

SMART TROLLEY WITH HUMAN FOLLOWER

Rahul Sonawane¹, Abhishek Pandey², Chetan Gorivale³, Hrushikesh Surve⁴, Prof. Minal Hardas⁵

¹⁻⁴B.E. Student, Department of Electronics and Telecommunication Engineering, Shivajirao S. Jondhale College of Engineering, Dombivli East, Thane, Maharashtra 421204, India.

⁵Professor of Electronics and Telecommunication Engineering, Department of Electronics and Telecommunication Engineering, Shivajirao S. Jondhale College of Engineering, Dombivli East, Thane, Maharashtra 421204, India.

ABSTRACT :

Shopping at big malls is becoming daily activity. There is big rush at these malls on holidays and weekends. People purchase different items and put them in trolley. After completion of purchases, one needs to go to billing counter for payments. At billing counter, the cashier prepares the bill using bar code reader which is very time-consuming process and results in long queue at billing counter. Hence, to make a system that can be used to solve the difficulties of customer and save the valuable time of users is the main aim of this project. This paper provides a glimpse of a smart shopping trolley which will help the user to scan the product by and send the bill directly to the billing counter.

KEYWORDS: Smart Trolley, RFID Scanner, Human Follower, Arduino Uno, Shopping Malls.

1. INTRODUCTION

Every supermarket provides shopping baskets to help customers to select and store the products. The customers have to drop the products which they wish to purchase and then proceed to checkout. At present in every super market, once the customer is entered in to the mall, he/she has to select the trolley and select the items he wishes to purchase and then drop into the trolley. Once all the items have to be selected, he need to make a bill of it for that the customer have to wait at the bill counter till he makes his turn to make payment. In order to make a payment at times it takes a lot of time so the waiting time of the customer is more which makes the customer to hesitate the visit the mall again. This is the common procedure followed in general marts where the employee of super market will scan all the products using barcode in the basket which leads to waiting. In general, a bar-code is a machine-readable strip of data printed in parallel lines, used to represent a multitude of information. Traditionally, a bar-code scanner is used by retailers to keep track of inventory and speedup data entry. Bar code scanning applications are product-centric we want to create an application that is consumer-centric. There are many different bar-codes typed that exist for different purposes. We can split them into 1D and 2D bar-codes. 1D bar-code are columns of varying width lines that are imprinted on back of products. 2D bar-codes are the kind of bar-codes which were invented to encode the data not only horizontally but also vertically. Each type of bar-code is called a symbology and there is a corresponding standard that defines a symbol and how to encode and decode the symbol. The drawbacks of the present procedure are each customer has to wait in the queue of the checkout counter while billing if the customers have to remove some products because of exceeds his budget, again some more items required to check which products has to remove from the basket. So, we need to develop a project for automated shopping trolley with RFID tags and RFID scanner which aims to reduce the total waiting time of customers, total man power requirement for markets in order to improve efficiency of shopping malls. In a world where technology is replacing the ways we pursue everyday activity, the future of retail industry also lies in more automated devices.

2. EXISTING SYSTEM

In the present system the customers are unaware of the supermarket discount on the products, sometimes the product discount is written on the shelves of the products but they in the form of percentage and it is hard to calculate the discount.

The use of existing system leads to the following problems: Discount on the products are not easy to calculate. Pushing trolley throughout the Supermarket is hectic. Waiting in the billing queue is a wastage of the valuable time of the customer. At the billing counter, if the bill exceeds the budget the customer has to remove the products that is sometimes embarrassing. All these problems can be solved in this project i.e. through Smart trolley with Human Follower all the problems mentioned above can be solved. The customer will easily come to know about the product discount, the cart will follow the user and also the waiting in the queue is minimized.

