Smart Auto Billing Shopping Trolley For Malls

Shubhang Agarwal[1],Pritam Adam[2],Amit Kori[3],Aamir Hamza[4] Jay Mehta[5]
Department Of Electronics And Telecommunication Engineering
AP Shah Institute Of Technology,
University of Mumbai,Maharashtra,India
e-mail: shubhangagarwal1710@gmail.com[1], a.pritam866@gmail.com[2],
kori4208@gmail.com[3], ansariaamirhamza18@gmail.com[4], jsmehta@apsit.edu.in[5].

Abstract : **The super shops are the places where people go to buy their daily using products and also pay for that. So the need to calculate the number of products sold and generation of bill for the customer. When people go for the shopping in a shop, we have to select the right product. After that, it's a hectic to stand in line for billing purpose. Hence, we are going to propose the "Smart Auto billing Trolley "that will save the track of products which are purchased and calculate the bill using RFID reader and Transmitter and Receiver.**

I. INTRODUCTION

Shopping is easy, but waiting at the bill counter can be very boring & laborious. Rush plus cashiers who prepare a bill with a barcode scanner take longer & have longer-lasting results [4]. This innovative project includes an automated billing system that can be placed in a shopping trolley. This automated payment system includes an RFID reader controlled by Arduino instead of the traditional barcode readers [1]. A unique membership card is provided to every customer where all the personal details & the account balance details of the customer are stored. The shoppers can deposit cash in counters before shopping, balance & other details will be updated whenever the shopper deposits cash at the billing counter. so, whenever the shopper goes shopping, he/she has to scan the special membership card against the RFID reader attached to the cart. Therefore, all the required personal details will be transferred to the microcontroller's memory. Then a welcome text with account balance details is displayed on the LCD screen. Now the system will be ready to start scanning the products. Any product, he/she has to scan it against the RFID reader & then has to get it into the cart. All the product details are displayed on the LCD along with the price of the product. As the shopper goes on adding products, every product is detected by the module & therefore the price will increase accordingly. In case if the shopper changes his/her mind & doesn't want any product added into the trolley, he/she can remove it by scanning the same product once again against the reader & the price added will be deducted automatically. A buzzer is used to verify whether the membership card/product scanning is successful or not. Buzzer beeps once the product scanning is successful. At the end of shopping, the shopper has to scan the membership card, when done the final bill details will be displayed on the LCD screen. The bill amount will be deducted from the membership card & the remaining balance amount will be displayed. Immediately after the bill is paid an SMS is sent to the prescribed members mobile phone via GSM module. Hence this technique is an appropriate method to be used in places like supermarkets. This will help in reducing manpower & helps in making a better shopping experience for customer

Every customer is identified by the ID of the cart s/he picks for shopping. The Base Station at the payment counter consists of a database that stores information of all the products, and a sensor mote to communicate with all the Smart Carts in the mall. When a customer starts shopping, s/he has to scan the barcode of the product with the barcode scanner present at the cart, after which the product has to be put into the basket. The barcode of the product is wirelessly transmitted by the ZigBee transmission placed at both the ends.

The Smart Trolley features an RFID reader, LCD module. When a person places any product on the **trolley**, it is scanned and the product's cost, name, and expiration date are displayed. The total cost will be added to the final check out bill. The bill is stored in the microcontroller's memory.

II.LITERATURE REVIEW

2.1. RFID & Barcode Processing

RFID and barcodes are similar in that they are both data collection technologies, which means they automate the process of data collection. However, they also differ significantly in many areas. If compared, RFID technology is found to be simpler than the barcode technology. Barcode scanner requires line of sight whereas RFID can be read without the line of sight. It is possible to scan RFID tags from a larger distance. An RFID reader can gain the information of the tag from a distance of about 300 feet, whereas barcode technology cannot be scanned from a distance of more than 15 feet. Barcode coded items can only be read individually whereas multiple tags can be read by RFID reader simultaneously.

RFID technology is better than barcode technology in terms of speed. RFID tags can be read much faster than the barcode tags. As it requires a direct line of sight, barcode reading is comparatively slower than the RFID tag reading.

2.2. RFID & Barcode Approaches

A barcode reader takes about 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 and implanted inside the product, and thus they are not subjected to too many wears and tears. The barcode requires a direct line of sight to the printed barcode, because of which the barcode has to be printed on the outer side of product, thus subjected to huge amounts of wears and tears. It is also limited to re-utilization of the barcodes. As barcode lacks with the read and write facility, it is not possible to add to the information that is already existing on it. The main advantage of using the RFID tags is that rewriting on RFID tags is possible.

