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Design and Development of a novel Intelligent Shopping Cart

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Abstract

In the present fast changing and competitive world, shopping in malls has become a hectic job. Retailers understand the frustrations of shoppers and have offered a wide range of alternatives such as late-night shopping and internet shopping. Yet all these have not caught on with consumers. After all, as all women and some men would know, "Physical touch and viewing" the products is what makes shopping enjoyable. Hence people would prefer shopping in the malls directly. There are many products / varieties / brands / offers being introduced everyday which is dynamic. It's difficult to choose the right product. During check out after encountering long queues few items may not fit the budget & it needs to be returned. This project is NOVEL and A LOW COST system which intends to solve this issue for the retailers. We begin by conceptualizing and formulating the issue keeping in mind the purpose and future scope of such a product. Thus, this project helps to reduce the complexity of searching & selecting products for the buyer making it simpler for updating the best deals. We then designed a model for the system, which we named as 'A Novel Low-Cost Intelligent Shopping Cart'. The next stage involved simulating this model for analysis and better understanding. This step is essentially lending credibility to the system. With this 'Shopping Cart', retailers can provide customer's a pleasurable shopping experience. With this user friendly cart the customer will get the required information about the product, best deals available for that particular day/hour. Hence the customers can decide the purchase depending on their budget.

Keywords: ZIGBEE module, RFID tag, RFID reader, barcode reader.

Introduction

An embedded system is one that has computer-hardware with software embedded in it as one of its most important component. Today purchasing various items in malls or supermarkets require a trolley. On each occasion, customer has to pull the trolley from one rack to another rack, for collecting items and simultaneously customer has to perform estimated expense computation. After total purchase, the customer needs to go to billing counter for payments. At billing counter, the cashier prepare the bill using barcode reader which is very time consuming process and results in long queue at billing counter. In this concept each and every product has RFID tag instead of barcodes and the smart trolley will consists of a RFID reader, LCD display and ZIGBEE transmitter.

Radio frequency identification(RFID) is becoming a preferable technology and also an alternative to barcode systems. RFID systems provide an automatic identification method. An RFID tag is an object that can be attached to a product. ZIGBEE is built on top of the IEEE 802.15.4 standard. Zigbee technology is a low data rate, low power consumption, low cost, wireless networking protocol. Zigbee can be implemented in mesh networks. The data rate is 250Kbps at 2.45GHz,40Kbps at 915MHz and 20Kbps at 868MHz.

Literature Survey

Currently available method in shopping malls is barcode method. In this method there are barcode labels on each product, which is read by a bar code scanner. A barcode reader (or barcode scanner) is an electronic device consists of a light source, a lens and

a light sensor translating optical impulses into electrical ones. At the billing counter, the cashier scans the product through the barcode scanner and gives us the bill. But this results in a time consuming process and thus it leads to a long queue. RFID technology is found to be more comprehensive than barcode technology. It is possible to read RFID tags from a greater distance. An RFID reader can access the information of the tag from a distance of around 300 feet, whereas barcode technology can't be read from a distance of more than 15 feet. RFID technology also scores over barcode technology in terms of speed. RFID tags can be interpreted much faster than barcode tags. Barcode reading is comparatively slower because it requires a direct line of sight. On an average, a barcode reader takes around one second to successfully interpret two tags, whereas in the same time the RFID reader can interpret around 40 tags. RFIDtags are well protected and hence is not subjected to too much wear and tear. Barcode is printed on the outer side and is thus subjected to greater wear and tear. It also limits the re-utilization of barcodes. As barcode lacks read and write facility, it is not possible to add to the information already existing on it. On the other hand rewriting on RFID tags is possible.

Proposed System

The proposed system consists of the two sections namely:

- Trolley Section
- Master Billing Section

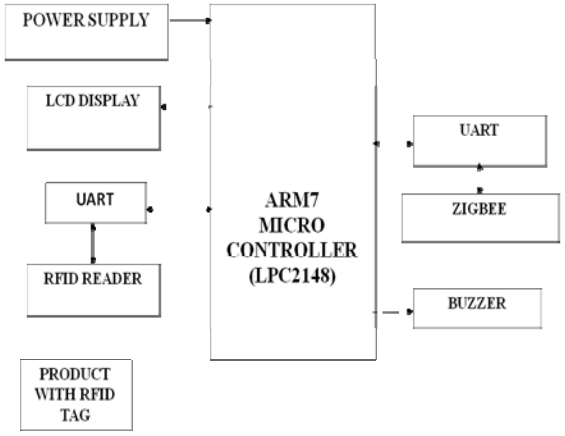


Fig1:Block diagram of trolley section

Fig2: Block diagram of Master Billing Counter

A Liquid crystal display (LCD) is a flat panel display or other electronically modulated optical device that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a black light or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as preset words, digits and 7-segment displays. Since LCD screens do not use phosphorous, they do not suffer image burn in when static image is displayed on a screen for a long time. The LCD screen is more energy efficient and can be disposed of more safely than a CRT can.

RFID is an acronym for "Radio-frequency identification" and refers to a technology whereby digital data encoded in RFID tags or smart labels are captured by a reader via radio waves. RFID has several advantages over system that uses barcode asset tracking software. The most notable is that RFID tag data can be read outside the line of sight, whereas barcodes must be aligned with an optical scanner. A radio-frequency identification system uses tags, or labels attached to the objects to be identified. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response. RFID tags can be either passive, active or battery-assisted passive. In 1972, the first active liquid-crystal display panel was produced in United States By Peter Brody's team.