3. PROPOSED SYSTEM

The Smart Shopping Trolley system infuses a Shopping cart (trolley) with a RFID reader. It makes possible for the user to self-scan the RFID tags of the purchased products which he aspires to purchase. A wireless transmission smart-device makes note of all the scanned items in the particular trolley (with allotment number) and is linked with the Supermarket's backend database which contains features of the products such as Cost Price. The scrutinized products are automatically billed in the wireless smart device for their purchases, thereby significantly reducing total waiting time and transmitted to the Shop's central Billing program.

A RFID tag is used to encode information in a visual pattern readable by the machine. Customers will have a RFID reader on their trolley. Whenever RFID tag gets nearer to the RFID reader, it will scan the tag present on the products and sends the data to Arduino uno which will decode the tag and store in the memory. Each tag has a unique identity and gives total information about the product related data. RFID tags are more secure and reliable than barcodes. So, it is better to work with RFID tags when we have a number of products in supermarket or hypermarket.

The Smart Shopping Trolley is semi-automated it means when there is rush in supermarket the user has to push the trolley but when there is no rush in odd hours then the trolley will follow the user. Semiautomatic or smart trolley system which requires a minute manual work but can carry any amount of weight based on the battery backup, motor's torque and speed. Smart Trolley system works with help of Arduino and sensors like ultrasonic sensor which are used to identify the presence of a user. Arduino is the main programmable part and draw wire sensor is the main sensor that would detect the user's position with respect to trolley. Other sensors like ultrasonic is used to detect the user's position without any contact between the user and the trolley.

In this project we make use of RFID tags attached to the products in which the detail about the product is encoded. RFID tags are simply called as advanced barcode. It is a small transponder which transmits a serial number to a reader. RFID is the special type wireless card which has inbuilt embedded chip along with loop antenna. The inbuilt embedded chip represents the 12-digit card number. RFID reader is the circuit which generates 125KHZ magnetic signal. This magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read the RFID card number. In this project RFID card is used as security access card. So, each product has the individual RFID card.

