ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

Smart Shopping Trolley Using RFID Based on IoT

K.Gogila Devi, T.A.Kaarthik, N.Kalai Selvi, K.Nandhini, S.Priya

Assistant Professor, Department of ECE, K.S.Rangasamy College of Technology, Tiruchengode, Tamilnadu, India[1]

Students, Department of ECE, K.S.Rangasamy College of Technology, Tiruchengode, Tamilnadu, India[2]

ABSTRACT -Purchasing and shopping at big malls is becoming daily activity in various cities. 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 prepare the bill using bar code reader which is very time consuming process and results in long queue at billing counter. In this project, we implement the automatic goods carrier navigation and the billing system in the shopping malls. The structure of the goods carrier consists of the robotic structure and keypad which is used to navigate the robotic goods carrier along the particular way. The keypad is used to give the commands to the controller where the robotic carrier has to move on. Keypad has the inbuilt product code reader. The use of product code reader is to read the bar codes of all products to define the name and price of the products. Depending on the signal from the reader, the controller display the name and price of the each product by using the LCD display. The wireless billing system is made up of the Wi-Fi communication module. A load cell has been attached so that even if the RFID is not read, the weight of the product is also been measured. If there is more weight without the signal from product code reader, then there will arise an alarm or error message in billing system.

KEYWORDS: Arduino Uno, IoT module, Infrared sensors, RFID reader, RFID tag, LCD display, DC Gear motor, Wi-Fi modem.

I. INTRODUCTION

The main aim of this project is to improve the quality of shopping experience to the customers. This can be done by simply attaching RFID tagsto 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.

II. HARDWARE USED

A. ARDUINO UNO

The microcontroller used for this project is Arduino uno. The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet) is shown in the Fig:1. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller operations. It is connected it to a computer with a help of USB cable.

The Uno varies from other boards because it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

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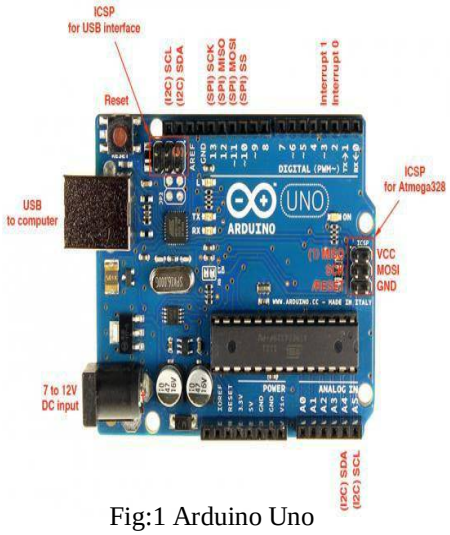

Fig:1 Arduino Uno

B.LCD DISPLAY

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

C. DC MOTOR

Fig:2 DC Motor

The 45 RPM 12V DC Motor as shown in the Fig:3 is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields.

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D. INFRARED SENSOR

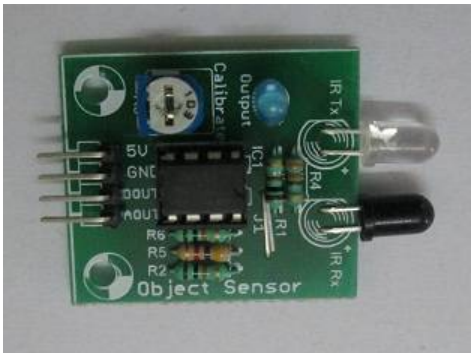

Fig:3 Infrared Sensor

An infrared sensor is an electronic device that emits infrared radiation in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. The radiations which are invisible to our eyes can also be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) as shown in the Fig:2 and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by theIR LED.

E. ARDUINO ETHERNET SHIELD

Fig:4 Ethernet Shield

To allows an Arduino board to connect to the internet using the Ethernet library and to read and write an SD card using the SD library. This shield is fully compatible with the former version, but relies on the newer W5500 chip.

To use the shield, mount it on top of an Arduino board. To upload sketches to the board, connect it to your computer with a USB cable as you normally would. Once the sketch has been uploaded, you can disconnect the board from your computer and power it with an external power supply. Connect the shield to your computer or a network hub or router using a standard ethernet cable. Connecting to a computer may require the use of a cross-over cable.

Network Settings:

The shield must be assigned a MAC address and a fixed IP address using the Ethernet.begin() function. A MAC address is a globally unique identifier for a particular device. Current Ethernet shields come with a sticker indicating the MAC address you should use with them. For older shields without a dedicated MAC address, inventing a random one should work, but don't use the same one for multiple boards. Valid IP addresses depend on the configuration of your network. It is possible to use DHCP to dynamically assign an IP to the shield. Optionally, you can also specify a network gateway and subnet.

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F. RADIO-FREQUENCY IDENTIFICATION

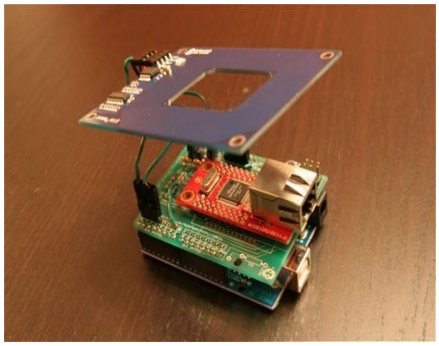

Fig:5 RFID Reader

Radio frequency identification (RFID) is a technology that uses radio wavesto transfer data from an electronic tag, called RFID tag or label, attached to an object, through a reader for the purpose of identifying and tracking the object. Some RFID tags can be read from several meters away and beyond the line of sight of the reader. The application of bulk readingenables an almost-parallel reading of tags.

