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ARM-7 Based Smart Trolley with Instant Billing to Ease Queues at Shopping Malls

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Abstract: The modern technology has increased the standard of living for the humans. Every one of us craves for a quality in everything we use in our daily lives. So, this has resulted in large crowds at shopping malls which have lead to long lines at the billing counter because the cashier has to scan every product item and then enter it into the billing record. The prevailing billing system is a bit time consuming. So, we thought of inventing a remedial electronic product to catch-up with this problem. We call it "Smart Trolley with Instant Billing to Ease Queues at Shopping Malls using ARM7 LPC2148: A Review''. This is based on arm7 microcontroller fitted with a LCD and RFID scanner and a wireless technology called zigbee. The LCD used is a 16x2 and zigbee modules make the wireless network to work even at long distance due to its wide range. The brief description of its operation is, when you pick a product and drop it into the trolley, the RFID scanner scans the product's unique code and its price. And it gets displayed on the LCD screen. So after costumer has finished with the shopping he/she has to visit the counter and pay the bill as displayed on the LCD screen fitted on the trolley. This will save the time that was earlier being consumed to scan each item.

Keywords: Smart Trolley, Digital Trolley, ARM7 LPC2148, Zigbee, RFID, Instant Billing.

I. INTRODUCTION

Barcodes have been in existence for many years and have been used by departmental stores and supermarkets to manage purchases of merchandize by customers and keep track of inventory. However, the barcode system is no longer the best way to business operation. Customers are tired of waiting in long, slowly moving checkout line in departmental stores, especially, in holidays. With the decrease of prices through efficiencies of technology and large-scale production of semiconductor wireless components, there has been a search for new markets in which semiconductor chips can be used. This has led to the use of RFID also known as smart tags. RFID stands for Radio Frequency Identification. The intelligent shopping cart is equipped with Radio Frequency Identification (RFID) for product identification with the shop's server. Besides, it also has an LCD display that informs customers about the product prices, discounts, offers and total bill. As soon as the object is dropped into or moved from the cart, the RFID tag identifies the product and updates the bill. When the customer is done with shopping, he can just press the 'END SHOPPING' button and the details are sent to the shop's server and the customer has to pay just the amount and leave. The proposed cart is easy to use and does not need any special training. The cart's inbuilt automatic billing system makes shopping a breeze and has other positive spin-offs such as freeing staffs from repetitive checkout scanning, reducing pilferage and increasing operational efficiency in stock taking.

II. EXISTING SYSTEM

A. Traditional billing method

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 hat consists of a light source, a lens and a light sensor translating optical impulses into electrical ones. Additionally, nearly all barcode readers contain decoder circuitry analyzing the barcode's image data provided by the sensor and sending the barcode's content to the scanner's output port. When we select any product for buying we put it in the trolley and take it to the billing counter. The cashier scans the product through the barcode scanner and gives us the bill. But this becomes a slow process when lot of products is to be scanned, thus making the billing process slow. This eventually results in long queues.

B. Barcode vs RFID

If compared, 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. RFID tags are well protected or either implanted inside the product, and hence is not subjected too much wear and tear. Interpreting a barcode requires a direct line of sight to the printed barcode, because of which the barcode is printed on the outer side of the product, 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