4. PROPOSED FLOW CHART

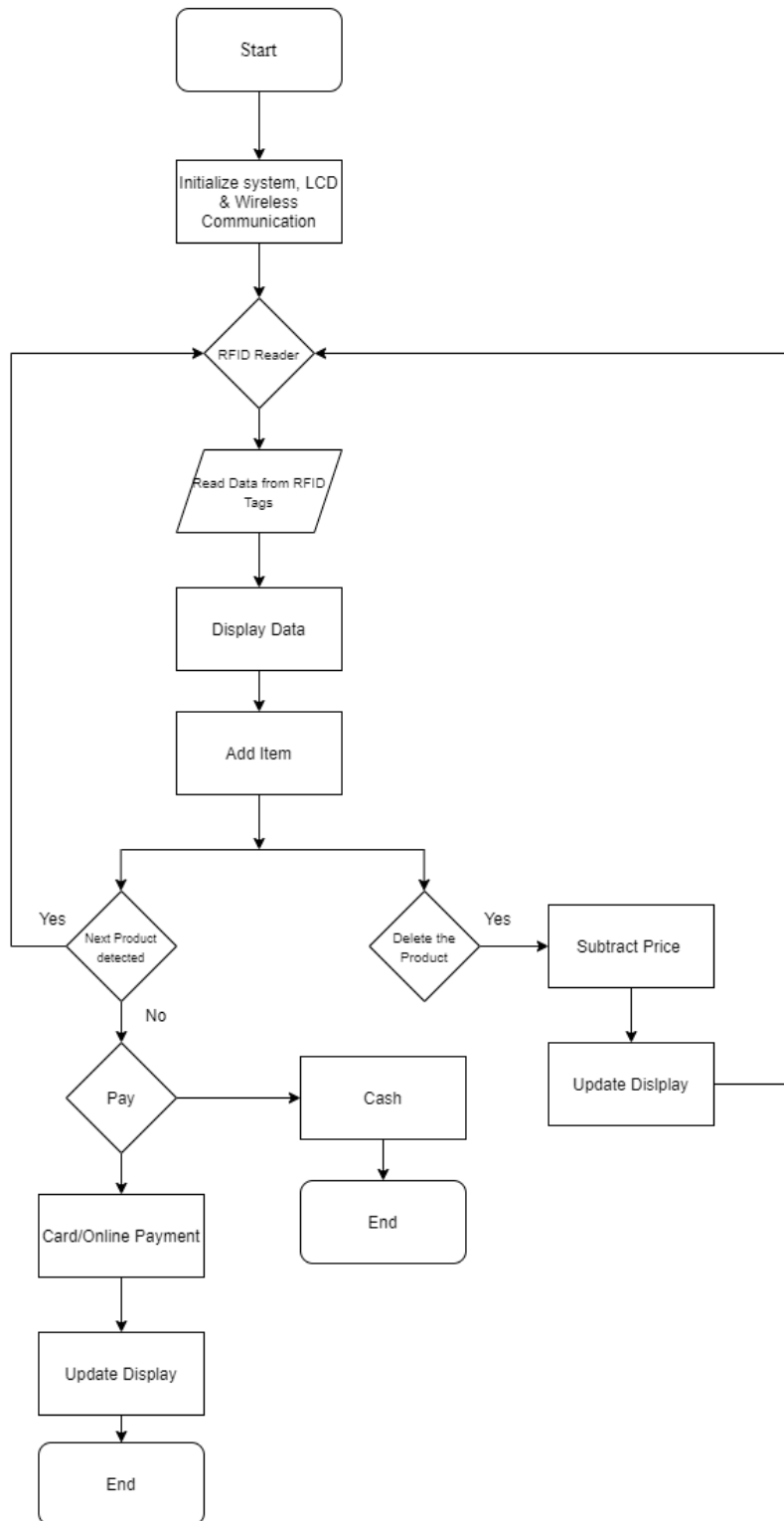


Figure 1. Flow Chart for Smart Shopping Trolley

A. ALGORITHM

Each trolley is associated with a RFID reader. When shoppers with the cart press “start button” the system turns ON and then all the components such as RFID reader, microcontroller and physical media start working. Every product has an RFID tag which contains unique id. These Ids are fed in the database assigned to the corresponding products.

The functioning of the system is explained below:

Step 1: Start the system

Step 2: Scan the products using the RFID tags present on the products.

Step 3: Place products in the trolley.

Step 4: Display information on LCD.

Step 5: Update the billing Information.

Step 6: Product that are not needed can be taken out from the trolley.

Step 7: Subtract the price of product and update the detail on LCD.

Step 8: Press the finish button to end shopping.

Step 9: The bill amount will be deduced from the available balance in the smart card.

Step 10: Display information on LCD.

