LINE TRACING TROLLEY USING ARDUINO WITH AUTOMATIC BILLING SYSTEM

Dinsha K K[1], Sayooj K V[2], Muhammed Shamil[3], Prof. Divya P V[4]

[1]*B-TECH Student, Dept. of Electronics and Instrumentation Engineering, KMEA Engineering College, Ernakulum, Kerala, India*

[2] *B-TECH Student, Dept. of Electronics and Instrumentation Engineering, KMEA Engineering College, Ernakulum, Kerala, India*

[3]*B-TECH Student, Dept of Electronics and Instrumentation Engineering, KMEA Engineering College, Ernakulum, Kerala, India*

[4]*Professor, Dept. of Electronics and Instrumentation, KMEA Engineering College, Ernakulum, Kerala, India*

ABSTRACT

Microcontroller based design, has acquired the status of most happening field in electronics. This is highly specialized field that has the power of integrating thousands of transistors on single silicon chip. In a mall every time customer has to pull the trolley from rack to rack for collecting item and at the same time customer has to do calculating the price. To avoid this procedure like pulling trolley, waiting queue, calculating price etc by comparing different existing method we proposing new method. According to that the customer can select the trolley and select the purchasing item from the computer monitor using android based application and transmit data to the trolley. The main algorithm of the software depends up on the position of the items. The arduino uno based trolley is line following and, it is having a distance sensor. According to the instruction the trolley is moving, after covering the corresponding distance the trolley will stop ,the items from rack is pick and place to the trolley using robotic arm. After collecting all items the trolley will move to the billing counter. Trolley movement is controlled by motor drive circuit. By using this trolley customer can buy large number of product with less time with less effort. At the billing counter computer can be easily interfaced for verification and bill print out.

Keyword:-*IR Sensor, Arduino UNO, Distance sensor, Robotic arm, Motor drive*

1. INTRODUCTION

Currently, human life style has changed. Day to day life of a ordinary human being has become a more hectic. Time has become money. So people actually don't have much time to spend for shopping which is an innovative thing. That is why people prefer shopping in the mall so that they can get the entire product at the same place. This saves them from going into different shops to purchase only limited types of product. Through shopping in mall give the benefit of the saving time to peoples, they have only weekend to visit shopping mall. This makes a problem at the cash counter because of increasing number of customers. The customer has to stand in the billing counter. In the mall every person take product put in to the trolley. After the shopping is done that person have to stand in the queue for billing. After this process the sell person scan barcode of the each and every product and give its final bill. This process is very time consuming and it become worst of holiday special offers or weekends. To avoid this problem we introducing a fully automatic microcontroller based trolley. In this trolley the customer has to select the products in the computer screen and that list are transmitted to the trolley using a smart phone. The trolley is line following and the corresponding distance are covered the trolley is stopped and that item is pick and place to the trolley using robotic arm. The robotic arm is attached to the trolley. The trolley collects all items and move to the billing counter.

By using this trolley customer can buy large number of product in very less time with less effort. At the billing counter computer can be easily interfaced for verification and bill printout.

2. LITERATURE REVIEW

2.1 Smart Trolley in Mega Mall:-This is an existing system in malls. It is amicrocontroller based TROLLEY which is totally automatic. This trolley follows the customer while purchasing items and it maintains safe distance between customer and itself. Only customer has to hold the barcode side of the product wrapper in front of barcode scanner. Then corresponding data regarding product will be displayed on display. And finally the display is inter faced with the computer and bill print out.

2.2 Smart Trolley System for Automated Billing using RFID and IoT:- In this system consist of an inexpensive RFID tag is embedded within each product. When the product is placed into a smart cart, the product detail is automatically read by the cart equipped with an RFID reader. Hence, billing is made from the shopping cart itself preventing customers from waiting in a long queue at checkout. Also, expiry date of the product is displayed and the damaged products can be identified with respect to its weight. Thus, expired and damaged products will not be considered for bill calculation.

2.3 Smart Shopping Cart For Automatic Billing In Supermarket:- This system consists of RFID reader, motion detector sensor, Liquid Crystal Display, push buttons, switches and Zigbee. If user wants to use smart trolley functions then start button should be pressed. When a user put some product in trolley then its code will be detected using RFID reader and cost of a product added to the list and sensor will sense the direction of motion of the product for fault detection and buzzer will be on if fault detected. In case, if user wants to remove some product then user should press the remove switch and product code will be detected by RFID reader and again for any false activity buzzer will be on. At last, counter with least number of queues will be detected and displayed on the cart LCD. Then, the final bill will be transferred to the counter having least waiting list using zigbee.