III.BLOCK DIAGRAM

The utility of trolley will be first one of its kind for commercial use. This device records the data of different products with the help of the suitable sensors like RFID Tags. This recorded data helps the shop owner with the detailed analysis of shopping by the customer & their preferences through computer; printout of the same can be obtained. In Automatic trolley, there is no need to pull heavy trolley, wait in billing queue and thinking about budget. The microcontroller-based trolley will automatically follow the customer. Also, it maintains safe distance between the customer and itself. It gives number of products in trolley and the total cost of the products on the spot. The block diagram consists of the transmitter side and receiver side.

1.Transmitter

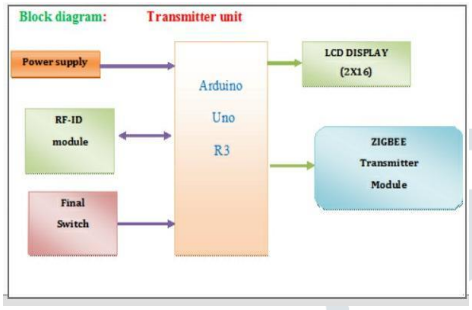

Fig.3.1 Transmitter block diagram

2.Receiver

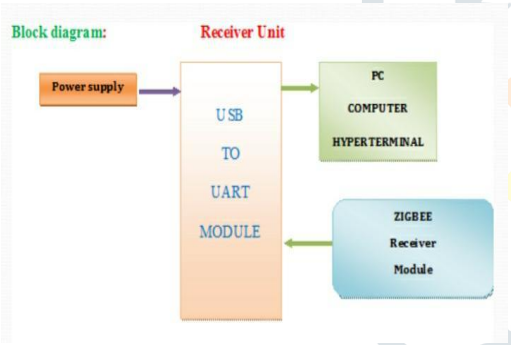

Fig.3.2. Receiver Block Diagram

IV.PRODUCT DESCRIPTION

The paper is to design a smart shopping cart which helps users with their shopping. The microcontroller used to achieve the functions required is an Arduino UNO. It is divided into the parts which shows the main components.

A. Arduino Uno Configuration

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program.

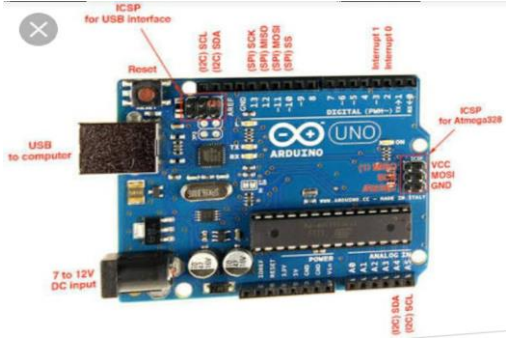

Fig.4. 1. Arduino Uno

B. RFID Reader Module

The EM-18 RFID Reader module operating at 125kHz is an inexpensive solution for your RFID based application. The Reader module comes with an on-chip antenna and can be powered up with a 5V power supply. Power-up the module and

connect the transmit pin of the module to receive pin of your microcontroller. Show your card within the reading distance and the card number is thrown at the output. Optionally the module can be configured for also a Wiegand output.

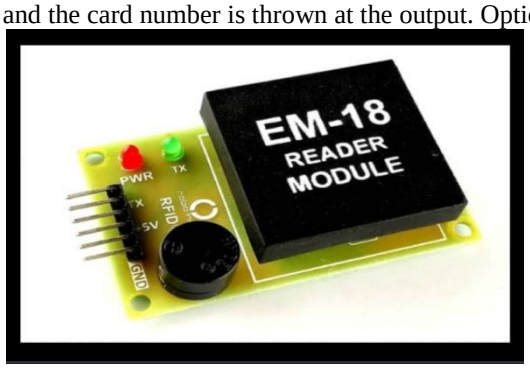

Fig.4.2. EM-18 Reader Module

C. Zigbee Module

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, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.

