

IOT and RFID based shopping mall

Mahek Vora¹, Sarang Rajan², Hrishikesh Lotekar³, Nilesh Kheratkar⁴, Pavan Thingalaya⁵,
Deepak Dave⁶

¹²³⁴⁵Student, Department of EXTC, Universal College Of Engineering, Maharashtra, India

⁶Assistant Professor, Department of EXTC, Universal College Of Engineering, Maharashtra, India

Abstract - This is a smart shopping mall in which the billing and the appliances are controlled by using Radio Frequency Identification (RFID) and Internet Of Things (IOT).

RFID reader module is sited in the shopping cart. The product which are added in the cart will be scanned by the RFID reader module and the details of the product which is stored in the Arduino (Atmega 328) will be displayed over the LCD placed in the cart. The LCD used in this project is 16x2 display.

IOT is basically used when the project wants to control the appliances remotely. NodeMcu is a mostly used in IOT projects. Using NodeMcu in the shopping mall we can control the lights and other electrical devices.

Key Words: Arduino UNO Board, RFID reader module, smart trolley, NodeMcu Wifi development board, Atmega 328

1. INTRODUCTION

Shopping mall is a place where people get their day-to-day requirements ranging from food products, clothing, electrical appliances, etc. Sometimes customers have difficulties regarding the incomplete information about the product on sale and waste of unnecessary time at the billing counters. At the time of festivals, special discounts, holidays, etc. there is a huge haste in shopping malls. The use of barcode reading technique in such situations always results in waste time since customer has to wait till all the products get scanned.

These drawbacks can be sidestepped by using IOT based intelligent trolley proposed in this project. RFID will reduce the required hardware and also gives the real time information about commercial. Using 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. So use of this RFID based intelligent trolley for shopping malls is helpful for customer as well as owners.

2. HARDWARE DETAILS

2.1 Arduino UNO

Arduino Uno is a microcontroller development board based on the Atmel ATmega328 MCU. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. This Arduino MCU board contains everything needed to support the microcontroller. Simply connect it to a computer with a adapter or battery to get started. The Arduino Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. The Arduino Uno MCU board can be powered via the USB connection or with an external power supply.[1]



Fig 1: Arduino UNO

Table -1: Arduino Specification

Pin Count	28/32
Flash (Bytes)	32K
SRAM (Bytes)	2K
EEPROM (Bytes)	1K
General Purpose I/O Lines	23
SPI	2
TWI (I2C)	1
ADC Channels	8
8-bit Timer/Counters	2
USART	1
ADC	10-bit 15kSPS
16-bit Timer/Counters	1

The Atmel AVR® core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in a single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs upto ten times faster than conventional CISC Microcontroller. Atmel offers the QTouch® library for embedding capacitive touch buttons sliders and wheels functionality into AVR microcontrollers.

2.2 RFID Reader module

Radio Frequency IDentification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method of



Fig 2: Em-18 Reader Module

Automatic Identification and Data Capture (AIDC).[2]

Table -2: RFID Specification

Input voltage	5V DC
Current	<50mA
Operating frequency	125Khz
Read distance	10cm

2.3 LCD Display

Liquid Crystal Display (LCD) screen is an electronic display module. This modules are preferred over seven segments and other multi segments LEDs. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instruction given to LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.[3]

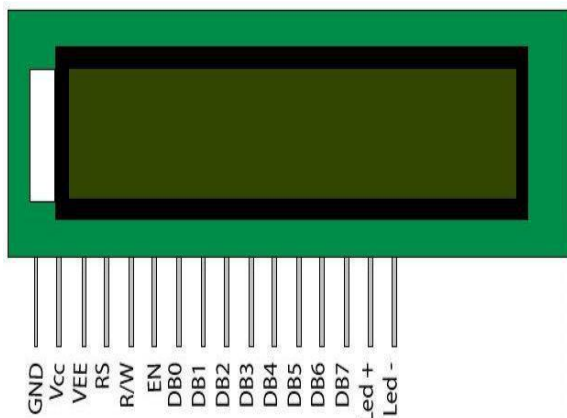


Fig 3: LCD Display

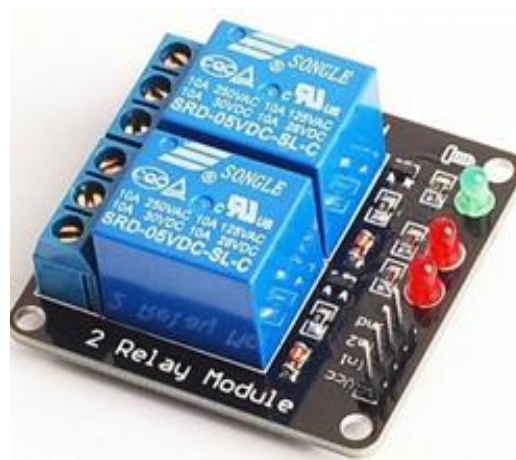


Fig 5: Relay Driver Module

2.4 NodeMcu

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.[4]

