

Wireless Smart Shopping Trolley

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Abstract— Nowadays purchasing and shopping at big malls is becoming a daily activity in metro cities. We can see huge rush at malls on holidays and weekends. The rush is even more when there are special offers and discount. The purchased products are put into the trolley by the customers. After total purchase one needs to go to billing counter for payments. At the billing counter the cashier prepare the bill using bar code reader which is a time consuming process and results in long queues at billing counters. Our aim is to develop a system that helps in shopping malls to solve the above mentioned challenge. The system will be placed in multiple trolleys which are available in shopping malls. The system will consist of a RFID reader. All the products in the mall will be equipped with RFID tags. When a person likes to purchase any item they should put into the trolley, its identified code will be detected and the price of those products will be stored in memory. For total purchased products, the individual costs for the each product will get added to total bill. Then each product name and its cost will be display on LCD Screen. The overall purchased details will be announced using headset. At last total purchased product has been confirmed by pressing button, and then the details will be sending as data that will be transferred to PC and Customer mobile by wireless RF & GSM modules.

Keywords — RFID reader; RFID tags; IR rays; GSM module; VB.Net; Embedded c

1. INTRODUCTION

Shopping mall is a place where people get their daily necessities ranging from food products, clothing, electrical appliances etc. Nowadays numbers of large as well as small shopping malls has increased throughout the global due to increasing public demand & spending. Sometimes customers have problems regarding the in complete information about the product on sale and waste of unnecessary time at the billing counters. Continuous improvement is required in the traditional billing system to improve the quality of shopping experience to the customers. To overcome the problems stated above and to improve the existing system, we have designed a SMART TROLLEY USING RFID. This can be done by

simply attaching RFID tags to the products and a RFID reader with a LCD display on the shopping trolley. With 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. This system will save time of customers and manpower required in mall and cost associated with the product.

2. LITERATURE SURVEY

1.R. Want, "An Introduction to RFID Technology", in IEEE Pervasive Computing, vol. 5, pp.25-33, 2006. RFID technology emerged some time back, this is due to lack of standardization and high costs. Latest technologies have made a down the costs and standards are being developed. Today RFID is almost used as a medium for several tasks including managing supply chains, tracking livestock, preventing counterfeiting, controlling building access, and supporting automated checkout. The use of RFID is limited by security concerns and delays in standardization.

2.J.Suryaprasad, B.O.P. Kumar, D. Roopa and A.K. Arjun, pp.1-4, 2011. The main objective of system is to provide a technology oriented, low-cost, easily scalable, and rugged system for assisting shopping in person. It maintains the connection of the shopping cart with the main server.

3. SYSTEM DIAGRAM

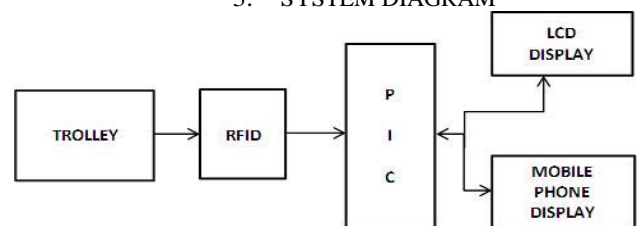
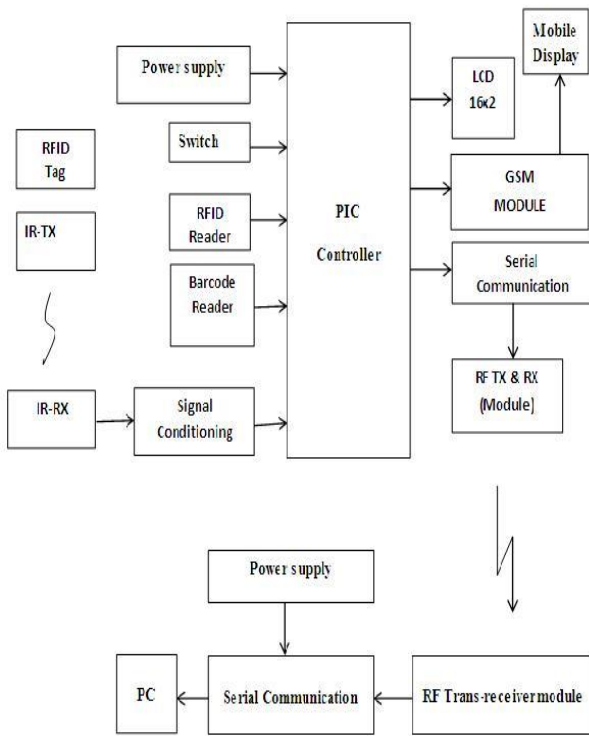


Fig3.1- System overview

III.A) BLOCK DIAGRAM



4. COMPONENT DESCRIPTION

TROLLEY UNIT

In this unit the PIC Controller 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 Controller processor. The PIC Controller 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.

