# Marathwada Mitra Mandal's Polytechnic
## Thergaon, Pune – 411033

## Institute

**Vision:** To nurture proficient technicians with sound ethical and social values contributing towards the welfare of masses.

**Mission:** We take ardent efforts to include technical skills, social, and ethical values among student along with Theoretical, Analytical and Practical Knowledge through an excellent harmony among academia, professional and extra-curricular activities.

## COMPUTER ENGINEERING DEPARTMENT

**Vision:** To develop technically proficient and competent professionals with latest technology and ethical values to serve society.

**Mission:**

- To impart latest and sound technical education
- To provide strong theoretical and practical knowledge of computer engineering branch with an example to maintain software and hardware system.
- Groom students with necessary skills and ethical values.

## Program Specific Objectives (PSO's)

- **PSO1:** Foundation of Computer System: Ability to interpret the fundamental principles, concept and methodology of computer system.
- **PSO2:** Ability to develop, maintain test computer system on the basic of programming language, computer network and hardware.
- **PSO3:** Professional Skills: Ability to communicate effectively recognizes ethical values and responsibility towards society.

# MARATHWADA MITRA MANDAL'S POLYTECHNIC

## THERGAON, PUNE 411027

**A**

**PROJECT REPORT**

***on***

# IOT Based Fire detection and Controlling System

***Submitted by***

**AVISHKAR SONTAKKE**
**PRATIK KULKARNI**

***In partial fulfillment for the***

***award of***

## DIPLOMA

***in***

## COMPUTER ENGINEERING

UNDER THE GUIDANCE OF

**Mrs. Aarti Deshmukh**

FOR THE ACADEMIC YEAR

**2020- 2021**

# MAHARASHTRA STATE
# BOARD OF TECHNICAL EDUCATION

## CERTIFICATE

This is to certify that,

Mr. Pratik Kulkarni Roll No 180332

Mr. Avishkar Sontakke Roll No 180352

of

**Sixth Semester**

of

**Diploma in** Computer Engineering

has completed

The Project entitled **IOT Based Fire Detection and Controlling System** satisfactorily for the academic year 2020 to 2021 as prescribed in the curriculum of MSBTE at Marathwada Mitra Mandal's Polytechnic, Thergaon, Pune 411027.

Place: Enrolment No.:1809890153
1809890173

Date: Exam. Seat No.:

**Project Guide** **Head of the Department**

**External Examiner**

Seal of Institution

**Principal**
M. M. Polytechnic,
Thergaon, Pune, 411027.

CERTIFICATE
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This is hereby Awarding this Certificate to

PRATIK KULKARNI

Student, Diploma in Computer Engineering, MM Polytechnic, Pune, India

Published a paper entitled

IoT Based Fire detection and Controlling System

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This is hereby Awarding this Certificate to

AVISHKAR SONTAKKE

Student, Diploma in Computer Engineering, MM Polytechnic, Pune, India

Published a paper entitled

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This is hereby Awarding this Certificate to

AARATI DEHMUKH

Professor, Diploma in Computer Engineering, MM Polytechnic, Pune, India

Published a paper entitled

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**Avishkar sontakke**
**Pratik Kulkarni**

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# ABSTRACT

Fire management is one of the main issue is that the developed or developing cities are facing. Fire accidental cases are increasing because of bad fire management by those peoples who don't know how to handle it and some of them are known but they can't afford the devices. Sometimes Peoples are out of town that they don't even get aware of the situation of their homes. That's the reason why we developed this device which constantly checks weather fire is detected or not even if someone is out of town they will get a notification via the Blynk application if fire is detected. This project Fire Detection and controlling system using IOT is a system which will co-operate to keep the Citizens aware of their homes situation. This system has a flame sensor which gives a digital signal to the ESP8266 which creates a notification and sends to the user .By this user can get early info of the detected fire and can take immediate action.

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# CHAPTER 1
# INTRODUCTION

## Overview

Nowadays, Fire detecting and alerting systems are very common in banks, offices, homes, etc. They usually detect fire and alert people with a siren. But, what happens, when nobody is there to listen to Alarm. Like when nobody is at home or office. So, to inform the authority about fire incidents and to automatically extinguish the fire we have made this IoT Based Fire Detector & Control System.

## Need for Improvement in Irrigation System

a. In the existing system it detects fire or smoke and starts water sprinklers which doesn't do that much help to stop fire. What if there is no one to hear the alarm like they are on another place.
b. Fire spreads faster and can do serious damage that’s why some more precaution is needed and cannot be depended on a fan.
c. In our Project system sends a message on user’s mobile to alert user but it can be improved further by sending that message directly the Fire department.

