PROJECT NAME:

Automatic Fire Detection, Alarm and Notification Message in Smartphone

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CHAPTER 1: INTRODUCTION AND PROJECT FORMULATION

1.1 Introduction

Fire detection systems are the most critical element of any building design these days. In recent days, fire incidents are commonly reported. This might be due to the negligence of people in many cases. Consider a few examples, in places like fuel filling stations, crackers shops, houses, and mainly in workplaces, etc. There are nearly thousands of fire accidents reported in a year. By taking all these into consideration. So we need taking step for it solution and now we will introduce an automatic fire detection using a fire sensor.

The existing fire detection system detects the fire by using a fire sensor, but our proposed system is different from that. The existing systems are with fire alarms and alerts by raising alarm when the fire is detected within a limited space. The proposed system contains the fire alarm, in addition to that it sends a notification to our mobile. Fire detection systems are designed to discover fire incidents early in their development itself. This would help in the safe evacuation of occupants, when time will still be available. Early detection of fire also plays a significant role in safety and alerting the emergency response personnel. By doing so, life loss and property loss can be reduced, and the time taken for the emergency response operation can be minimized through early detection. Because in case of early detection, the control efforts can be started while the fire is just starting. Most alarm systems work by providing alert messages to the emergency responders from the location of the fire and hence speeding the process of fire control. Fire detector systems are essential in alerting people in time before fire engulfs their homes. Hence, we have planned to make an IoT based wireless fire detector system which is not very difficult to place. Wireless sensor network here, does its job by monitoring the surrounding conditions and has achieved a big amount of attention now-a-days and it is also very well established. We have used a NodeMCU, for which we get an inbuilt Wi-Fi and for simulation we have used Arduino as the NodeMCU was not available in the TinkerCad software for implementation. Each of these nodes consists of a microcontroller (NodeMCU) connected to smoke detector sensors that continuously sense the surrounding environment to detect the presence of fire. These nodes generate their own WiFi network. At the stage when fire is detected by this node, it sends a signal to a center node that is reminded to send the SMS to the fire-fighter office and the user, and then it informs the user and

alerts the house by processing a local buzzer, when it is switched on. The buzzer keeps going on till the degree of temperature is high. It stops buzzing on its own when the temperature falls to ordinary value and smoke amount decreases. This system is very useful whenever the user is not in the proximity of the affected area. Sometimes it takes so much time for the fire fighter officers to reach where fire outburst has taken place and start their work on eliminating the fire. Thus, this model and buzzer will contribute as an early alarm system which will send an email confirmation to our mobile phones, fire department and the nearby hospitals if any sudden appearance of fire has been occurred. By this process we get to know about the situation happening at the location clearly and before it gets very late, we tend to avoid the consequences and damages in some cases where the fire outburst is observed after a long time from its explosion.

1.2 Project Perspective

This project is mainly based on IoT technology. Also, the system uses a flame sensor to detect fire. The unique feature of this system is that it receives a push notification to your smartphone in the event of a fire at the connected location. That function is performed by the Blynk app. We can use this project mainly for homes, offices, and factories. The main advantage and function of a fire alarm system is to ensure ultimate safety. They help warn and keep people safe and reduce the amount of destruction to a building. This is probably the major reason as to why a business will install a fire detection system.

CHAPTER 2: PROJECT DESIGN

2.1 Theory

Fire alarm systems are very common nowadays and commonly installed in Banks, shops, offices, home etc. They detect the fire and trigger a loud alarm to aware everybody. But what if nobody is there to hear that alarm, like in night time or when nobody is at home. So to inform the authority about any fire incident today we are building a IoT based Fire Alarm system which not only trigger an alarm but also sends a Email alert to concern persons. This method can also be used to inform fire department automatically in case of fire. Here we will use Infrared Flame Sensor to detect the fire and ESP8266 NodeMCU to trigger the alarm and send email with the help of SMTP server. This project can be further extended to make a phone call or send an SMS with the help of GSM module in case of fire.

