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Smart Trolley in Mega Mall Using Zigbee

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Abstract - *Shopping is a need of people that covers different fields from vegetable and grocery to clothing. The statistics of the minor and major shopping malls comes over the years throughout the world due to the request of the community. Thus, this leads to rise in the level and structure of a shopping mall. In our country, there is still an ample need for upgrading the facilities for providing the worthiest shopping experience to customers. Customers frequently deal with difficulties and problems while shopping. These problems also contain worrying trends about the total amount of money, waiting in the queue at the billing counter for the bill which heads to the wastage of unnecessary time. For resolving the problems stated above different methods are developed. Examples of these various existing methods such as barcode technology, where the price is stored in barcode and RFID technology are implemented for smart shopping. Radio Frequency Identification (RFID) reader helps to scan through the tag and display the product number and price with total billing amount on LCD display. Zigbee serves as a transmitter and receiver. All the components are interfaced with central PC which has database of a particular product. The goal of this task is to improve the speed of shopping. Hence, this system provides time-efficient, cost-effective, reliable, and eco-friendly solution for shopping.*

***Key Words*: Smart Shopping, RFID tag, RFID reader, Zigbee, LCD display, Central PC.**

1. INTRODUCTION

People have a list of items which they want to buy. The moving ahead in technology changes the way of shopping over the last ten years. The owners of malls and mega malls are working to improve the facilities for customers to make sure the customers are happy with the shopping experience and at the same time factors such as providing the customer needs and to meet the expected sales growth and profit are also believed. The first thing is to eliminate the waiting time taken for billing the items and in addition to this people prefer to have a then and there checking of the increasing count, rate of each and every item that is added into the smart trolley. The customers prefer to have short look of amount and price level to make purchase decisions. Anyways, increase in capital cost and accuracy when the shopping trolley if full with items are the major bad result of this smart trolley system.

Microcontroller based design has bought the status of most happening field in electronics. This is very special field that has the power of combining different things together so they work as a one unit as the thousands of transistors on a single silicon chip. Recently in mall for buying-related variety of items it needs trolley. Every time customer has to pull the trolley from rack to rack for collecting items and at the same time customer has to do calculation of those item and need to compare it with his budget in pocket.

After this procedure, customer has to wait in queue for billing. So, to avoid headache like pulling trolley, waiting in billing queue, thinking about budget, we are introducing new concept that is "SMART TROLLEY IN MEGA MALL USING ZIGBEE".

When the customers want to purchase items then customer has to hold the RF tag side of the product wrapper in front of RF Reader. Then corresponding data regarding product will be displayed on display. By using this trolley, customer can buy large number of products in very less time with less effort. At the billing counter, computer (central PC) can be easily interfaced for verification and bill print out.

2. LITERATURE SURVEY

1] "Implementation of Smart Trolley System in Malls", International Journal for Research in Applied Science & Engineering Technology.

This paper suggests implementing a smart trolley system based on RFID in order to reduce the billing time by creating two modes Auto and Manual mode. Auto mode guides and moves forward before the customer to find product when they are new to the supermarket and in the Manual mode customers have to drag the trolley. In addition to this, the smart trolley is capable identifying the product with the help of RFID reader, adds or reduces and displays its count and product price and calculations of final price of purchased product to the cashier or server with trolley number for cash settlement using wireless transmission reducing the wastage of time in the queue.

2] "RFID Based Smart Shopping Trolley with IR Sensor", International Journal of Scientific Research in Science and Technology.

This trolley system used RFID tags on products that one wants to buy, which are read by barcode scanner and the cost is displayed on LCD screen attached to the system.

As customer buy the next product its price added with the previous amount. The cost of the product is given to the microcontroller by using Zigbee communication from the host PC. Zigbee supports a bidirectional communication between host PC and microcontroller. Customer get direct bill at the billing section which is already stored at host PC which ultimately reduces queue.

3] "Advancement of shopping cart for Supermarket", IEEE.

This paper proposed microcontroller-based smart shopping handcart for supermarkets to make the shopping experience very convenient for customers. This work can potentially reduce the human efforts and manpower requirement at the billing desk. RFID reader helps to scan through the tag and display product information on LCD screen. Zigbee serves as the transceiver. All the components are interfaced with microcontroller which has database of the particular product in its memory. So, whenever tag is swiped the microcontroller checks the database and displays the details of the product. At the final stage, the list of details of the products is maintained and convenient payment solution is provided when shopping is finished.

4] "Smart Trolley Shopping System", International Journal for Research in Applied Science & Engineering Technology.

This paper proposes the use of RFID tags to identify each product and to eliminate the problem of long waiting lines. The microcontroller will read the RFID input will then search for the RFID tags number in the computer file and return the products price. The proposed system uses an LCD display to add just the total amount which will be displayed on the display. However, no more information about the product can be viewed using this proposed system. Also, it is not possible to use RFID tags on every item specially the cheaper ones. So, this proposed system will be good for stores having only expensive items, but for putting into use a smart shopping experience in malls having cheaper products also, this system needs to be changed.