2.4 Automation of Shopping Cart Using Raspberry Pi:-This shopping cart using RFID tags instead of barcodes. This RFID tags will be on the product. Whenever the customer puts a product into trolley it will get scanned by RFID reader and product price and cost will be display on LCD display. Like this the process goes on. The trolley follows us without any human effort. Here using a GSM transmitter which will be at trolley which is used to transfer the data to Mobile. Also the products name and its cost can be announced using headset. In Smart Trolley app, the amount will be sent and the payment will be done using mobile**.**

2.5 Automatic Human Guided Shopping Trolley with Smart Shopping System:-In this paper, a portable robot with human and line following functions is developed. This system is to identify the location of each item in the supermarket, thus assists the customers to locate the desired items. The RFID reader is used to read tag cards and send tag data to Android smart phone via Bluetooth module. Ultrasonic sensors are used for obstacle avoidance. The line sensor is used for the robot line following purpose. The motor driver is used to drive the electric scooter motor. There is a robot based mechanism installed under the shopping trolley. In this system customer has to guide the trolley using mobile phone and purchase large number of product. This trolley follows the line while purchasing items and it maintains safe distance between customer and itself.

3. HARDWARE IMPLEMENTATION

The fig1 shows hardware module for the device which is attached to the trolley. It consists of a microcontroller, robotic arm, motor drive, IR module, Distance sensor and a battery power source. The arduino uno microcontroller is heart of our system. IR sensor which sense the line and move the trolley. Motor driver circuit is used to connect motors. Stopping, receiving facility is provided using RF trance-receiver section. IR sensor is used to detect the distance. When a desired distance is covered trolley will stop and the robotic arm connected with the trolley collect the product and it come back to the billing section

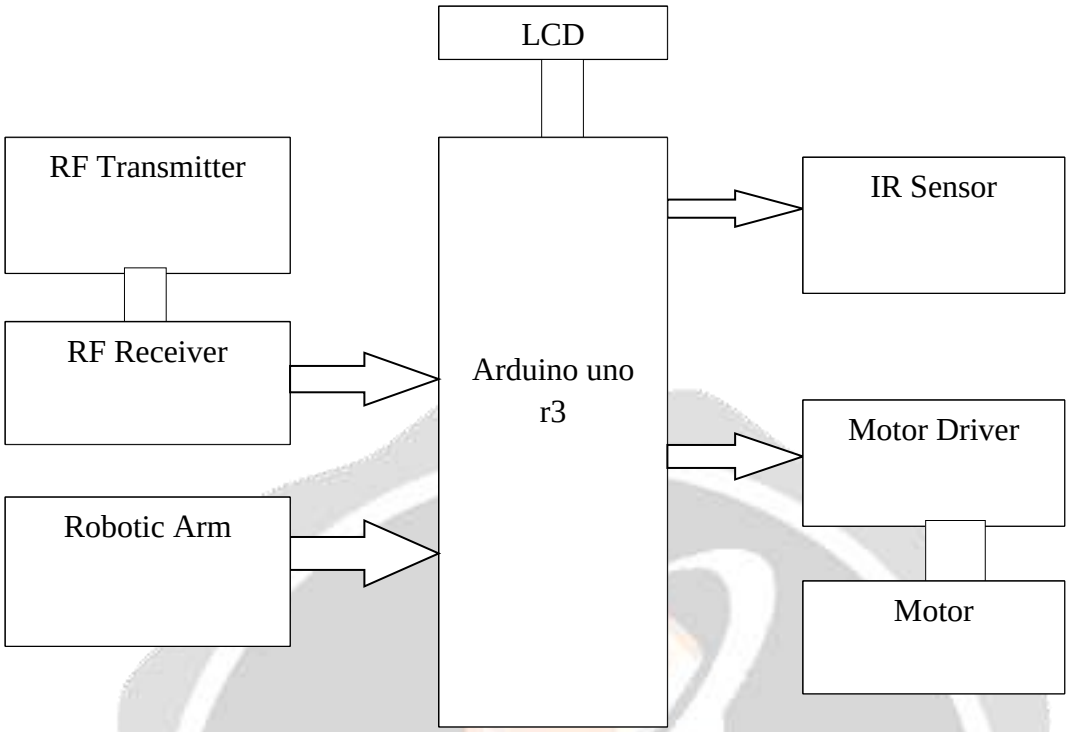

Fig 1 Block diagram of smart trolley

3.1 Arduino Uno

In our proposed method we have used a microcontroller to control whole the process of system that is ARDUINO. Arduino is an open source hardware and very useful for project developments. There are many types of arduino like Arduino UNO, arduino mega, arduino pro mini, Lilypad etc. available in the market. Here we have used arduino uno r3 in this project as arduino uno is small and so bread board compatible. To insert the program using arduino software.