III. SYSTEM DESIGN

A. Block Diagram

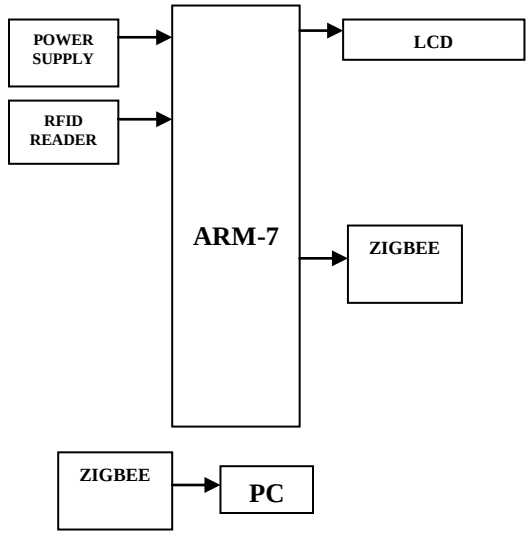

Fig 1. Block diagram

B. Operation

In our Intelligent Billing Trolley system environment, each product will have the passive Radio Frequency ID tag which is bearing a unique Electronic Product Code.. This Electronic Product Code provides the info like name, price etc about the product. When the customer will put the product in the Intelligent Billing Trolley, the Radio Frequency ID scans the tag and the Electronic Product Code number is known by Radio Frequency ID reader. Radio Frequency ID reader passes the Electronic Product Code to the ARM 7 micro-controller where ARM 7 compares the Electronic Product Code with the database of the system containing various products. After that the name and price of the product obtained by the ARM gets displayed on the LCD display of the Intelligent Billing Trolley, where user can see the product information. The ARM 7 microcontroller also passes the data obtained from the database to the Zigbee transmitter from where the data is wirelessly transmitted to the billing computer. The master computer receives this data through Zigbee receiver using Max 323 interface. Max 323 interface is the interconnection media between the Zigbee receiver and the computer.

C. Microcontroller (ARM LPC2148)

The LPC2148 microcontrollers are focused around a 16-bit or 32-bit ARM7TDMI-S CPU with constant imitating and implanted follow help, which consolidate microcontroller with inserted high velocity streak memory extending from 32 kb to 512 kb. A 128-bit wide memory interface and one of a kind quickening agent building design empower 32-bit code execution at the most extreme clock rate. For discriminating code size applications, the option 16-bit Thumb mode decreases code by more than 30 percent with negligible execution punishment. Because of their little size and low power utilization, LPC2148 are perfect for applications where scaling down is a key prerequisite, for example, access control and purpose of-offer. Serial interchanges interfaces running from a USB 2.0 Full-speed gadget, various UARTS, SPI, SSP to I2c-transport and on-chip SRAM of 8 kilo Bytes up to 40 Kilo Bytes, make these gadgets extremely appropriate for correspondence entryways and convention converters, delicate modems, voice distinguishment and low end imaging, giving both extensive cradle size and high transforming force. Different 32-bit clocks, single or double 10-bit ADC(s), 10-bit DAC, PWM channels and 45 quick GPIO lines with up to nine edge or level touchy outside intrude on pins make these microcontrollers suitable for mechanical control and restorative frameworks.

D. Liqid Crystal Display (LCD)

LCD is a short type of Liquid Crystal Display. LCD is finding no matter how you look at it use supplanting LEDs because of the going with reasons:

1. The declining expenses of LCDs.
2. The ability to show numbers, characters and representation. This is as opposed to Leds, which are confined to numbers and a few characters.
3. Wire of a resuscitating controller into the LCD, in this way reducing the CPU of the task of strengthening the LCD. Curiously, the LED must be empowered by the CPU to keep demonstrating the data.
4. Effortlessness of programming for characters and representations.
5. 5 These parts are "specific" for being used with the microcontrollers, which suggests that they can't be established by standard IC circuits. They are used for making differing messages on a little LCD.

A model depicted here is at its negligible exertion and mind blowing potential results most continually used as a piece of practice. It is engaged around the Hd44780 microcontroller (Hitachi) and can indicate messages in two lines with 16 characters each. It demonstrates every one of the letters all together, Greek letters, highlight marks, and numerical pictures et cetera. Besides, is possible to show pictures that customer makes up isolated. Customized moving message on showcase (move left and right),

appearance of the pointer, scenery light et cetera are considered as supportive qualities.

E. RFID (Radio Frequency Identifier)

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal. Chip less RFID allows for discrete identification of tags without an integrated circuit, thereby allowing tags to be printed directly onto assets at a lower cost than traditional tags. Primarily, the two main components involved in a Radio Frequency Identification system are the Transponder (tags that are attached to the object) and the Interrogator (RFID reader). Communication between the RFID reader and tags occurs wirelessly and generally does not require a line of sight between the device.