Fig.4.3 .Zigbee Module

D. LCD Display

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates o a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix

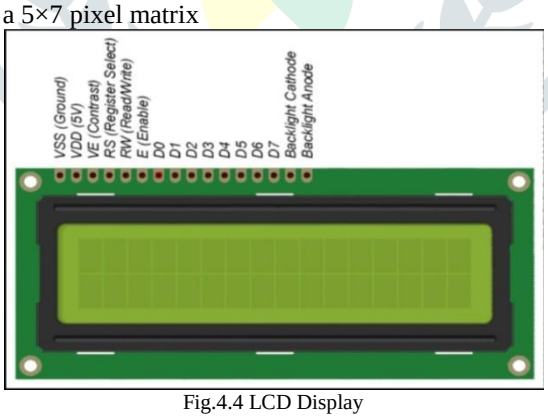

Fig.4.4 LCD Display

A. USB To UART Module

This is a USB to Serial UART (TTL level) converter module. It is allow you to connect your computer through USB port and use it as a regular serial communication. All USB protocol is handled within the module. There is no other device or programming required.

Fig.4.5. USB to Uart Module

4.1. RFID & Barcode Processing

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V.METHODOLOGY

This system makes use of one central processing unit which is Arduino uno and we had used two ZigBee modules for transmitting data over receiver side at the database. The Arduino interfaced with ZigBee gives the communicating database to our system.

ZIGBEE INTERFACING WITH ARDUINO

It is very easy to interface the ZigBee with Arduino. Before interfacing, the user must know about the series. Series one is better for beginners. It can communicate with communication devices, sensors etc. If two ZigBee modules are of same types, then they can communicate with each other. To achieve communication between two ZigBee, first one ZigBee is connected to Arduino and the other ZigBee is connected to sensor, microcontroller or computer. There is no need of additional electronics to connect the ZigBee with Arduino. After that, configuration is set on two modules. The below figure shows the interfacing of ZigBee with Arduino. The supply voltage of module is regulated to 5V and 3.3V. The VCC of ZigBee module is connected to 3.3V of Arduino and GND of ZigBee is connected to the GND of Arduino. The figure shows that the transmitter and receiver pin of ZigBee is connected to the transmitter and receiver pin of Arduino. Using Arduino board, the ZigBee module can be connected with the microcontroller.

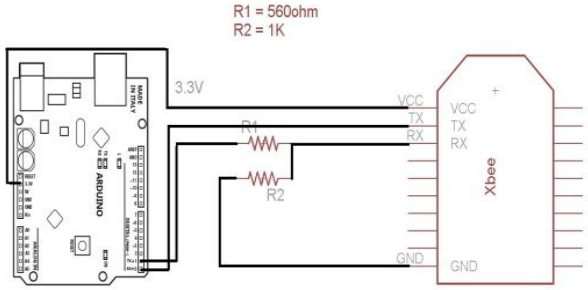

Fig.5.1. Zigbee Interfacing with Arduino

RFID READER AND ARDUINO INTERFACING

RFID is Radio Frequency Identification. An RFID reader is used to read RFID tags (which contain certain unique data stored in a chip). An RFID reader and an RFID tag, both have a coil surrounding them. When an RFID tag is shown near an RFID Reader, it collects the unique tag data (a combination of digits and characters) from the RFID tag. You will be wondering how the chip inside RFID tag gets power? This is made possible via Electromagnetic Induction. I told you, both RFID reader and RFID tag

come with a coil in them. We power the RFID reader from power supply for reading purpose. Now when an RFID tag is shown near the reader, electromagnetic induction will take place between the coils and this powers the chip inside tag. This chip will send data electromagnetically to the reader. The reader will receive this electromagnetically transferred data and outputs it serially. Every RFID reader comes with Serial output pins. We can collect the read data through these serial pins using Arduino or any other micro controller. So here begins our classic tutorial on Interfacing RFID with Arduino