2.2 Equipment and Apparatus Required

1. NodeMCU board(ESP8266) x 1
2. Flame sensor x 1
3. LED x 2
4. 180-ohm resistor x 2
5. Buzzer x 1
6. Breadboard x 1
7. Jumper wires

2.3 Introduction to Equipment

1. NodeMCU ESP8266

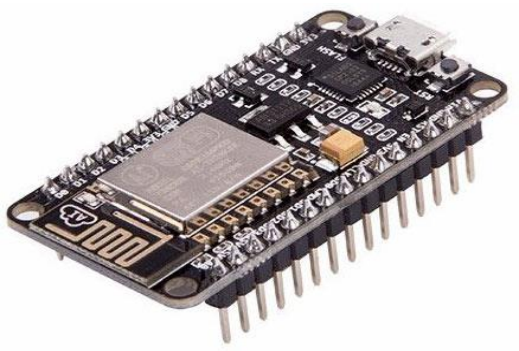

Figure 2.1: NodeMCU ESP8266

ESP8266 NodeMCU is an open source IoT platform. It includes firmware which runs on the low cost Wi-Fi enabled ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

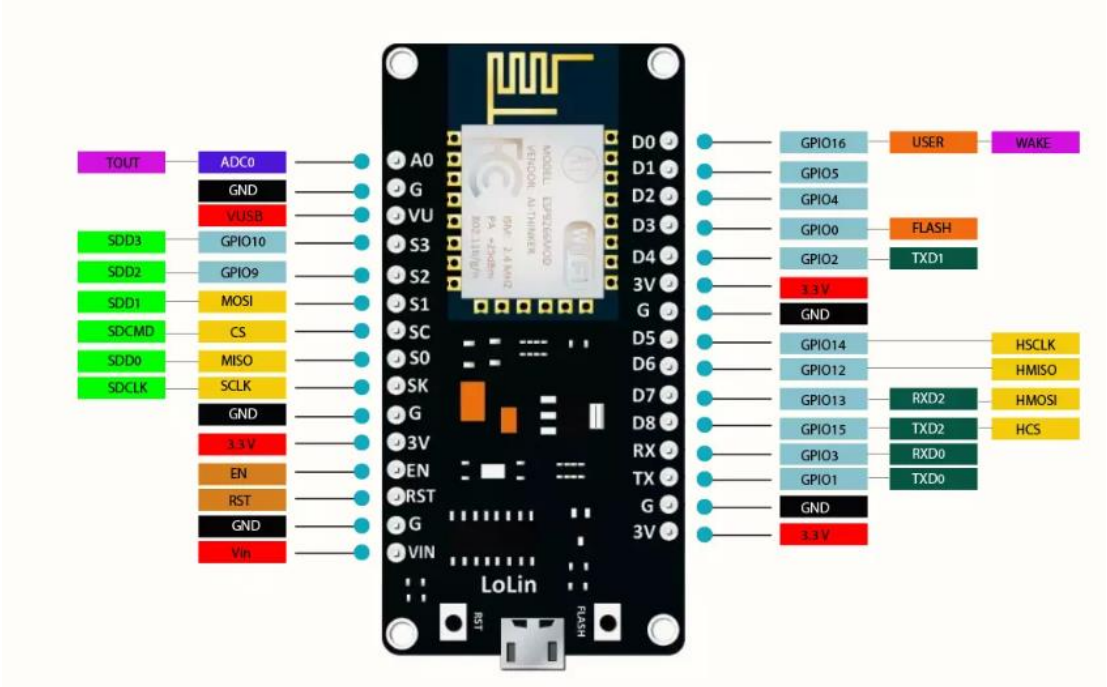

Figure 2.2: Pinout Diagram of NodeMCU ESP8266

It has GPIO, SPI, I2C, ADC, PWM AND UART pins for communication and controlling other peripherals attached to it. On board NodeMCU has CP2102 IC which provides USB to TTL functionality.In this IoT Fire Alarm, we are using one GPIO pin to get the digital data from the flame sensor.

Features of ESP8266:

- It is also known as a system-on-chip (SoC) and comes with a 32-bit Tensilica microcontroller, antenna switches, RF balun, power amplifier, standard digital peripheral interfaces, low noise receive amplifier, power management module and filter capability.
- The processor is based on Tensilica Xtensa Diamond Standard 106Micro and runs at 80 MHz.
- It incorporates 64 KiB boot ROM, 80 KiB user data RAM and 32 KiB instruction RAM.
- It supports Wi-Fi 802.11 b/g/n around 2.4 GHz and other features including 16 GPIO, Inter-Integrated Circuit (I²C), Serial Peripheral Interface (SPI), 10-bit ADC, and I²S interfaces with DMA.
- External QSPI flash memory is accessed through SPI and supports up to 16 MiB and 512 KiB to 4 MiB is initially included in the module.
- It is a major development in terms of wireless communication with little circuitry. and contains onboard regulator that helps in providing 3.3V consistent power to the board.
- It supports APSD which makes it an ideal choice for VoIP applications and Bluetooth interfaces.