F. Zigbee Technology

Zigbee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it is the product from Zigbee alliance. This communication standard defines physical and Media Access Control (MAC) layers to handle many devices at low-data rates. These Zigbee's WPANs operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. The date rate of 250 kbps is best suited for periodic as well as intermediate two way transmission of data between sensors and controllers.

Fig 2. Zigbee Modem.

Zigbee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. This communication system is less expensive and simpler than the other proprietary short-range wireless sensor networks as Bluetooth and Wi-Fi. Zigbee supports different network configurations for master to master or master to slave communications. And also, it can be operated in different modes as a result the battery power is conserved. Zigbee networks are extendable with the use of routers and allow many nodes to interconnect with each other for building a wider area network.

VI. RESULTS

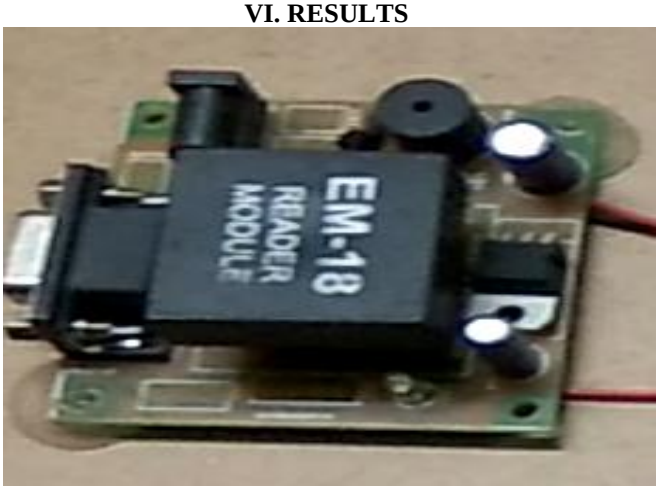

Fig 3. RFID Reader.

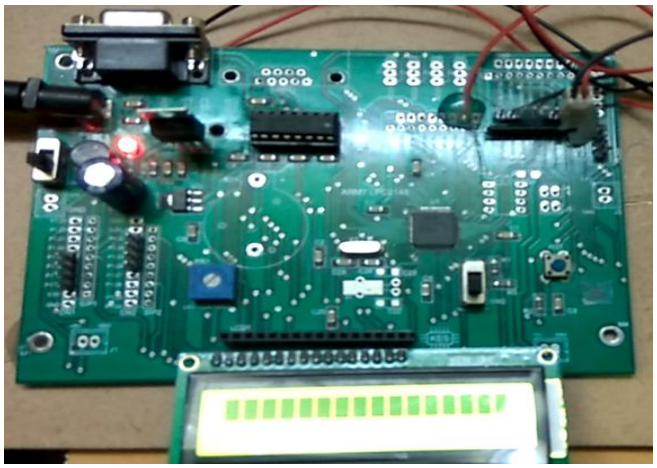

Fig 4. ARM-7With LCD.

Fig 5. ARM-7

V. CONCLUSION

The introduction of this electronic product to the supermarkets will be a boon for shopping as it would make shopping easier. Now, the customer needs not to stand in a queue to pay the bill. This product makes billing automatic. The inspiration and idea of this paper was drawn from large queues at the shopping mall and the inconvenience that it causes to the costumers. This new system of billing is fast as the single product detail gets recorded as it is dropped into the trolley. Working on this product it was noted that RFID technology and ZIGBEE has a very vast applications in the near future. Also, RFID is better and faster than bar code reading because the later works on line of sight which is not the case for RFID technique. RFID technology is compact and reliable. ZIGBEE is the wireless network that connects the costumer to the retailer and is very secure with long range of operation. This intelligent shopping system can completely change the way of shopping. The RFID and ZIGBEE technologies that are not commonly used would definitely find some use commercially. Moreover, this smart trolley will be very beneficial as it would reduce the number of salesmen and billing counters and also prove to be time saver for both costumer and the shopkeeper.

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