## Feature of Smart Irrigation System

a. The smart, sensor-based Fire detection system will detect the fire and send the Alert to the user.
b. It can also extinguish the fire.
c. According to the temperature level of the fire the sensor will be activated, If the temperature is low the sensor will not send any signal and if it is high then the sensor will send activation signal.

## Advantages of Smart Irrigation System

a. Fire detection systems can optimize danger levels based on things such as fire temperature.
b. Prevents damage causing from late realization of fire.
c. Cost & Effort are less in this system.
d. Reduces the human efforts required for controlling the fire.

# CHAPTER 2

# ANALYSIS

## Project Management

**Project management** is the practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time. The primary challenge of project management is to achieve all of the project goals within the given constraints. This information is usually described in project documentation, created at the beginning of the development process. The primary constraints are scope, time, quality and budget. The secondary and more ambitious challenge is to optimize the allocation of necessary inputs and apply them to meet pre- defined objectives.

The objective of project management is to produce a complete project which complies with the client's objectives. In many cases the objective of project management is also to shape or reform the client's brief to feasibly address the client's objectives. Once the client's objectives are clearly established, they should influence all decisions made by other people involved in the project – for example project managers, designers, contractors and sub-contractors. Ill-defined or too tightly prescribed project management objectives are detrimental to decision making.

## Requirement Analysis

In Requirement analysis user requirements are gathered. Software Requirement Specification (SRS) documents are prepared. Functional requirements are to be considered. Hardware and software constraints are considered. This page is detailed appraisal of existing system. This appraisal includes how the module work and what it does. It also includes finding out in more detail about the system problems and what users require from new system or any new change in the system. After this phase the analyst should be familiar with both the details and operations of the module and what else is required for the system. This output of this phase results the detailed model of the system. This chapter defines the module functions and data. The phase also contains detailed set of user requirement and these requirements are used to set objectives for new system.

# CHAPTER 3

## COMPONENTS REQUIRED

### ESP8266 Node MCU Module

The Node MCU with cp2102 Wi-Fi Board is an all-in-one microcontroller + Wi-Fi platform that is very easy to use to create projects with WiFi and IoT (Internet of Things) applications. The board is based on the highly popular ESP8266 WiFi Module chip with the ESP-12 SMD footprint. This WiFi development board already embeds in its board all the necessary components for the ESP8266 (ESP-12E) to program and upload code. It has a built-in USB to serial chip upload codes, 3.3V regulator and logic level converter circuit so you can immediately upload codes and connect your circuits. This board contains the ESP-12E chip with a 4MB! Flash memory so no worries for your long project codes!

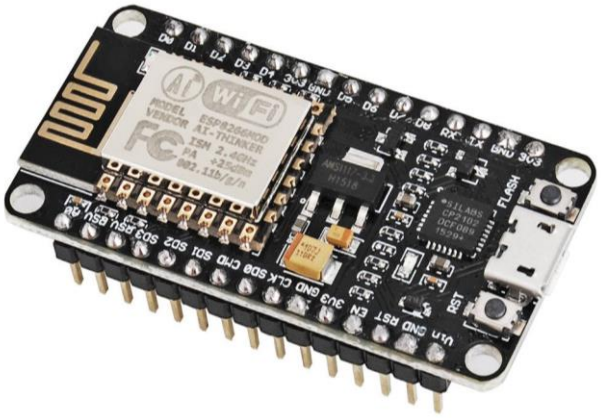

**Fig 3.1 ESP8266 NodeMCU**

### Flame Sensor

A sensor which is most sensitive to a normal light is known as a flame sensor. That's why this sensor module is used in flame alarms. This sensor detects flame otherwise wavelength within the range of 760 nm – 1100 nm from the light source. This sensor can be easily damaged to high temperature. So this sensor can be placed at a certain distance from the flame. The flame detection can be done from a 100cm distance and the detection angle will be 600. The output of this sensor is an analog signal or digital signal. These sensors are used in fire fighting robots like as a flame alarm.

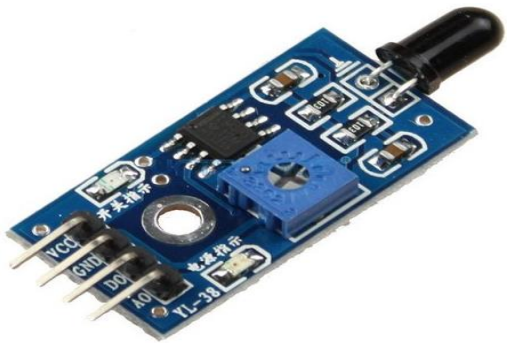


**Fig 3.2 Flame Sensor**

## Breadboard

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connects the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.