3. SYSTEM DESIGN AND DEVELOPMENT

BLOCK DIAGRAM

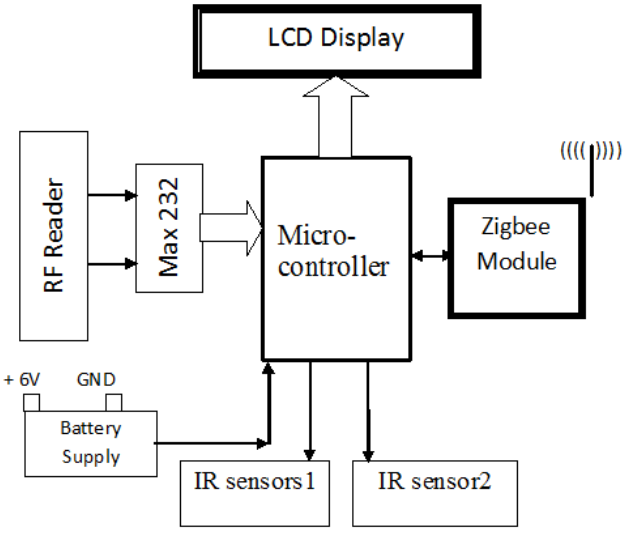

Figure: Block Diagram of Trolley Side

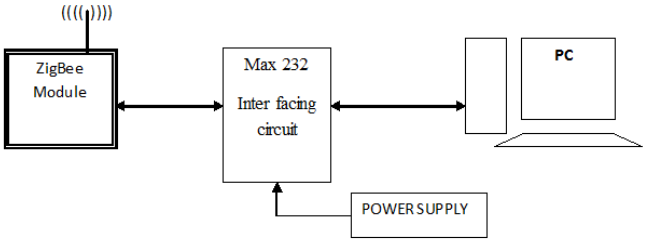

Figure: Block Diagram of Central PC Side

HARDWARE MODULES

1) MICROCONTROLLER AT59S52:

The AT59S52 microcontroller is a low voltage, high performance, powerful CMOS 8-bit microcomputer, which is highly flexible and provides cost effective solution to many embedded control applications by combining an adaptable 8-bit control processing unit with a flash on a monolithic chip. Atmel's high density nonvolatile memory technology is used in manufacturing this device. AT59S52 microcontroller is designed with static logic for operation down to 0 frequency and it will support 2 software selectable energy saving modes. While allowing the RAM, Serial port, counter or timer and interrupt system to continue functioning, the idle mode stops CPU.

Figure: Microcontroller AT59S52

2) VOLTAGE REGULATOR:

Voltage regulator are used for good regulation, stabilization and temperature independent of load voltage. IC voltage regulators are compact in size, light in weight, cheaper in cost, provided with inbuilt protection ciecuits.Voltage sources in a circuit may have fluctuations resulting in not giving fixed output voltage. Voltage regulator IC maintains the output voltage at a constant value. IC 7805 provides +5 volts regulated power supply with provisions to add heat sink as well.

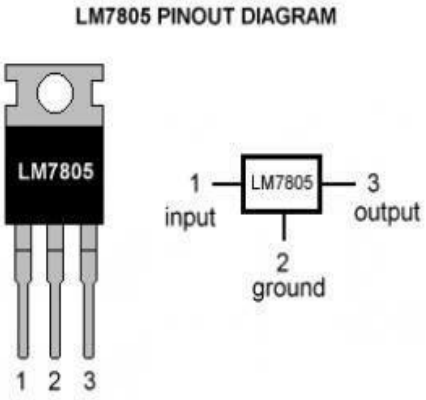

Figure: IC LM7805 Voltage regulator

3) LCD :

LCD interfaced with the port-0 (D0-D7) that is from pin number 32 to pin number 39. In other words, the data-bus D0-D7 is connected to port-0 of IC 89S52. Pin RS is directly connected to Pin11 of controller and one more another important Pin EN (LCD Enable) is directly connected to Pin 14 of controller. On other hand Pin R/W of LCD is connected to ground. The LCD interfacing is done here for indicating various display message for the user.

Figure: LCD Display

4) POWER SUPPLY:

The system requires 5 V power supply for the proper functioning for that purpose we designed the power supply which has circuitry as shown in figure.

The input ac voltage, typically 220V RMS, is connected to a transformer, which steps that ac voltage down to the level of the 9V dc output. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to provide a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripple and also remains the same dc value even if the input dc voltage varies. This voltage regulation is usually obtained using voltage regulator IC units.

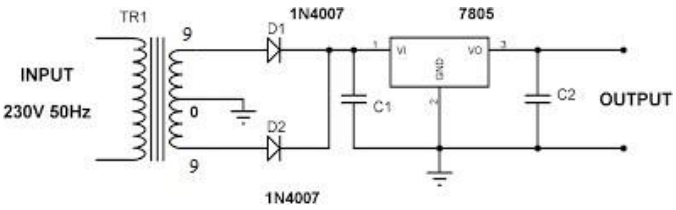

Figure: Power supply

5) ZIGBEE:

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area network with small, low-power digital radios. It is a wireless network communication tool. Here, we use Zigbee as a transceiver in trolley side and central PC side.