2. Flame Sensor

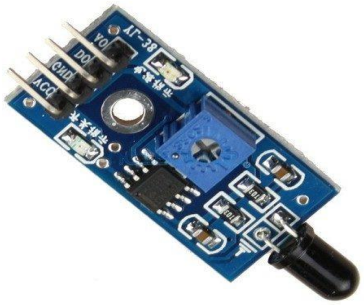

Figure 2.3: Flame Sensor

Flame sensor is a device which is used to detect the presence of fire in its surrounding. There are many types of flame sensors available such as Infrared Flame sensor, Ultraviolet flame sensor etc. In this project we will be using Infrared Flame Sensor to detect the fire. Infrared Flame Sensor consists of a photodiode coated with black epoxy which makes it sensitive to the infrared radiations

having wavelength between 700nm to 1mm and can detect fire up to distance of 100cm within 60 degrees of angle of detection. This photodiode is based on a three terminal YG1006 NPN Photo transistor.

3. Led

Figure 2.4: Led

We need to led for indicating the normal state and fire detection state.

4. Resistor

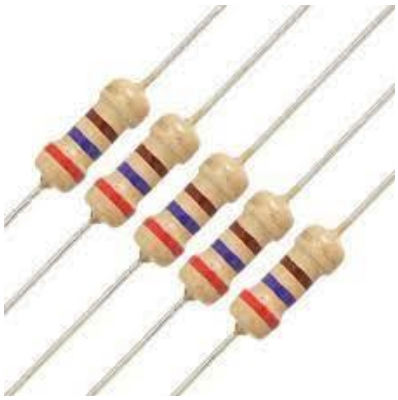

Figure 2.5: Resistor

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. We need two Resistor for protecting the bulb.

5. Buzzer

Figure 2.6: Buzzer

Buzzer is usually used to make sounds via setting under some specific circumstance.

6. Breadboard

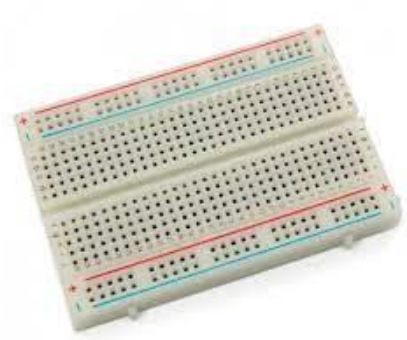

Figure 2.7: Breadboard

A breadboard is a rectangular plastic board with a bunch of tiny holes in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit, like this one with a battery, switch, resistor, and an LED .We need a breadboard for set up our practical circuit.

7. Jumper Wires

Figure 2.8: Jumper wires

Jumper wires are used to connect two points in a circuit. All Electronics stocks jumper wire in a variety of lengths and assortments. Frequently used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