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 and customer mobile.

POWER SUPPLY

The 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.

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.

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; a modulator to make impact on data commands upon this carrier signal & receiver that contains demodulator to extract the data returned.

BARCODE READER

A barcode reader is used to read printed barcodes. All barcode readers consist of decoder circuitry for analyze the barcode's image data and sending the barcode's content to the output port of scanner.

IR SENSOR

IR sensor is used for detecting a select light wavelength in the infra-red (IR) spectrum by using a specific light sensor. In IR sensor, LED is used that produces light at the same wavelength as what the sensor looking for.

EEPROM

The AT24002A/04A/08A provides 2048/4096/8192 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 256/512/1024 words of 8 bits each. The device is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24002A/04A/08A is available in space saving 8-pin PDIP, 8-pin and 14-pin JEDEC SOIO, and 8-pin TSSOP packages and is accessed via a 2-wire serial interface. In addition, the entire family is available in 5.0V (4.5V to 5.5V), 2.7V (2.7V to 5.5V), 2.5V (2.5V to 5.5V) and 1.8V (1.8V to 5.5V) versions.

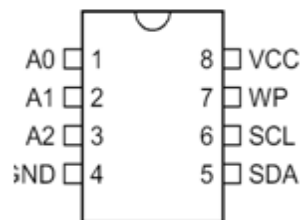


Fig4.1- 8 Pin PDIP

Pin Name	Function
A0 - A2	Address Inputs
SDA	Serial Data
SCL	Serial Clock Input
WP	Write Protect
NC	No Connect

Fig4.2- Pin configurations

MAX 232

The serial port is full duplex, meaning it can transmit and receives simultaneously. It is also receive-buffered, meaning it can commence reception of a second byte before a previously received byte has been read from the register. (However, if the first byte still hasn't been read by the time reception of the second byte is complete, one of the bytes will be lost.) The serial port receive and transmit registers are both accessed at Special Function Register SBUF. Writing to SBUF loads the transmit register, and reading SBUF accesses a physically separate receive register.

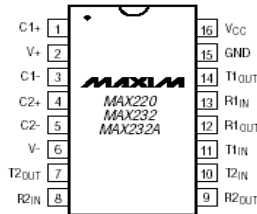


Fig4.3- Pin out diagram

transformer used here is a 230/ (12V-0-12V) step down transformer.

Even though output of rectifier circuit is DC it is not smooth or fixed DC. So filter circuits are used to convert rippling DC to smooth DC. The filter circuit is a capacitor, connected parallel to the output of rectifier circuit. This smooth DC voltage will be in the range of +12 volts. But we require only 5V supply for the operation of micro controllers and its supporting components. Here again regulator ICs such as 7805 is used to regulate the incoming 12VDC to fixed regulated 5V as output. This DC regulated 5V is applied to the circuits.

Even though the circuit is functioning with 5V, the relays are driven by 6V or 12V. For this purpose 7806/7812 regulator IC is additionally connected to the rectifier filter circuit. Thus 12V regulated is used for driving 12V relays.

PIC CONTROLLER

The PIC16FXX series has more advanced and developed features when compared to its previous series. The important features of PIC16F877 series is given below.

- High performance RISC CPU.
- Operating speed: clock input (200MHz), instruction cycle (200nS).
- Up to 368x8bit of RAM (data memory), 256x8 of EEPROM (data memory), 8kx14 of flash memory.
- Low power consumption (<0.6mA typical @3v-4MHz, 20µA typical @3v-32MHz and <1 A typical standby).
- Timer 0: 8 bit timer/counter with pre-scalar.
- Timer 1:16 bit timer/counter with pre-scalar.
- Timer 2: 8 bit timer/counter with 8 bit period registers with pre-scalar and post-scalar.
- Two Capture (16bit/12.5nS), Compare (16 bit/200nS), Pulse Width Modules (10bit).
- Maximum operating frequency is 20MHz.
- Flash program memory (14 bit words), 8KB.
- Data memory (bytes) is 368.
- 5 input/output ports.
- 10bit, up to 8 channel A/D converter.
- Analog comparator module.
- 100000 times erase/write cycle enhanced memory.