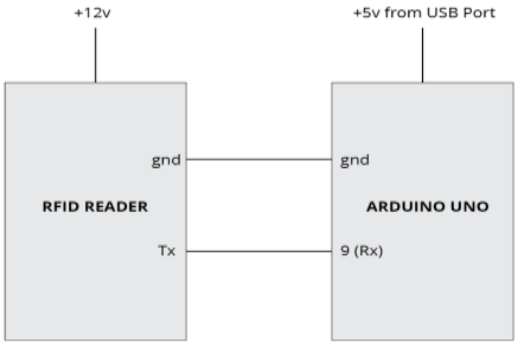

Fig.5.2. RFID Interfacing with Arduino

LCD INTERFACING WITH ARDUINO

A **Liquid Crystal Display** commonly abbreviated as **LCD** is basically a display unit built using *Liquid_Crystal technology*. When we build real life/real world electronics-based projects, we need a medium/device to display output values and messages. The most basic form of electronic display available is **7 Segment display** – which has its own limitations. The next best available option is **Liquid Crystal Displays** which comes in different size specifications. Out of all available LCD modules in market, the most commonly used one is **16×2 LCD Module** which can display 32 ASCII characters in 2 lines (16 characters in 1 line). Other commonly used LCD displays are 20×4 Character LCD, Nokia 5110 LCD module, 128×64 Graphical LCD Display and 2.4 inch TFT Touch screen LCD display.

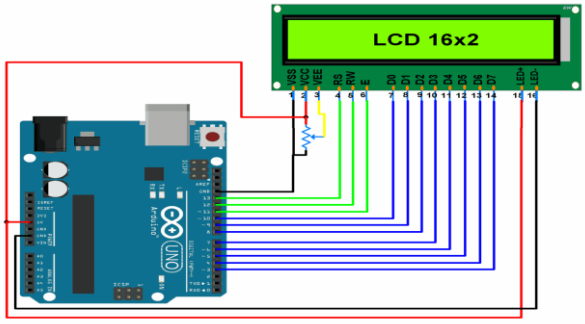

Fig.5.3. LCD Interfacing with Arduino

USB TO UART INTERFACING WITH ZIGBEE

USB UART offers a USB to asynchronous serial data (UART) interface, allowing the microcontroller-based designs to communicate with the personal computer, in a very simple way. It is equipped with the FT232RL, a very popular USB to UART interface IC, used on many MikroElektronika devices - both for its reliability and simplicity. USB UART click is used for whenever there is a need to seamlessly and effortlessly interface the UART lines to a personal computer. It can be used with any UART terminal, like the one found in MikroElektronika compilers.

Fig.5.4. USB To UART Module

ARDUINO COMPILER

The Arduino Integrated and Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

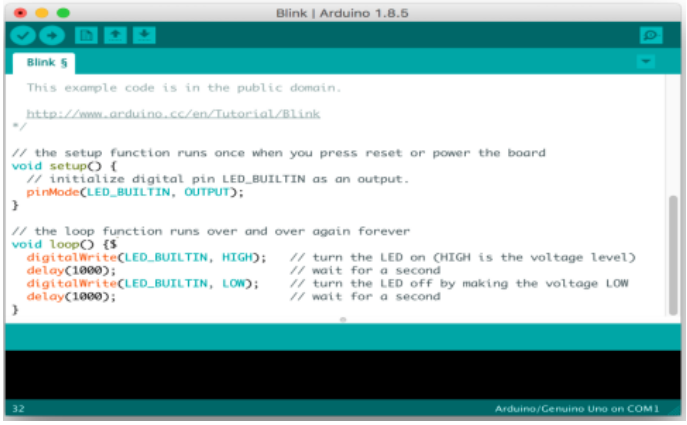

Fig.6.5.Arduino Compile

VI.RESULT AND DISCUSSIONS

The implemented steps to be executed are as follows:

Step 1: First step when we just on the system with power supply

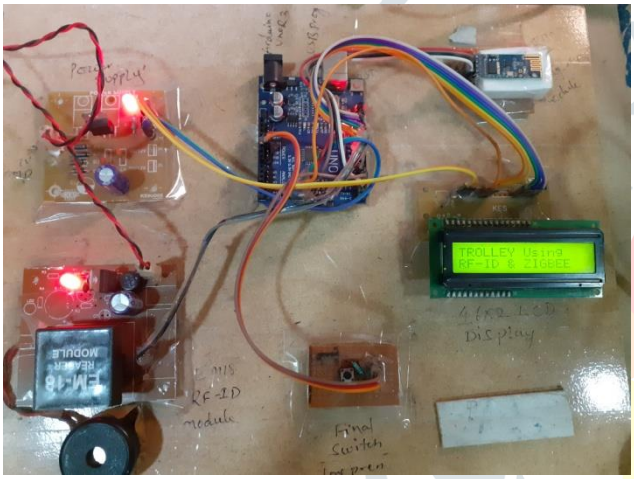
Fig.6.1 Starting System

Step 2: This is when we show the rfid tag to rfid scanner and that output is shown on LCD display