Step 11: End

B. Block Diagram

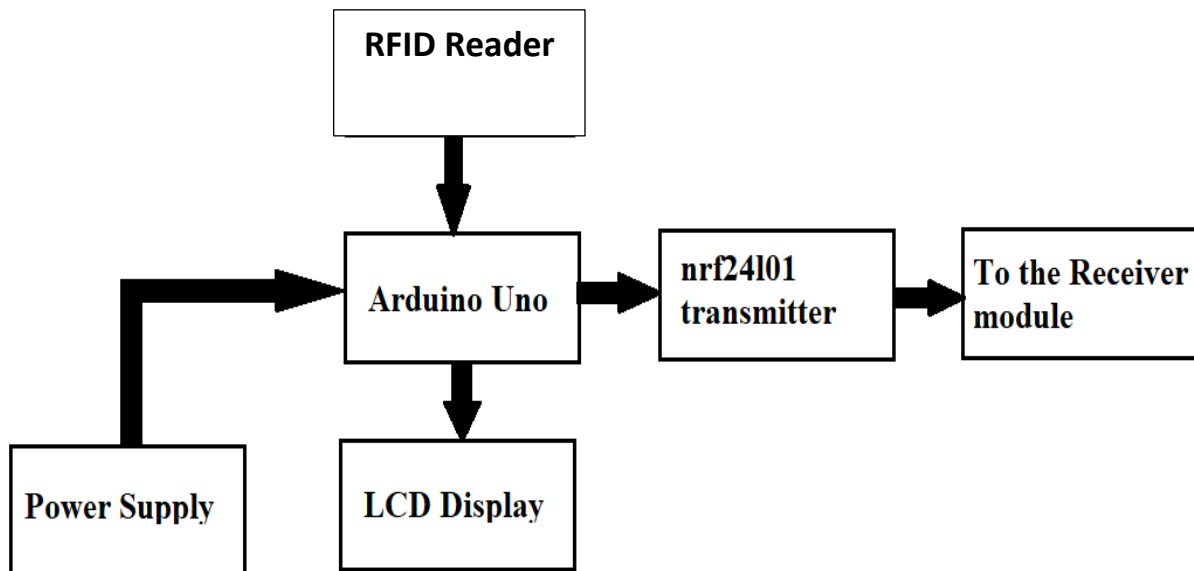


Figure 2. Block Diagram of Trolley

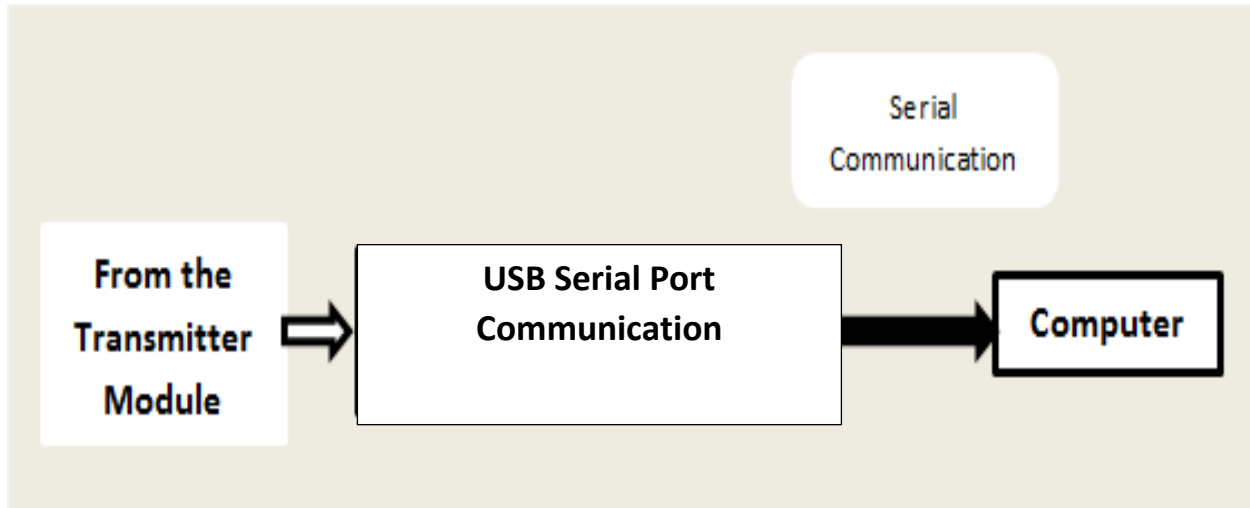


Figure 3. Block Diagram of Receiver Side

Explanation:

The barcode scanner present in the trolley which will help the user to scan the barcodes present on the products which they prefer to buy. The user scans the barcode and the data is send to the Arduino uno which will process the data. Multiple items can be scanned simultaneously with the help of Barcode scanner. The scanned items are stored in the memory which will refer as a list. The received list is processed in the processor i.e. Arduino Uno. The List is displayed on the LCD display on the trolley. The product list is forwarded to the transmitter (nrf24l01 transmitter). The Transmitter (nrf24l01 transmitter) transmits the list towards the receiver module which will process the billing of the products. The receiver (nrf24l01 receiver) will receive the product list and it will be processed in the computer and send it to the billing counter for the billing process. Refer Figures [2] and [3].