One unit of PIC16F877A microcontroller can be programmed and erased so many times. Some said about 10 000 times. The erasing time is almost unnoticeable because once new program are loaded into the PIC, the old program will automatically be erased immediately. PIC16F877A already made with 368 bytes of Random Access Memory (RAM) inside it. Any temporary variable storage that we wrote in our program will be stored inside the RAM. Using this microcontroller does not require any external RAM. There are 5 input/output ports on PIC microcontroller namely port A, port B, port C, and port D and port E. Each port has different function. Most of them can be used as I/O port.

GSM MODULE

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting

9 Pin Connector on a DTE device (PC connection)	
Male RS232 DB9	
Pin Number	Direction of signal:
1	Carrier Detect (CD) (from DCE) Incoming signal from a modem
2	Received Data (RD) Incoming Data from a DCE
3	Transmitted Data (TD) Outgoing Data to a DCE
4	Data Terminal Ready (DTR) Outgoing handshaking signal
5	Signal Ground Common reference voltage
6	Data Set Ready (DSR) Incoming handshaking signal
7	Request To Send (RTS) Outgoing flow control signal
8	Clear To Send (CTS) Incoming flow control signal
9	Ring Indicator (RI) (from DCE) Incoming signal from a modem

Pin description

POWER SUPPLY

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors, the transformer's coils or windings. Transformer is used here to step down the supply voltage to a level suitable for the low voltage components. The

mobile voice and data services. GSM differs from first generation wireless systems in that it uses digital technology and Time Division Multiple Access (TDMA) transmission methods. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. The 850MHz band is also used for GSM and 3GSM in Australia, Canada and many South American countries. GSM supports data transfer speeds of up to 9.6 Kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service). Another major benefit is its international roaming capability, allowing users to access the same services when travelling abroad as at home. This gives consumers seamless and same number connectivity in more than 210 countries. GSM satellite roaming has also extended service access to areas where terrestrial coverage is not available.

FEATURES

- SMS - Short Message Service - Allows you to send text messages to and from phones
- Multi Party Calling - Talk to five other parties as well as yourself at the same time
- Call Holding - Place a call on Hold
- Call Waiting - Notifies you of another call whilst on a call
- Mobile Data Services - Allows handsets to communicate with computers
- Mobile Fax Service - Allows handsets to send, retrieve and receive faxes
- Calling Line Identity Service - This facility allows you to see the telephone number of the incoming caller on our handset before answering
- Advice of Charge - Allows you to keep track of call costs
- Cell Broadcast - Allows you to subscribe to local news channels
- Mobile Terminating Fax - Another number you are issued with that receives faxes that you can then download to the nearest fax machine.

5. SOFTWARE DESCRIPTION

The software consists of two segments

1. Embedded c that is used by the hardware that is RFID receiver (fitted in trolley) and transmitter (RFID tags) that look ups up the specified table of item and maps the product with price.
2. VB is used on the front end to display the final billed amount to the customer on both the display on the trolley and display exit where the final payment is made. VB has to ensure simpler user interface and embedded C must ensure accurate billing.

6. WORKING OPERATION OF A SYSTEM

The detail description of proposed system is explained in the next sub section.

FEATURES OF RFID BASED TROLLEY

- Bill calculation at trolley itself.
- Low chance of traffic and mismanagement.

- Reduction in support staff.
- No more queues for billing hence real customer satisfaction.

HOW SYSTEM WORKS

A customer enters into a shopping mall. On entering, she/he first picks up a trolley. Each trolley is associated with a RFID reader and a barcode reader. The functioning of the system is explaining below:

- When the customer purchase a product, she/he first scans the RF tag of the product using the RFID reader and then places it into the trolley .While the customer is scanning the RF tag of the product, a price of the product is taken and stored in the system's memory.
- Information stored in system's memory is compared with the lookup table. If matches are found then cost, name of respective product gets displayed on the LCD. At the same time PIC CONTROLLER processor sends the same information to computer for billing purpose with the help of RS232 protocol.
- Here we have used IR sensor for counting purpose. This works as the IR sensor continuously emits IR rays. If we put a product in a trolley ant at that time there is obstacle for IR rays, then it would result in interruption in counting of products in trolley. This recorded data is stored in PIC Controller processor.
- Counting is mainly done for security purpose. If in case while wandering round the mall someone removes the RFID tag and puts the product in trolley then counting the no of items helps to get information of items purchased. Thus counting is done but there is no addition of cost respective product in bill. This shows the increase in number of products but not increase in bill.
- If an unwanted product is removed from trolley then it decreases the number of products as well as bill. Double entry of product deletes the product name with respective to cost of product.
- After completion of shopping, a key is pressed indicating final billing of all the products. Thus the final information of all products is transmitted to a computer with the help of serial communication & the final billing is done by VB software on computer.
- There is a barcode system in our project. It is impossible to stick the RFID tag to some product like coconut, vegetables etc. Hence in such cases conventional scanning of barcode is more sophisticated than RFID technique.

