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Smart Trolley with Smart Billing

Dr. V. Karpagam[A], S. Balapriya [B,] G. Kalairubini[C], A. Kalaivani[D]

Department of Information Technology,
Sri Ramakrishna Engineering College, Coimbatore, India.

Abstract

Shopping mall is a place where people get their daily necessities. There has been an emerging demand for quick and easy payment of bills in shopping malls. In the current scenario, many models have been developed including interfaces, algorithms and hardware platforms to assist smart shopping. In this paper, we propose a model named Smart Trolley using ZigBee to automate the billing process in shopping. This system is based on detection of products, weight estimation and billing. This Smart Trolley includes the RFID reader, RFID tag, Load Cell, LCD, ZigBee, and Controller. Purchasing product information will be read through a RFID reader on smart trolley and it is displayed in LCD which is interfaced to the Controller. The Load cell is to estimate the weight of the product against the weight information registered in the processor memory. At the billing counter, the total bill will be transferred to main system by ZigBee module.

Keywords: *Smart Trolley, ZigBee, RFID tag, RFID reader.*

I. INTRODUCTION

Smart Trolley is currently being explored in the retail business in order to improve the customer inclination rate and desire towards shopping. Customers find quite a number of difficulties in shopping malls.The major difficulty faced by customers is that they have to wait in long queues for billing**.** Thus, the proposed system has exploited a new way to ease the billing process through integration of various interface with Microcontroller.

Each trolley is implemented with a RFID reader, LCD display, Arduino microcontroller, Load Cell, Zigbee module, Buzzer. The RFID reader, scans the product which is put into the trolley. As each product is placed in the trolley, various information like product name, weight of the product are displayed in the LCD display placed in the trolley. The Load cell is to estimate the weight of the product against the weight information registered in the processor memory. A Buzzer has been provided to notify the abnormal activities. The total bill amount will reach the bill counter immediately through the zigbee technology as customer presses the button after purchasing. Then the customer just has to pay the total amount at the billing counter. This proposed system eliminates different sectional counters and long queues, which has been consistently reported as one of the most negative aspects of shopping mall.

The rest of the paper is organized as follows, section 2 describes the related work, Section 3 explains the proposed model, section 4 explains the experimental results and finally section 5 is concluded.

II. LITERATURE SURVEY

In work[1], a sensor-based smart shopping cart has been proposed to detect the behavior of customers and respond to them in real time. This system makes use of two applications in order to reach correct accuracy of finding the products. In this system, each cart checks if the customer has interest in some products and suggests some information about the products. By using product-navigation application, the customer asks the system to find the shortest path to obtain the product. In [4], a centralized and automated billing system using RFID and ZigBee communication is employed. Each product is bprovided with a RFID tag. Each shopping cart is implemented with a Product Identification Device (PID), that contains microcontroller, LCD, RFID, and ZigBee module. Purchasing product information will be read through a RFID reader on shopping cart, this information is sent to the billing counter using ZigBee module. The billing system gets the cart information and EEPROM data, then it accesses the product database and calculates the total amount of purchasing for that particular cart. This system, mainly focuses in solving queue in the store.

III. PROPOSED SYSTEM

3.1 System Design

Hardware module for the proposed model, that is attached to shopping Trolley of supermarket is described in the Figure 1. It consists of a microcontroller, display unit (LCD), RFID reader, ZigBee module, Load Cell and a battery power source. The battery power source increases the mobility of the device.

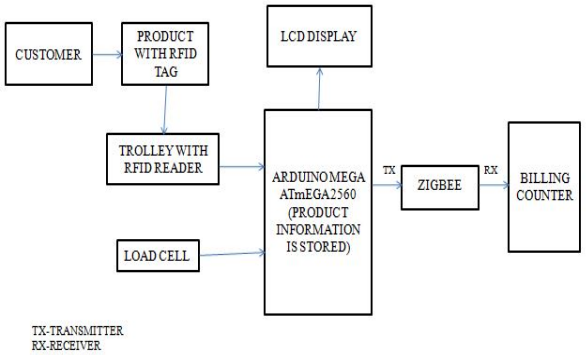


Fig 1. Architecture diagram of proposed smart trolley system

A. Microcontroller

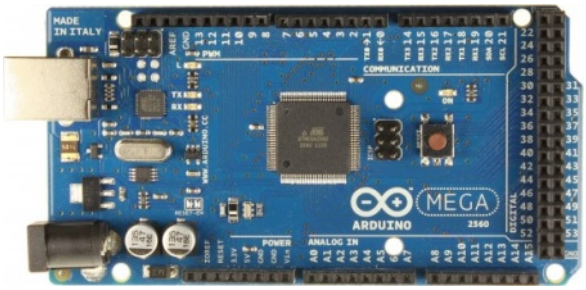


Fig. 2.Microcontroller

The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a system, with a USB cable or power it with a AC-to-DC adapter or battery. The board can operate on an external supply of 5volts. It provides 4 hardware UARTS for TTL(5V) serial communication.

B. RFID reader

Fig. 3.RFID reader

RFID reader consists of an RF module that acts as a transmitter and receiver of radio frequency waves. Transmitter consists of an oscillator to create the carrier frequency, a modulator to make impact on data commands upon this carrier waves and a receiver that contains demodulator to extract the data returned.