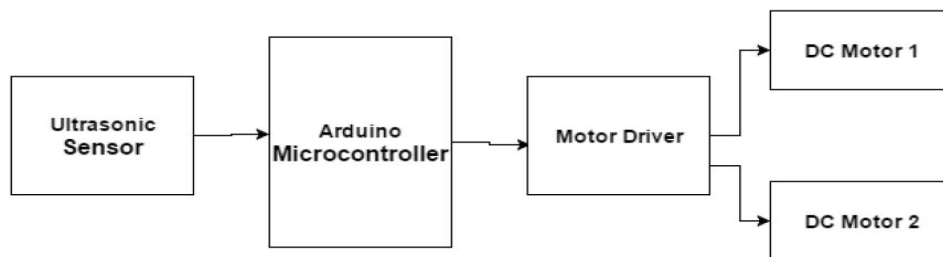


Figure 4. Block Diagram for Human Follower Trolley

Explanation:

The Ultrasonic sensors present at the front of the trolley will detect the obstacles and send the readings to the processor. A line following robot is a kind of robot that is designed to follow a predetermined line or path. Infra-Red (IR) line sensor equipped with IR transmitter and receiver to trace black line with white surface or vice versa on the floor. The sensor output will be fed to the microcontroller and thus the microcontroller can give a suitable command to motor driver in order to allow motor moving according to the command given. The microcontroller will be programmed to make the robot move in any direction based on the output of line sensor. Hence, a robot can move according to the line or path given. In this circuit 555 is used in a stable mode generated 5 Hz clock pulse which are decode by 4017-decade counter. and it given to transistor name is bc547 NPN transistor. Isolated output is driven three PWM remote of different frequency. LM358 consists of two independent,

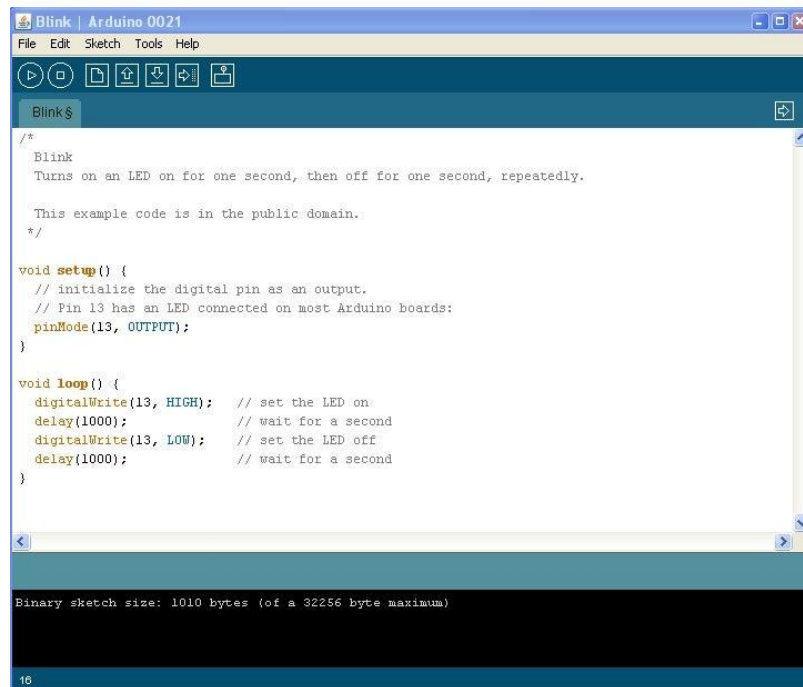
high gain operational amplifiers in one package. Important feature of this IC is that we do not require independent power supply for working of each comparator for wide range of power supply. LM358 can be used as transducer amplifier, DC gain block etc. It has large dc voltage gain of 100dB. This IC can be operated on wide range of power supply from 3V to 32V for single power supply or from $\pm 1.5V$ to $\pm 16V$ for dual power supply and it also support large output voltage swing.