2.4 Block Diagram of the Proposed Project

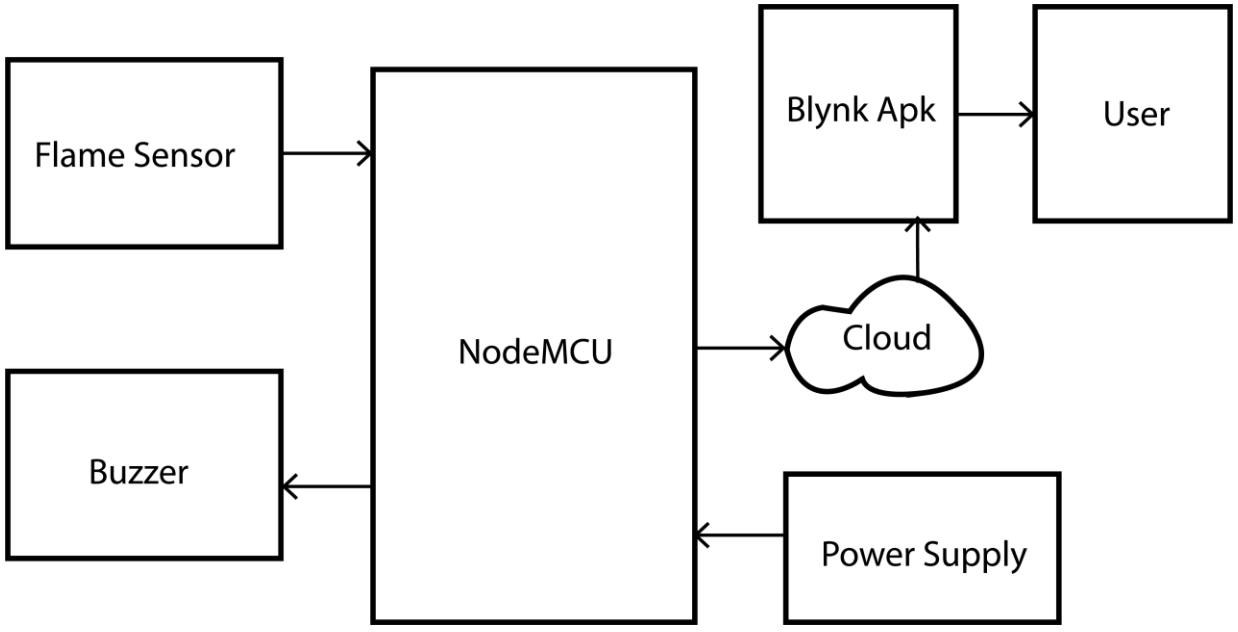

Figure 2.9: Block Diagram of our project

2.5 Flow chart of the Proposed Project

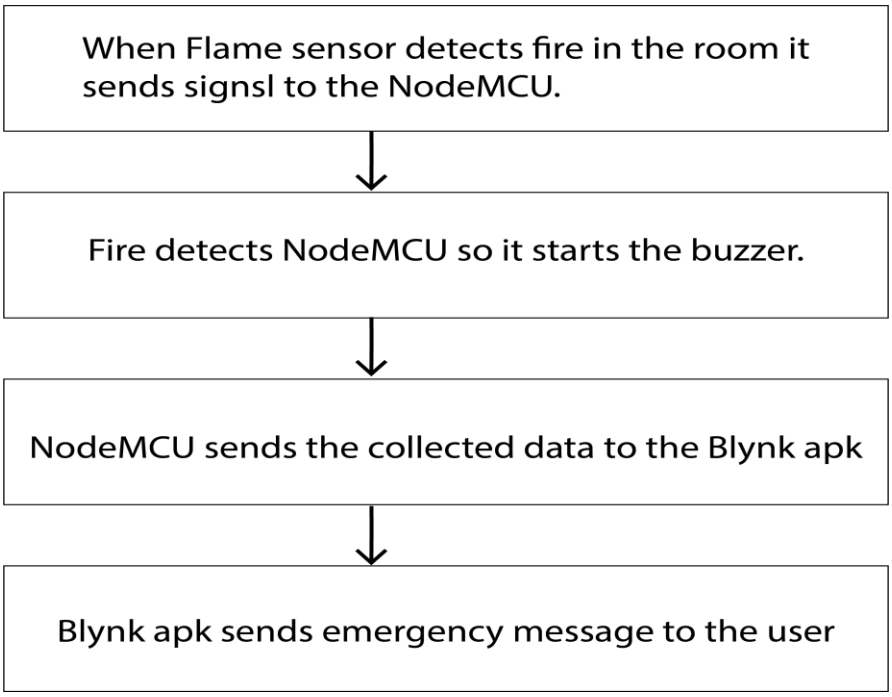

Figure 2.9: Flow Chart of the Proposed project

2.6 Practical Circuit Diagram of the Proposed Project

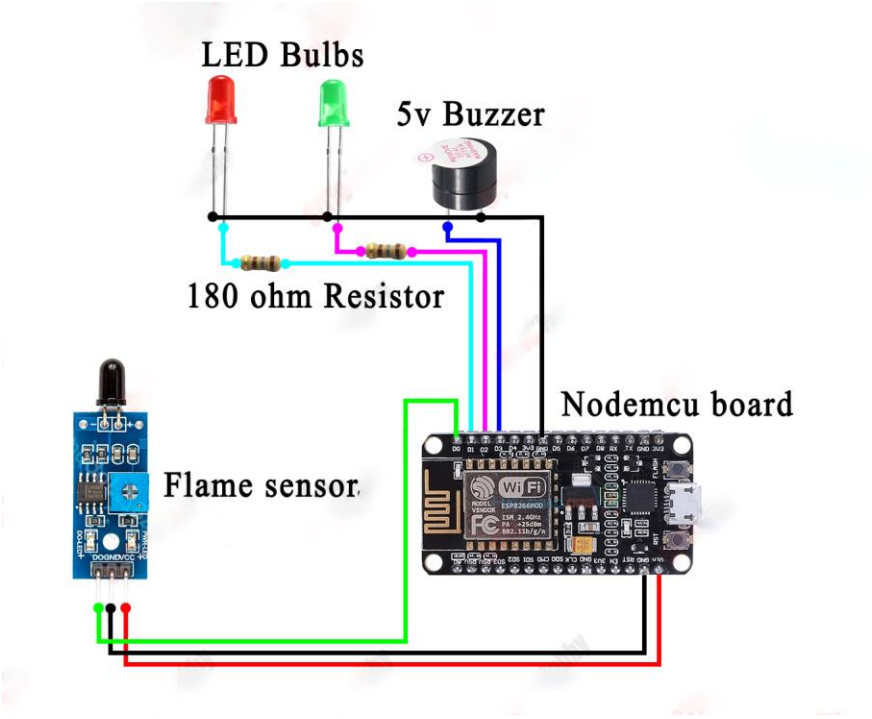

Figure 2.10: Practical Circuit Diagram of the Proposed Project

2.7 Practical Model of the Proposed Project

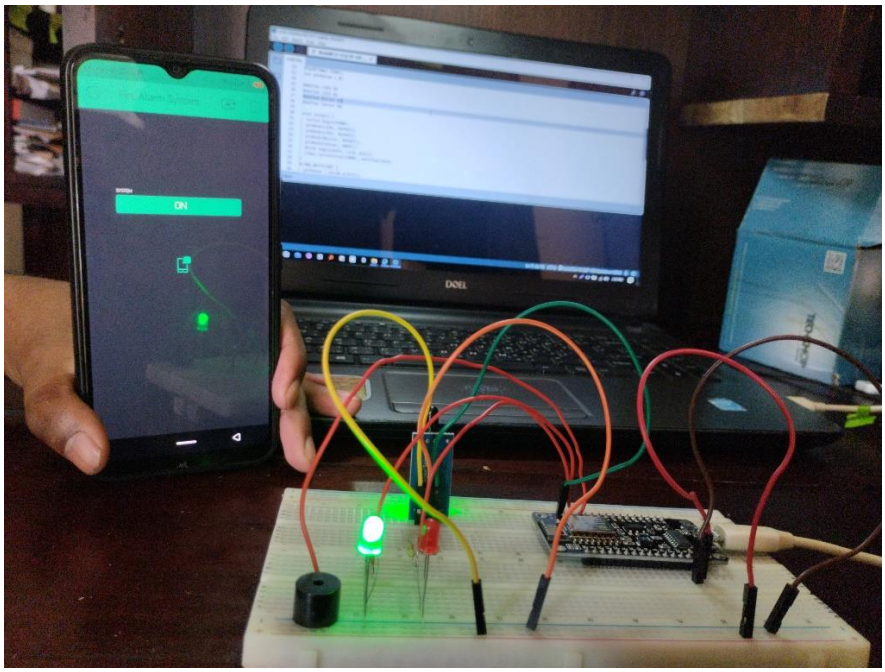

Figure 2.11: Practical Model of the Proposed Project

2.8 Cost of the Model of the Proposed Project

Components	Quantity	Unit Price(BDT)	Total Price(BDT)
NodeMCU (ESP8266)	1	469	469
Flame sensor	1	95	95
Buzzer	1	60	60
Breadboard	1	159	159
Resistor	2	5	10
LED	2	5	10
Power supplier	1	60	60
Jumper wires	10	5	50
Extra cost & Delivery charge			100
Total cost:			1013

Table 2.1: Components List with Price

This type of device's in market price around 1370tk and our project cost around 1000tk.

CHAPTER 3: DEVELOPMENT AND IMPLEMENTATION

3.1 Development of the Proposed Project

The project step by step

Step 1: Firstly, we have identify all the components.