A Radio Frequency Identification Reader is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader. RFID is not a replacement for the bar-coding, but a complement for distance reading codes. This technology is used for automatically identifying a person, a package or an item.

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. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range low-rate wireless data transfer. Its low power consumption limits transmission distances to 10-100 meters line-of-sight, depending on power output and environmental characteristics. ZigBee devices can transmit data over long distances by passing data through a mesh network of

intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys.) ZigBee has a defined rate of 250 kbit/s, best suited for intermittent data transmissions from a sensor or input device. ZigBee is a low-cost, low-power, wireless mesh network standard targeted at the wide development of long battery life devices in wireless control and monitoring applications. ZigBee devices have low latency, which further reduces average current.

A universal asynchronous receiver or transmitter is a computer hardware device for asynchronous serial communication in which data format and transmission speeds are configurable. UARTS's are most commonly used in microcontrollers. A dual UART , or DUART , combine two UART,S into a single chip.

Working Of Proposed System

In our proposed system, we discuss an innovative concept of smart billing and shopping. The key idea here is to assist a person in everyday shopping activity. This in turn helps in reducing the shopping time which is normally taken for purchasing different products. The main aim is to provide a technology oriented, low-cost and provide an easy shopping facility to customers.

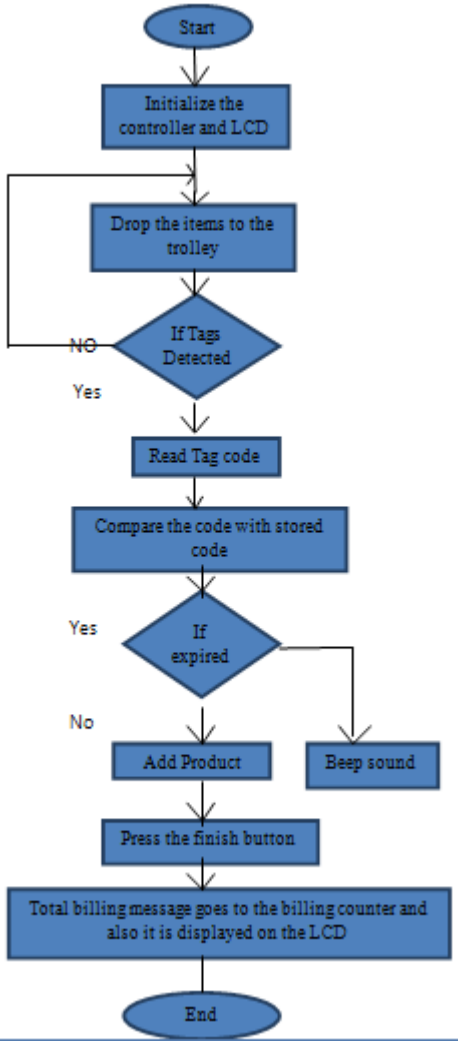
The developed system comprises of ARM7 microcontroller, 16x2 LCD display unit, RFID reader, RFID tags, ZIGBEE transceiver and a battery power source.

All the items in the mall will be equipped with RFID tags. When a person puts any item in the trolley its code will be detected and that code is send to the master billing counter, in the master billing counter side we are using PC, to store all the data base. Once the PC receives that code it sends the particular product cost to the controller part, price of that item will be stored in memory. As we put the items, the costs will get added to total bill. Thus the billing will be done at the trolley itself. For detecting different items RFID reader will be used. RFID tags are used to uniquely identify products respective details. LCD is used to display item names, item cost etc. Whenever a product is purchased it automatically checks for the expiry date. So it helps us to remove the expired product. Navigation facility helps us to locate the items which we want. The customer will be able to know all the details of the items in the trolley itself, that is displayed on the LCD of the trolley.

All the product information is stored in a database at a central server. The information received from the server is temporarily stored in the shopping cart memory and then displayed on the display unit affixed on the cart. As the products are selected and added into the cart, the RFID reader will identify the product and the price will be added to the temporary bill. If the customer need to 'cancel' a selected product, it can be accessed through swiping the product tag two times. After completing the shopping, the customer has to select the "Finish" button. This enables the total bill being generated after confirmed purchase of all the selected products in the shopping cart. At the same time, this information is sent to the database server through the wireless ZIGBEE transmitter.

At the billing Counter, the total bill data will be transferred to PC by wireless ZIGBEE receiver. Later the billing is carried out by master billing section. Finally the customers need to pay the total amount at the billing counter, so the queue problem is avoided.

System Flow Chart



- All the items in the mall will be equipped with RFID Tags. When customer puts an item in the trolley, its code will be detected by RFID reader which is interfaced with processor.
- Reader sends this code to ARM processor, after matching code with stored code, processor reads products name, cost and other details. The product details like name, cost , expiry date and the total bill of the products inserted in the trolley is displayed on the LCD.
- As the customer put the products , the cost will be added to the total. Thus the billing is done at the trolley itself. Simultaneously all the details are displayed on LCD.
- If tags are detected and reader will read the tag code and it compares the code with stored code. If the product has been expired then it will be identified by a beep sound. If products are not expired then the total bill is sent to the master billing counter.

Conclusion

This application creates an automated central bill system for supermarkets and mall. There is no need for the customers to wait near the cash counter for their bill payment, since their purchased product information is transferred to central billing system.

It would also reduce the required number of salesmen. Thus it is truly time saving method and uses less time consumption out of all present billing methods. The developed product is easy to use, economical and does not require any special training. This project simplifies the billing process. This will take the overall shopping experience to a different levels.

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