C. Software Requirement

Arduino integrated development environment (IDE)

The Arduino integrated development environment (IDE) is a cross-platform application written in Java, and derives from the IDE for the Processing and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a *sketch*.

We are using Arduino for burning the program of the Smart Trolley in to the controller. Using Arduino integrated development environment (IDE) is easy because we can write program using C or C++ languages. The Language used for this project is C. The language C is easy to code with and gives more flexibility than Java or other coding languages.



```
Blink | Arduino 0021
File Edit Sketch Tools Help
Blink$
/*
  Blink
  Turns on an LED on for one second, then off for one second, repeatedly.

  This example code is in the public domain.
  */

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000);            // wait for a second
  digitalWrite(13, LOW);  // set the LED off
  delay(1000);            // wait for a second
}

Binary sketch size: 1010 bytes (of a 32256 byte maximum)
10
```

Figure 5. Arduino integrated development environment (IDE) Window

Visual Basic

Visual Basic is a third-generation event-driven programming language from Microsoft known for its Component Object Model (COM) programming model first released in 1991 and declared legacy during 2008. Microsoft intended Visual Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects, Remote Data Objects, or ActiveX Data Objects, and creation of ActiveX controls and objects.

A programmer can create an application using the components provided by the Visual Basic program itself. Over time the community of programmers developed third-party components. Programs written in Visual Basic can also use the Windows API, which requires external function declarations.

Visual Basic is used at the front end of the project. The Programming in Visual Basic is simple. The billing side is based on Visual Basic. At the counter on the Computer side the VB is used. It is programmed in a way where the customer can scan the product from the aisle and send the list to the counter by using serial communication. This list can be seen on the computer screen with products price and total amount to be paid. The Customer can also see the total amount to be paid on the display provided on the Smart Trolley.

The customer can pay using Cash or Online Payment whichever the customer comfortable. Online payment can be done and the customer will get notification of it as the payment is done.