Step 2: Secondly, connect these components. To do this, we have to use the circuit diagram of the Proposed Project.

Step 3: Thirdly, let's set up the Blynk app. For that we have follow some steps.

- First, we have to download and install the Blynk app on our smartphone. After, sign up for this app using any email address. Then, we have to run the Blynk app and click the "New project" button.
- Next, we have to enter the project name. Also, have to select the device and connection type. Finally, click the "Confirm" button.
- Now we can see the project interface. Then, we have to click the + icon in the corner. OK, now we have to include a button widget and a notification widget.
- OK, let's set up these widgets. First, we have to click the button widget and named it anything.Change the PIN as V0 and mode to switch. Next, we have to click the notification widget and change the priority to HIGH.
- OK, now the Blynk app is ready.

Step 4: Now, we have to create the program for this project. The code is below (3.2).
Step 5: OK, now we have to select board and port. Afterward, upload this code to the Nodemcu board.
Step 6: Lastly, we have to go to the Blynk app and click the run button. OK, project is ready.

3.2 Experiment Code of the Proposed Project

```
/*Fire alarm security system with Nodemcu */
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

char auth[] = "HJhzGqWHWILTaaoqHP2H92UDW2peC_zx";
char ssid[] = "emon";
char pass[] = "eeeeeeee";

BlynkTimer timer;
int pinValue = 0;

#define LED1 D1
#define LED2 D2
#define Buzzer D3
#define Sensor D0

void setup() {
 Serial.begin(9600);
 pinMode(LED1, OUTPUT);
 pinMode(LED2, OUTPUT);
 pinMode(Buzzer, OUTPUT);
 pinMode(Sensor, INPUT);
 Blynk.begin(auth, ssid, pass);
 timer.setInterval(1000L, notifiaction);
}
BLYNK_WRITE(V0) {
 pinValue = param.asInt();
}

void notifiaction() {
 int sensor = digitalRead(Sensor);
 if (pinValue == 1) {
  Serial.println("System is ON");
  if (sensor == 1) {
   digitalWrite(LED2, HIGH);
   digitalWrite(LED1, LOW);
   digitalWrite(Buzzer, LOW);
  } else if (sensor == 0) {
   Blynk.notify("WARNING! A fire was detected");
   digitalWrite(LED2, LOW);
   digitalWrite(LED1, HIGH);
   digitalWrite(Buzzer, HIGH);
  }
 } else if (pinValue == 0) {
  Serial.println("System is OFF");
 }
}

void loop() {
 Blynk.run();
 timer.run();
}
```

3.3 Implementation of the Proposed Project

Fire risks are largely dependent on a building's purpose and can vary greatly between rooms. We offer dedicated protection concepts for all environments typically found in corporate or public buildings. Discover our room-specific recommendations on fire safety system design. Which area(s) do you need to protect? Select the room description that matches your demand to access exclusive risk analyses and recommendations specifically for your needs, compiled by our global team of fire safety experts. Please note that while these documents have been created with specific commercially used buildings in mind, they can naturally be applied to different markets as well.

3.4 Advantages of the Proposed Project:

- Low cost
- Reliable
- Fast response
- Circuit can be easily constructed
- High level security
- Easy to design
- Low power consumption
- Early warning benefits
- Can easily be installed anywhere in commercial buildings
- Speed of response
- Sensitivity
- Portable

3.5 Limitation of the Proposed Project

- Sometimes false alarm by other radiation
- Senses near range heat(fire) only
- Uses continuous power supply

CHAPTER 4: CONCLUSION AND FUTURE EDITION

4.1 Future Edition:

- Notifying by calling system
- Call to fire station
- Expand fire detection range

4.2 Conclusion

The main aim was to develop an automatic fire alarm system to safeguard the user and their surroundings and to provide an early alarm system to avoid serious damaged due to such type of incidents. Our proposed system was capable of achieving its main goals which were mainly building an IoT-based fire alarm system. It is capable of detecting the presence of fire, communicating with the concerned parties by calling them when a fire is detected.

Thus, we conclude from this fire alarm is used for safety and emergency purpose. This is not only use in houses but also in any type of buildings.

4.3 References

[1] www.instructables.com/Fire-SMS-Notification/

[2] www.viralsciencecreativity.com

[3] www.cadlog.com/iot-design/