Fig 2. Arduino uno r3

The Arduino Uno R3 board includes the following specifications.

- It is an ATmega328P based Microcontroller
- The Operating Voltage of the Arduino is 5V
- The recommended input voltage ranges from 7V to 12V
- The i/p voltage (limit) is 6V to 20V

- Digital input and output pins-14
- Digital input & output pins (PWM)-6
- Analog i/p pins are 6
- DC Current for each I/O Pin is 20 mA
- DC Current used for 3.3V Pin is 50 mA
- Flash Memory -32 KB, and 0.5 KB memory is used by the boot loader
- SRAM is 2 KB
- EEPROM is 1 KB
- The speed of the CLK is 16 MHz
- In Built LED
- Length and width of the Arduino are 68.6 mm X 53.4 mm
- The weight of the Arduino board is 25 g

3.2 L293D Motor driver

L293D is a motor driver IC which has two channels for driving two motors. L293D has two inbuilt Transistor Darlington pair for current amplification and a separate power supply pin for giving external supply to motors.

Fig 3. L293D Motor driver

Features

- Speed and Direction control is possible
- Motor voltage Vcc2 (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to Vcc1(vss): 4.5V to 7V
- Transition time: 300ns (at 5Vand 24V)
- Automatic Thermal shutdown is available
- Available in 16-pin DIP, TSSOP, SOIC packages

3.3 IR Module

IR Module is sensor circuit which consists IR LED/photodiode pair, potentiometer, LM358, resistors and LED. IR sensor transmits Infrared light and photo diode receives the infrared light. The output voltage of the energy harvester is an AC signal; an AC-DC convertor can be used if sensors need DC input voltage. In addition, vehicles travel with different speeds thus the output AC signal at different speeds is not uniform and using the AC-DC convertor can either used to have a consistent input power to the sensors.

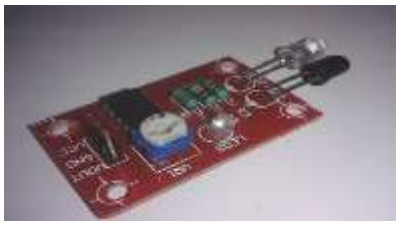

Fig4. IR module

Features

- 5VDC Operating voltage
- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current
- Mounting hole

3.4 Power supply

Here we added a voltage regulator to get 5 volt for arduino, comparator and motor driver. And a 12 volt battery is used to power the circuit.

3.5 RF Trance-receiver

At the transmitter section the control signals are transmitted using radio frequency. These control signals are transmitted serially. At receiver section these signals receive and decoded.

3.6 Robotic arm

Robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm. The robotic arm consists of base plate and gripper. The motion to the robotic arm is given by dc motors.The motors were selected based on the torque required for working of the arm. The light weight gripper is used for picking the object and placing it at the trolley. The robotic arm motions are controlled by Arduino.

4. SYSTEM IMPLEMENTATION

The Arduino uno r3 is heart of our system. The IR sensor which senses the line and according to the control action trolley will move. The IR sensor is connected to the port 3 and 4 of microcontroller. The IR sensor senses the distance and the microcontroller take the decision whether to drive motor or not. The motor driver is connected to the output pin of the microcontroller. 4 motors are connected to the motor driver. In this system trolley starting, stopping, turning motion is provided using RF trance- receiver section. When the power supply is ON according to instruction from controller, the line following trolley move through the corresponding path and IR sensor is sense the distance. When the distance is covered the motor is stopped and the robotic arm will collect the item and move to next area. After collecting all items the trolley will move to the billing counter. The bill is processed on the billing counter the customer collects the trolley and completes the billing procedure.