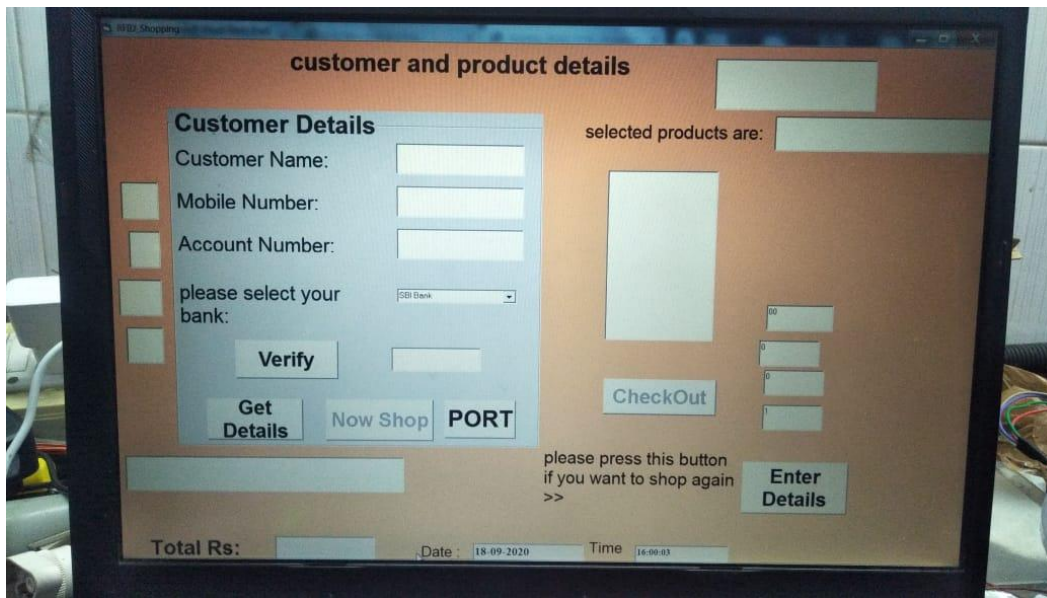


Figure 6. Front end at the Counter Computer

5. OPERATION OF WORKING

The Smart Trolley has following applications

- 1) Scanning the products
- 2) Following the User of the Smart Trolley

The RFID Reader present in the trolley which will help the user to scan the RFID tags present on the products which they prefer to buy. The user scans the tags and the data is send to the Arduino uno which will process the data. Multiple items can be scanned simultaneously with the help of RFID reader. The scanned items are stored in the memory which will refer as a list. The received list is processed in the processor i.e. Arduino Uno. The List is displayed on the LCD display on the trolley. The product list is forwarded to the transmitter (nrf24l01 transmitter). The Transmitter (nrf24l01 transmitter) transmits the list towards the receiver module which will process the billing of the products. The receiver (nrf24l01 receiver) will receive the product list and it will be processed in the computer and send it to the billing counter for the billing process.

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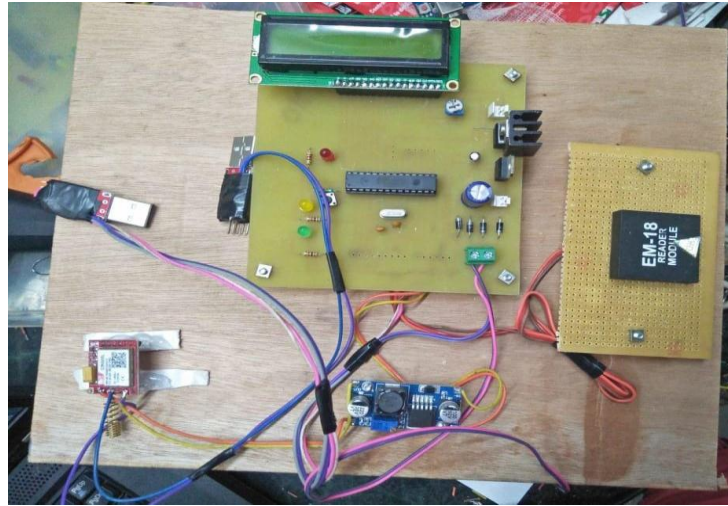


Fig 7. Hardware Setup for Smart Trolley (Scanning Process)



Figure 8. Hardware of Smart Trolley with Human Follower

6. ADVANTAGES

1. The Smart Trolley will minimize the billing process.
2. As the products are scanned the discount on the product will be directly be visible so the user doesn't need to calculate the cost price of products.
3. The Customer can directly pay bill at the counter without standing in queue to scan the products.
4. The trolley will follow the user so the user doesn't need to push the trolley throughout the supermarket.
5. Accurate and complete data collection; and Better utilization of employee's time.
6. Maintenance is easy.
7. Shopping made easy.

7. APPLICATIONS

1. Shopping mall
2. It is use in shopping mall for automatic billing.

3. Use as common observatory system for owner as he/she can observe billing of all mall from anywhere.

8. CONCLUSION

Taking into account the changing trend in retail shopping. We come to a conclusion that the Intelligent Shopping Basket is most certainly a definite necessity for the Retail marketing industry for fast billing. It can follow a human whenever he moves in a straight line. The project aims to develop an automatic human guided shopping trolley with a smart shopping system. This shopping trolley can lead a user to the items' locations in supermarket and he or she is able to know the items' locations through a shopping map. It will follow user. Accuracy - advance IR systems improve accuracy by improving. With the aid of automatic line following and human leading functions portable robot, supermarket owners need only to purchase the portable robot and can easily install it under shopping trolleys. Users can then enjoy shopping without pushing the shopping trolleys themselves.

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10. Faculty of Electrical Engineering, University Technology Malaysia, 81310 UTM Johor Bahru Johor, Malaysia