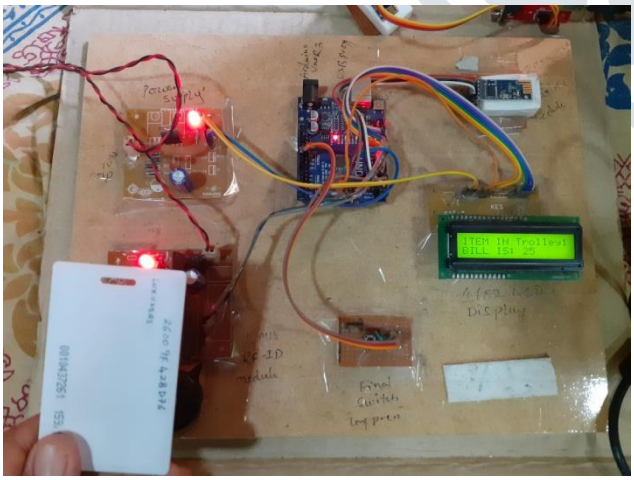
Fig.6.2 RFID Tag shows to reader

Step 3: This is the step where we press the final bill payment and that final bill is shown on the LCD display

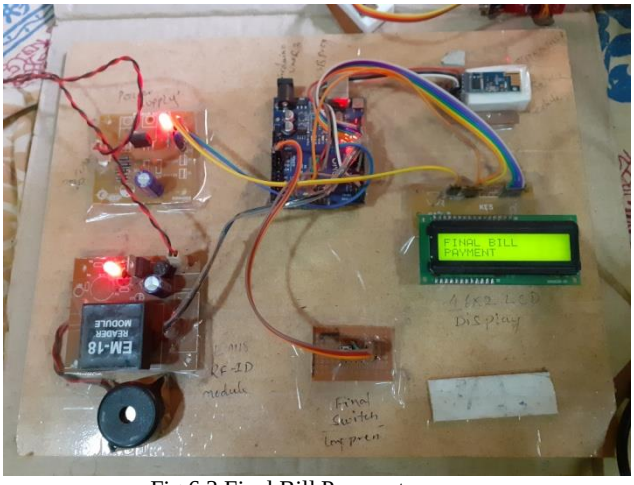

Fig.6.3.Final Bill Payment

Step 4: This the final step when the final bill payment button is pressed all the data goes by receiver side to the database created

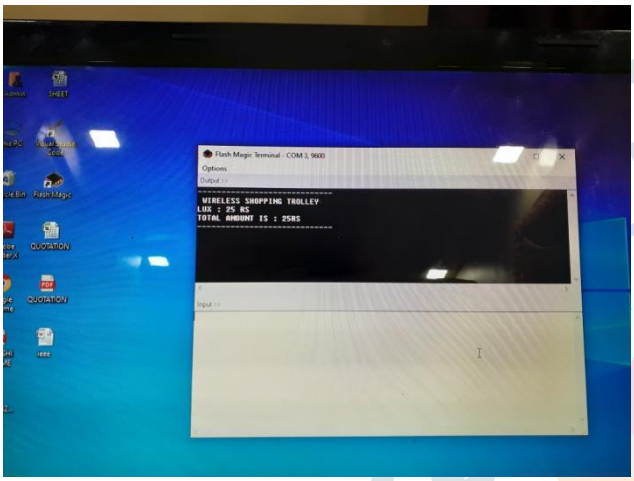

Fig.6.4..Receiver Output

APPLICATIONS AND FUTURE SCOPE

I. APPLICATIONS

1. Shopping Malls
2. Use as common observatory system for the owner as he or she can observe the billing of all mall from anywhere

II. FUTURE SCOPE

1. The same system can be used in various places
2. Shopping budget limit can be set; when the limit exceeds buzzer should beep indicating this.
3. Providing an option to the shoppers to priorly create a shopping list.
4. Automatic track detection & movement of the cart can be implemented by using various sensor technologies.
5. This system can be advanced by using Beacon Module instead of RFID Module & including a Load sensor is also a helpful implementation.
6. This system can be also implemented using LI-FI, NFC & other communication systems

VII.CONCLUSION

"Smart Cart using Arduino and RFID" has been successfully implemented. This system is not only effective in eradicating the long queues but also manages the budget of the customer. This system is automated and far better than the existing Barcode system. With new technologies rapidly making every walk of life smart, shopping should be made smarter too. The system also has a very quick and easy billing option

VIII.REFERENCES

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