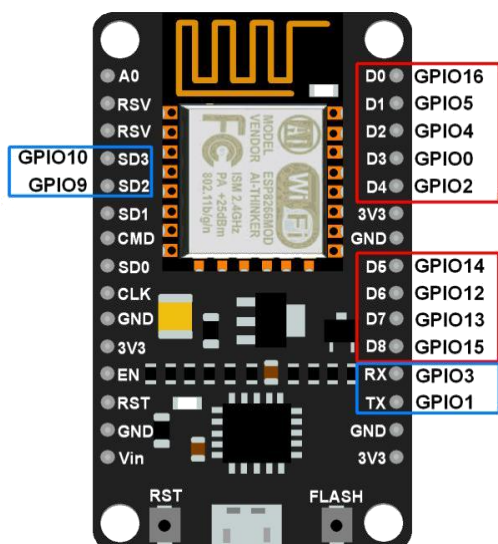


Fig 4: Node MCU Board

2.5 Relay driver module

A Relay driver is an electro-magnetic switch that will be used whenever the project wants to use a low voltage circuit to switch a light bulb ON and OFF which is connected to 220V mains supply. The required current to run the relay coil is

more than can be supplied by various integrated circuits like Op-Amp, etc. Relays have unique properties and are replaced with solid state switches that are strong than solid-state devices. High current capacities, capability to stand ESD and drive circuit isolation are the unique properties of Relays.

3. BLOCK DIAGRAM

RFID section:

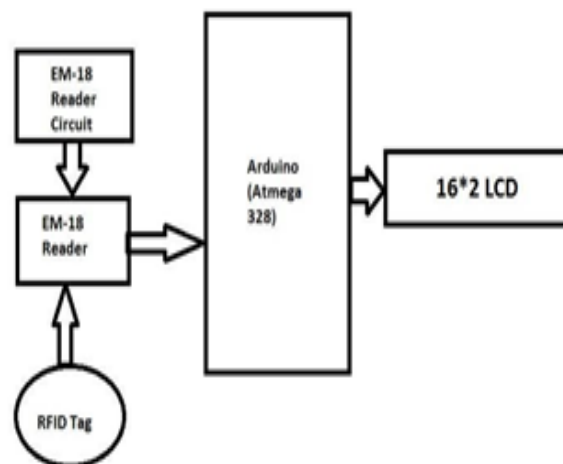


Fig 3.1: RFID block diagram

The power is connected to Arduino through USB (Type B). The LCD display is connected to Arduino. The Arduino is main controller which controls all input devices connected to it. The Arduino is reprogrammable device, which can be programmed according to user requirements. RFID scans the tag and reads the 12 digit address of the card. The Arduino will display the required output over the LCD Display according to the program.

IOT section:

NodeMcu is operated on 5V DC voltage via usb (type A). The NodeMcu is used to trigger the relay driver where the relay driver operate as switch and act according to the input given from NodeMcu. The electrical devices to be controlled is connected to relay.

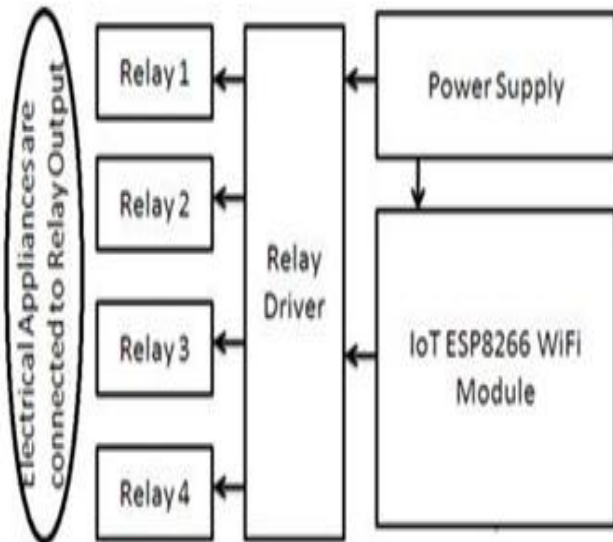


Fig 3.2: IOT block diagram

4. RESULTS

The developed product is easy to use, low cost and does not need any special training. This architecture of the system can be used in the shopping malls instead of the normal carts which are currently being used for intelligent and easy shopping in the malls to save time, energy and money of the consumers. This project improves the speed and experience of shopping at malls. Also it is best suited for present fast growing RFID and IOT technology.

5. CONCLUSION

After taking into consideration the solutions proposed by different researchers, the proposed model concludes of a design with RFID tags and reader against existing printed barcode and barcode scanner for reducing long queues at the billing counter and making purchase experience of customers satisfactory. Moreover trolley equipped with RFID reader displays the total amount of products added in the cart.

6. REFERENCES

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