7. ALGORITHM

- Step1: Start
- Step2: Initialize System
- Step3: search for RFID
- Step4: check RFID tag
- Step5: Read related data from memory
- Step6: Display data on LCD
- Step7: Add item cost as items are added
- Step8: When upload key is pressed send data to the counter
- Step9: Print the Bill

Step10: Stop

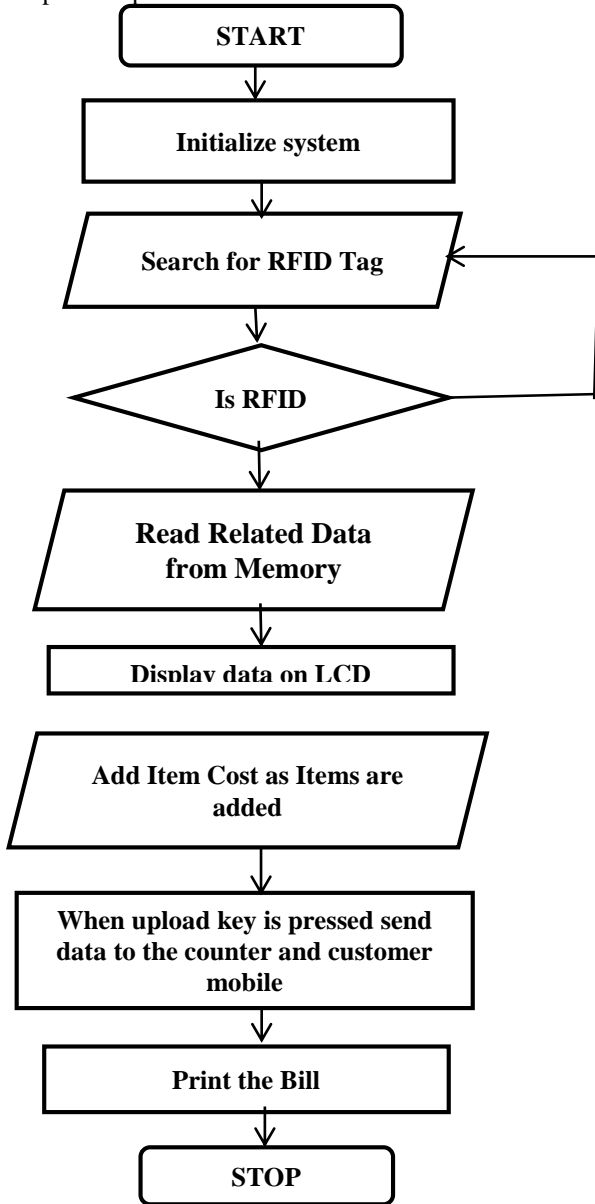


Fig7.1- Flow chart

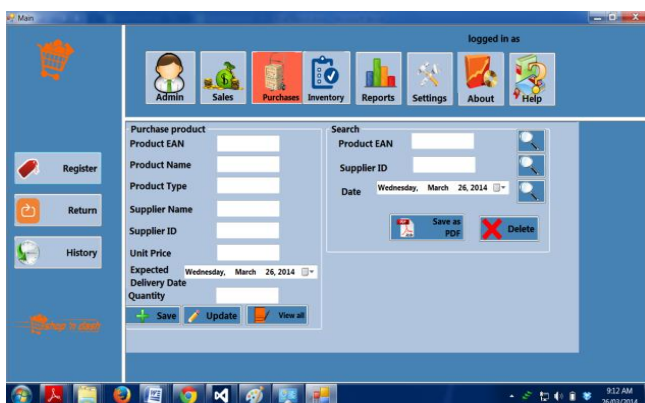
9. CONCLUSION

The development of the project WIRELESS SMART SHOPPING TROLLEY has been accomplished using an RFID evaluation kit and developing the software for the same. Depending on the RFID reader used, it could read around 7 tags in a second. And the major task of avoiding the reading of the same tag multiple times has also been accomplished by implementing a quiet tag function. Finally the billing is completed in nearly one-tenth of the time required in barcode based billing system including the time required in dispatching the items which include removing of tags from the items. Further, in future we can look forward to implementing it in shopping malls using a long range RFID reader

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8. SIMULATION OUTPUT



Purchase panel