C. RFID tag

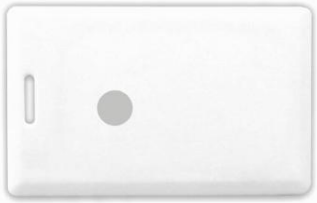


Fig. 4.RFID tag

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. LCD

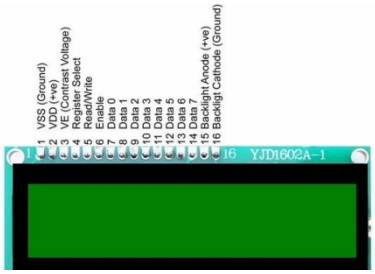


Fig. 5.LCD

LCD has the ability to display numbers, characters and graphics. The display is interfaced to I/O port of microcontroller (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.

E. Load Cell

Fig. 6.Load cell

Load Cell is used for measurement of weights. It is provided with the boost up driver in order to convert analog values to digital values, hence most of the system works only with the digital value to get accurate result. Load Cell sends data(weight) and clock value in analog form. It is a transducer that is used to create an electrical signals whose magnitude is directly proportional to the force being measured.

IV. DETAILED DESCRIPTION OF THE SMART TROLLEY SYSTEM

A. Feature Of the Smart Trolley System

The capabilities of the system are listed below:

1) The basic functionality are calculating and updating customers bill as when s/he places the shopped products in the trolley.

2) The customer can view the products name and weight as and when the products are kept inside the trolley.

3) In addition to the above features, it also includes the handling of some special cases. All the cases mentioned below are detected by the system.

a) Attempt to take away products by keeping them into the trolley without scanning the products against the RFID reader.

b) When the customer scans a product, but forget to keep it in the trolley.

c) Attempt to scan one product, but place multiple products in the trolley.

d) Since customers are likely to change their mind, our system allows for cancelling any item already placed in the trolley with the help of attendant.

B. Operation of the Smart Trolley System

Fig. 7.Smart Trolley

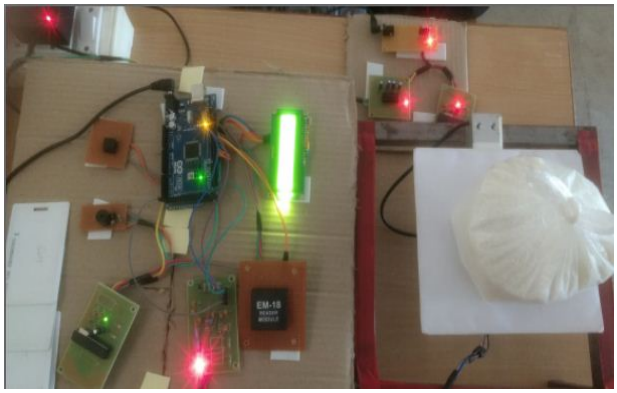
On entering the grocery store, s/he picks a smart shopping trolley. Each trolley is given a unique number and every customer is associated with the trolley choosen. A typical trolley is expected to look like the one shown in the Figure 7.

The functioning of the system is listed below:

- When the customer picks up a product, s/he first scans the product against the RFID reader and then places it in the trolley.
- Once the product is kept in the trolley, the weight of that product is displayed in the LCD, if the weight does not matches with the stored weight, then a beep sound is produced.
- All the details of the products are stored in the arduino.
- When the purchase is over, the customer presses the button.
- The billing counter displayes the trolley number in the LCD, to that corresponding counter the customer goes and take away the products after paying the bill.
- If s/he changes their mind, cancellation of products are done at the billing counter.
- The bill will be generated only if all the products are removed from the trolley.

V. EXPERIMENTAL RESULTS

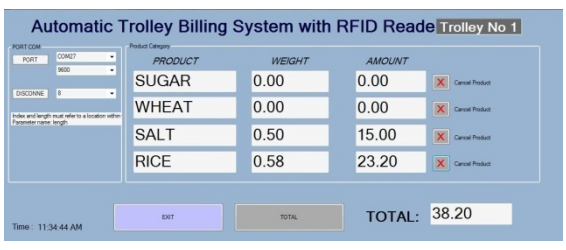
The automated Smart Trolley system consists of three modules namely product scanning , load weighing and billing push. Each Smart Trolley is designed or implemented with a system that contains RFID reader, LCD, Loadcell and transmitter.



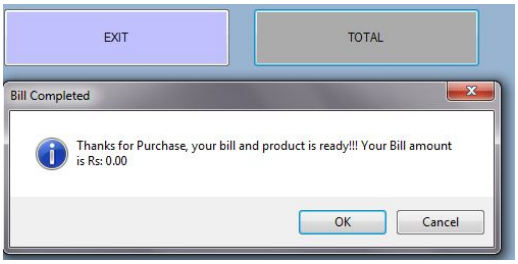
Initially it will display the quote ‘select item’ in the LCD. Once the product is scanned against the RFID reader, it will display the name of the product. After the product is scanned, it will display as place the product. After placing the product, it will calculate the weight of the product.

When the purchase is over, the button is pressed. The data is transferred from trolley to the billing counter. The product list is displayed in the system, only when all the products are removed from the trolley.

The billing window is displayed along with the list of products, price, weight and total amount. The port and baud value is selected from the drop down box. The connect button is clicked before billing.



If there is any cancellation of product, the cross button provided near that product is clicked and the total gets modified. When the total button is clicked, Thanks window is displayed.



VI. CONCLUSION AND FUTUREWORK

The desired objectives were successfully achieved in the proposed model developed. The product developed is easy to use. The long queue in the billing counter is far reduced with the help of this "Smart trolley" system.Though the project showcases the proof of concept, there are a few aspects that can be included to make the smart trolley more robust. It is impossible to stick RFID tag to some products.

In such cases, barcode scanner is more sophisticated. Further, it can be designed to display the list of products in the trolley, allowing customers to cancel the products if needed.

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