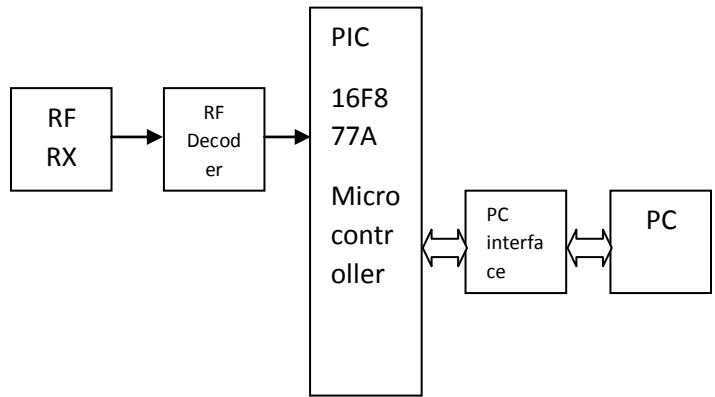
BLOCK DIAGRAM

Fig no. 1

Fig no.2

TABLE

Parameter	Barcode Scanner	RFID Scanner
Read Rate	High, greater than 100 tag can read one after	One tag can be read at a time, read rate is slow
LOS	Not required	Required
Durability	High	Low
Security	High	Low

RFID technique has many advantages over barcode systems. RFID reader reads the tag from a distance of 300 feet whereas barcode can read the information at distance not greater than 15 feet. Also the barcode need one site of propagation. Reading frequency of barcode reads is only two tags whereas reading frequency of RFID is 40 tags. So the use of RFID is more useful than traditional barcode reading technique.It will reduce the required hardware and also gives the real time information about commercial activity in all malls from any location .Using this system, customer will have the information about price of every item that are scanned in, total price of the item and also brief about the product. So use of this IOT based intelligent trolley for shopping malls is helpful for customer as well as owners .

IV. RESULTS AND DISCUSSIONS

The project **RFID TROLLEY** has been completed successfully and the output results are verified. The results are in line with the expected output. The project has been checked with both software and hardware testing tools. In this work RFID reader, Zigbee transceiver and PC interface are chosen are proved to be more appropriate for the intended application. The project is having enough avenues for future enhancement. The project is a prototype model that fulfills all the logical requirements. The project with minimal improvements can be directly applicable for real time applications. Thus the project contributes a significant step forward in the field of commercial automation, and further paves a road path towards faster development s in the same field. The project is further adaptive towards continuous performance and peripheral up gradations. This work can be applied to variety of industrial and commercial applications.

V. CONCLUSION AND FUTURE WORKS

The main objective of this system is to avoid standing in queues while billing and reduce the time taken for shopping. With the usage of RFID technology, the billing process takes place automatically and payment is also enhanced. Security is also managed by checking products in trolley and verifying it with billed products. If any product is expired, a buzzer sound will be produced. There are many useful ideas for further enhancement. Automatic billing system with a credit/debit card facility in the trolley itself will further reduce the human effort. Indoor mapping technology along with IoT can be used to locate the commodities in large Supermarkets. Continuous development in this area will lead to a revolutionary
change in shopping experience.

REFERENCES

[1] Victor Nandhi, Dhivyashree, An IoT Based Automated Shopping System for Blind People using RFID, International Journal of Trend in Research and Development, Volume 4(3), May-June 2017.

[2] K.Santhosh Kumar, R.Sudha, M. Umamaheshwari, . Smart Shopping System By Using Li-Fi Technology, SSRG International Journal of Computer Science2017

[3] Snigdha Kesh, S.VasantiVenkateshwar, Ananthanagu, Detection of Interactions in Ambient Assisted Living Environments using RFID,volume 6, No 2 February-March, 2017,.

[4] J. Han et al., "Cbid: A customer behavior identification system using passive tags," IEEE/ACM Trans. Netw., vol. 24, no. 5, pp. 2885–2898, Oct. 2016.

[5] N. Gowtham ,G. RamachandraKumar ,K. Narasimha, . IOT APPLICATIONS ON SECURE SMART SHOPPING SYSTEM,2016 Department of Electronics and Communication Engineering, Sreyas Institute Engineering &Technology ,Hyderabad. Page no: 360-370.

[6] T. Liu, L. Yang, X.-Y. Li, H. Huang, and Y. Liu, "Tagbooth: Deep shopping data acquisition powered by rfid tags," in Proc. INFOCOM, May 2015, pp. 1670–1678.

[7] Rupa N. Digole1, Prof. S. M. Kulkarni, . Smart Navigation System for Visually Impaired Person, International Journal of Advanced Research 2015

[8] Smart Navigation System for Visually Impaired Person, RF Based Talking Signage for Blind Navigation,International Journalon Cybernetics & Informatics (IJCI) Vol. 4, No. 2, April 2015

[9] P. Rajasekaran,N. Prabakaran, V. Magudeeswaran, Context-Aware Computing Using Rich Contexts for Pervasive Environment,26 August 2014, pp.425-431.

[10] Y. Liu, Y. Zhao, L. Chen, J. Pei, and J. Han, "Mining frequent trajectory patterns for activity monitoring using radio frequency tag arrays," IEEE Trans. Parallel Distrib. Syst., vol. 23, no. 11, pp. 2138–2149, Nov. 2012.

[11] L.-A. Tang et al., "On discovery of traveling companions from streaming trajectories," in Proc. ICDE, Apr. 2012, pp. 186–197

[12] .M. Popa, A. K. Koc, L. J. M. Rothkrantz, C. Shan, and P. Wiggers, Kinect Sensing of Shopping Related Actions. Berlin, Germany: Springer, pp. 91–100, 2011.

[13] T. Staake, F. Thiesse, and E. Fleisch, "Extending the EPC network: The potential of RFID in anti-counterfeiting," in Proc. ACM SAC, Mar. 2005, pp. 1607–1612.

[14] R. Kohavi, N. J. Rothleder, and E. Simoudis, "Emerging trends in business analytics," Commun. ACM, vol. 45, no. 8, pp. 45–48, Aug. 2002.

[15] Y. H. Cho, J. K. Kim, and S. H. Kim, "A personalized recommender system based on Web usage mining and decision tree induction," Exp. Syst. Appl., vol. 23, no. 3, pp. 329–342, Oct. 2002.