Figure: Zigbee

6) IR SENSORS:

IR Sensor works by using a specific light sensor to detect a light wavelength in the Infra-Red (IR) spectrum. When an object is close to the sensor, the light from the LED bounces off from the object and into the light sensor, and that can be detected using a threshold. IR Sensor includes photodiode and IR LED that play the role of receiver and transmitter respectively.

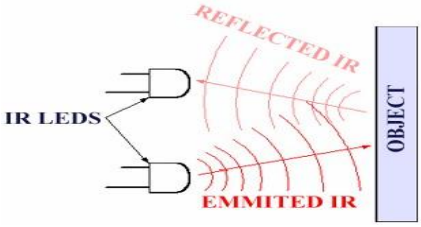

Figure: IR Sensor

7) RFID MODULE:

The RFID reader used in proposed system is EM18 is shown on figure. When a customer puts product in the trolley the RFID reader scans the product and details regarding the product prize display on LCD screen.

Figure: RFID reader module EM18

8) RFID TAG:

An RFID tag is a micro chip combined with an antenna in a compact package. The packaging is structured to allow the RFID tag to be attached to an object to be tracked. RFID tags are very small. The RFID tag is attached to a product.

Figure: RFID Tag

SOFTWARE

- **Keil uVision5 –** Embedded in C programming.
- **Proteus –** Design system.
- **Visual Basic 6.0 –** Server side or Central PC side Programming.

4. IMPLEMENTATION RESULTS AND DISCUSSION

Following figures show the results of our system. As in our system, when the customer wants to purchase an item then customer has held the RF tag side of the product wrapper in front of RF reader. Then the corresponding data regarding product display on screen.

Figure 1 shows the LCD display in smart trolley having the customer taking one product. Then the corresponding price of product, total bill of the trolley and number of products are added in trolley are shown in LCD screen.

(P- Price of product, T- Total bill, Q- Total number of products added in trolley)

Figure 1

Figure 2 shows LCD Display in smart trolley having the customer take second product. And individual second product price, total bill and number of products in smart trolley are shown in LCD display.

Figure 2

Similarly, Figure 3 and figure 4 shows the corresponding data related to corresponding product 3 and 4 as per price, total bill and number of products in smart trolley.

Figure 3

Figure 4

In figure 4, we see the total bill of the smart trolley is 373Rs. Therefore, the bill in Central PC side is also shown in figure 5.

If the customer has not enough money for paying the bill, then the customer has choice to remove any products from the smart trolley. Figure 6 shows the LCD display in smart trolley having bill of 3 products because we have removed one product in smart trolley. So, the bill can easily pay.

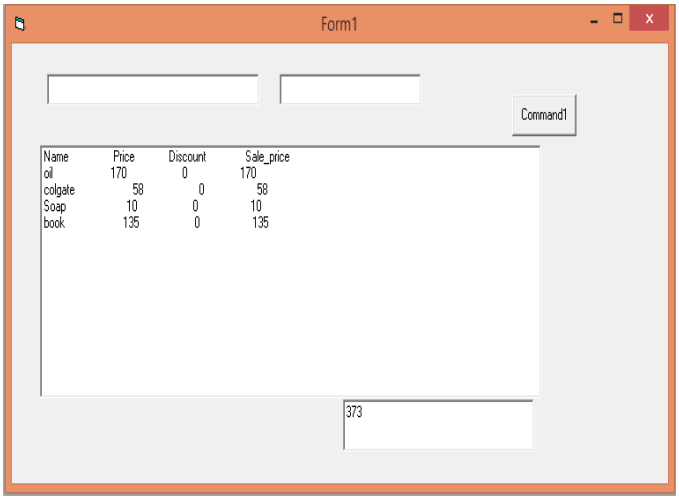

Figure 5

Figure 6

From figure 1 to 6, it is clear that the customer can take decision whether to take the product re remove the product as per total bill displayed on screen. So, the process time will save in our system so this will prove the system has faster. And in display shows the total bill so customers only give print of bill and pay the bill easily.

5. ADVANTAGES AND APPLICATIONS

ADVANTAGES:

- RF tag gives total information about product related data.
- RF tag maintains secrecy.
- User interactive system.
- Quicker shopping and saving much time.
- Improved shopping Experience.

APPLICATIONS:

- Wireless data logger system.
- Billing system.
- Super market.

6. CONCLUSION AND FUTURE SCOPE

As in our system the customer can take decision whether to take all the product or remove some product as per the total bill displayed on the screen. So, the process time will be saved in our system so, this will prove the faster system. And the rush at the billing counter will be reduced due to this system. In the system we can also add billing process. So, after adding the billing process this will be the much faster system and this will prove best and faster system as we have going to develop.

All the billing information in microcontroller can be send to central computer using Zigbee technology. Trolley handling can be added using GPS system or remote.

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