RFID TAGS

Fig:6 RFID tag

RFID tags can be either passive, active or battery assisted passive. Passive RFID does not use a battery, while an active has an on board battery that always broadcasts or beacoms its signal. A battery assisted passive (BAP) has a small battery on board that is activated when in the presence of a RFID reader.

Most RFID tags contain at least two parts: one is an integrated circuitfor storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions; the other is an antennafor receiving and transmitting the signal.

G.RELAY

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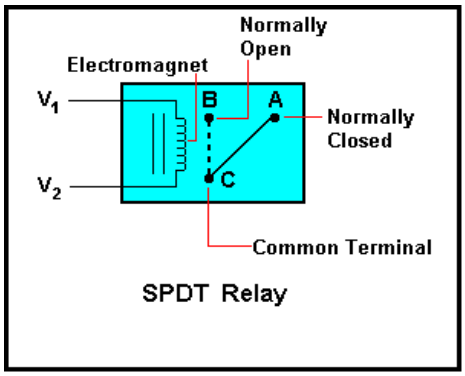

Fig:7 Relay

A Relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another.

H.WIFI- ESP8266

This is WiFi serial transceiver module, based on ESP8266 SoC., The SOC has Integrated TCP/IP protocol stack. ESP8266 is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.

ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

I.LOAD CELL

Fig:8 Load Cell

A load cell is a transducer that is used to convert a force into electrical signal. This conversion is indirect and happens in two stages. Through a mechanical arrangement, the force being sensed deforms a strain gauge. The strain gauge measures the deformation (strain) as an electrical signal, because the strain changes the effective electrical resistance of the wire. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cells of one strain gauge (quarter bridge) or two strain gauges (half bridge) are also available. The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer is plugged into an algorithm to calculate the force applied to the transducer.

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III. PROPOSED WORK

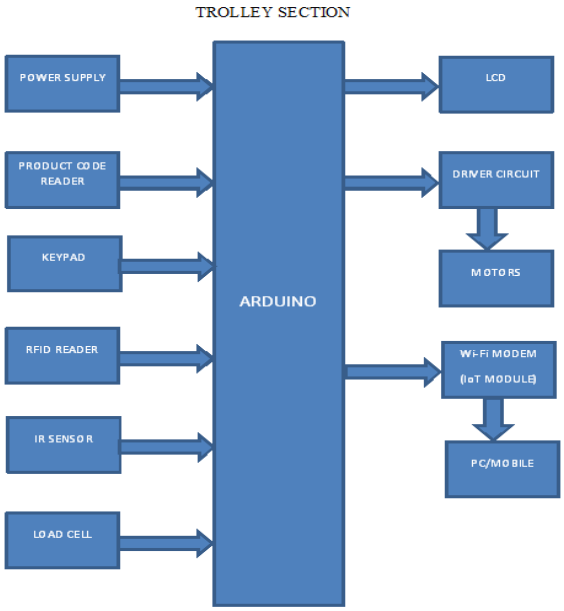

Fig:9 Block Diagram Of The Proposed Work

BLOCK DIAGRAM EXPLANATION

The trolley section consistsofpowersupply, ATMEGA8 microcontroller, RFID tag, RFID reader, LCD display and navigation unit which has IR sensor and gear motor. The 12V power supply is given to the microcontroller. The power indication LED is used to check whether there is a power flows through the circuit or not. After giving the power supply, the customer should select the particular section they want to purchase from. With the help of gear motor the trolley moves to the section which is already selected by the customer. The motor consists of driver circuit and relay. Inside the driver circuit, NOT gate and ULN2003 takes place. The IR sensor is connected to the driver circuit. Except the black surface the sensor can detect and gives the output as '1' to the NOT gate, which is inside the driver circuit. As well as the output of NOT gate is given to the pins 15 and 16 of IC ULN2003. With the help of ULN2003 the motor will run. The operating voltage of the motor is 12V. Another pin of the motor is connected to the relay circuit. The relay acts as an electromagnetic switch. Inside the relay circuit, fly-back diode and transistor is connected together. Due to the excess of voltage, the circuit may affect. To overcome this problem, fly-back diode is used. By using RFID reader the trolley moves to the selected section. If the 8bit data matches the trolley will be stopped. After purchasing the items, they put into the trolley. With the help of RFID tag and RFID reader the customer will have the information about the price of every items that are purchased in, and to display the total cost of items using LCD display. The LCD display consists of 8x8 display unit, which is more than enough to show the details.

IV. IoT MODULE

The Wi-Fi modem is connected to the Ethernet shield through Ethernet cable. The purpose of Ethernet shield is to transmitting the selected items from trolley to customer mobile phone and cashier PC for billing. Before shopping the customer, they select the trolley and similarly to connect their mobile phone from the trolley's IP address. Due to this the customer knows about the particular product's details and total cost for every item they purchase. And similarly the total cost will be displayed on cashier PC.

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V. PROGRAMMING

Embedded C Language.

VI. SOFTWARE DESCRIPTION

ARUINO 1.0.5

VII. ADVANTAGES

- Accurate and complete data collection; and Better utilization of employee's time.
- There are five major areas where RFID can be effectively used in a port cargo terminal:
- Access Control;
- Container Security;
- Container Identification and Location;
- Activity Tracking;
- Regulatory Compliance.
- Low cost
- Maintenance is easy
- No need of human interference, it can do its job automatically
- Shopping is made easy

VIII. CONCLUSION

By means of this paper intent to simplify the billing process, make it swift and increase the security using RFID technique. This will take the overallshoppingexperience to a different level. Different parameters such as the system parameters of smart trolley like products name, products cost, product weight etc. are continuously display. Thus with the help of the conclusion we can say that

1. Automatic billing of products by using RFID technique will be a more viable option in the future.
2. The system based on RFID technique is efficient, compact and shows promising performance.

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