The software design approach in this method based on android application and it is used for the spot identification of products and price details. The customer has to scan the QR code visible in computer screen using phone scanner. At that time the available product list are viewed in the customer's mobile and can select the item, such as name of the

product, weight of the product, the price of the item. It also shows the expiry date of the product. The selected list of items is transferred to trolley using smart phone. The main algorithm of the software depends up on the position of the items. The product is placed in the different distance and the distance is measured using IR sensors. The program is based on this, when an item is selected its data is send to the receiver section of the trolley. The trolley is a line following it moves along path to the selected item. The trolley collects all the selected item and move to the billing counter. At any instant, customer wants to remove any of the collected items, then delete button is provided for that purpose. The arm is used for the pick and places the product. At the billing counter computer can be easily interfaced for verification and bill print out. If the trolley will select the item directly that item is not in the list "Product Mismatch" will displayed on the billing section .At billing counter the sell person remove that product and process the bill. In this way the customer has not enter inside the mall. Only the trolley will move inside the mall and collects the selected product. The customer needs to stay outside the mall for the billing purpose.

5. CENTRAL AUTOMATION BILLING SYSTEM

The fig5 shows the concept of central automated billing system. Since each trolley is attached with product identification devices, through RF communication send its information to central automation billing system. There it calculate net price for the purchased products. Customer can get their bulling information at the packing section according to their trolley number.

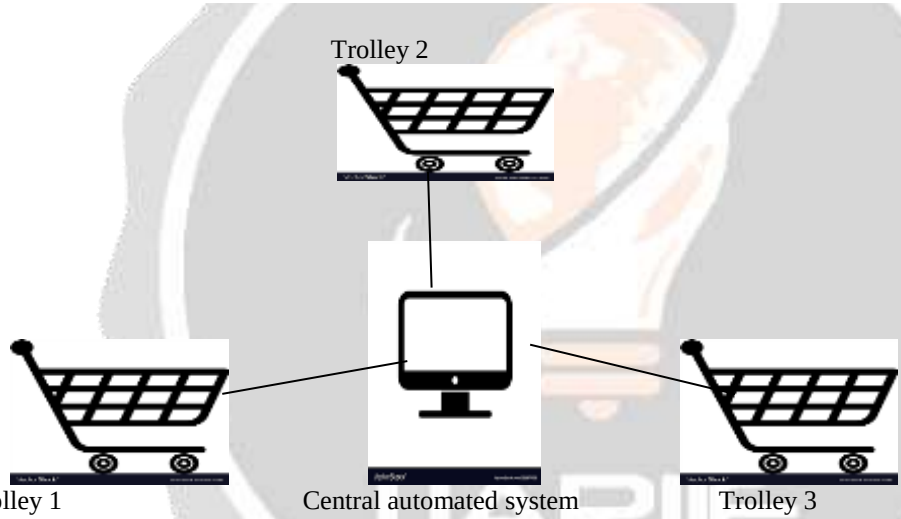

Fig 5. Centralized system

6. CONCLUSION

In automatic smart trolley, there is no need to pull heavy trolley, no need to wait in billing queue and no need of thinking about budget The microcontroller based trolley follow the path and the robotic arm is pick and place the selected item safely. It gives number of products, weight of products in trolley and total cost of the product on the spot. It is user friendly and cost effective. The future scope of the trolley is the distance sensor is eliminated and to added the barcode scanner to identify the product.

7. REFERENCE

[1] A Line Follower Robot from design to Implementation:Technical issues and problems- Mehran pakdaman, M. Mehdi Sanaatiyan, Mahdi Rezaei Ghahroudi-978-1-4244-5586-7/10/$26.00 C 2010 IEEE.

[2] Smart Trolley using Smart Phone and Arduino- Harpreet Singh Bedi, Nikhil Goyal, Sunil Kumar and Avinash Gupta-Bedi et al., J Electr Electron Syst 2017, 6:2.

[3] Smart Shopping Cart with Automatic Billing System through RFID and ZigBee- Mr.P. ChandrasekarMs.T. Sangeetha-ICICES2014 - S.A.Engineering College, Chennai, Tamil Nadu, IndiaISBN No.978-1-4799-3834-6/14/$31.00©2014 IEEE

[4] http://www.semico.com

[5] Smart Trolley in Mega Mall- J.S.Awati, S.B.Awati-International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, Volume 2, Issue 3, March 2012)

[6] BillSmart- A Smart Billing System using Raspberry Pi and RFID -Dr. Mary Cherian, Disha DH, Chaithra KB, Ankita, Aishwarya- International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization)

[7]Automatic Human Guided Shopping Trolley with Smart Shopping System -Yen Leng Ng, Cheng Siong Lim, Kumeresan A. Danapalasingam,Jurnal Teknologi · March 2015