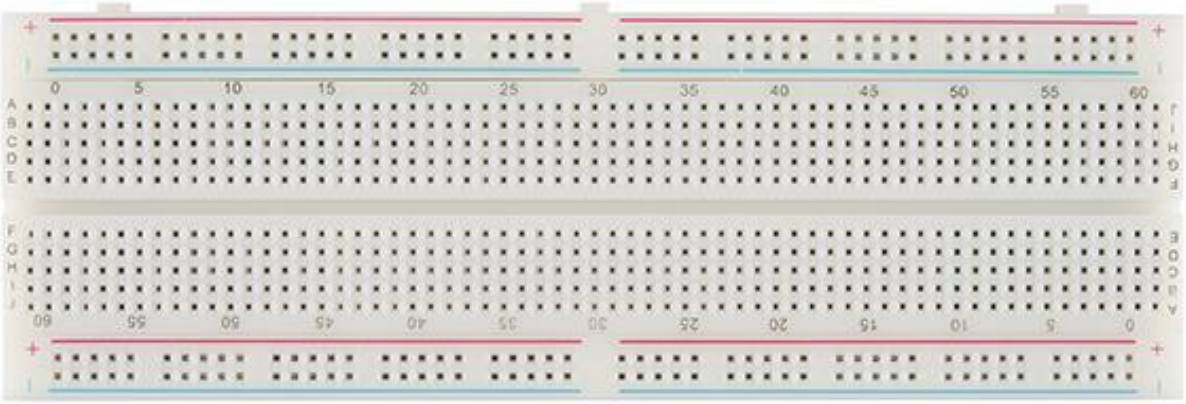

**Fig 3.3 Breadboard**

### Relay Module (1-channel)

The Single Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc. The relays terminal (COM, NO and NC) is being brought out with screw terminal. It also comes with a LED to indicate the status of relay.


**Fig 3.4 Relay Module**

### Jumper Wires

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a bread board, the header connector of a circuit board, or a piece of test equipment.

**Fig 3.5 Jumper Wires**

## Arduino IDE

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. 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 provides simple one-click mechanism to compile and load programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch".

The Arduino IDE supports the languages C and C++ using special rules to organize code.

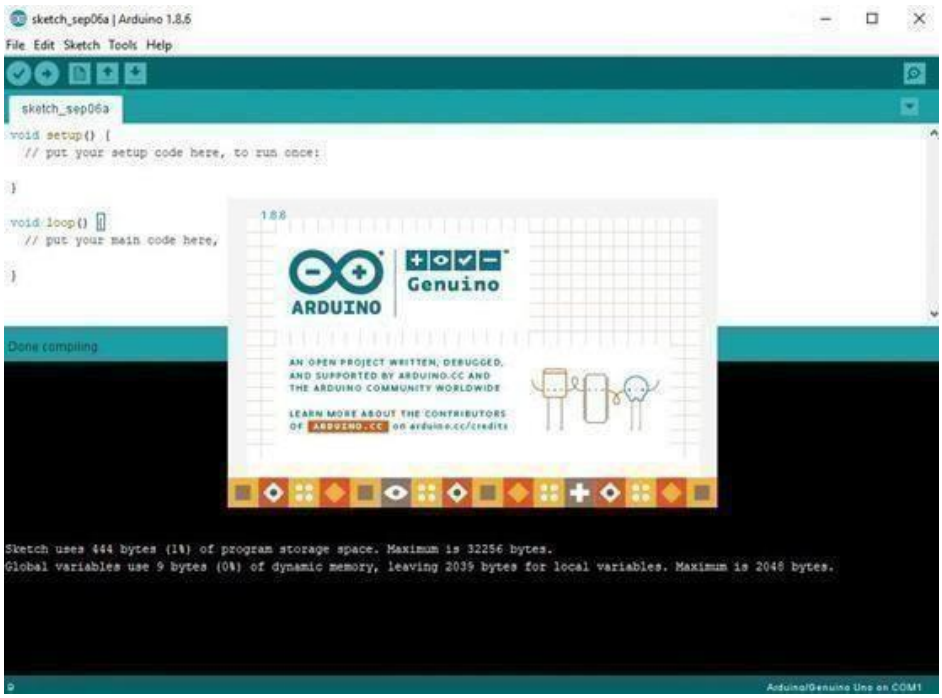


**Fig 3.6 Arduino IDE**

# CHAPTER 4
# SYSTEM MODELLING

## Activity Diagram

An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling. They can also describe the steps in a use case diagram. Activities modeled can be sequential and concurrent.

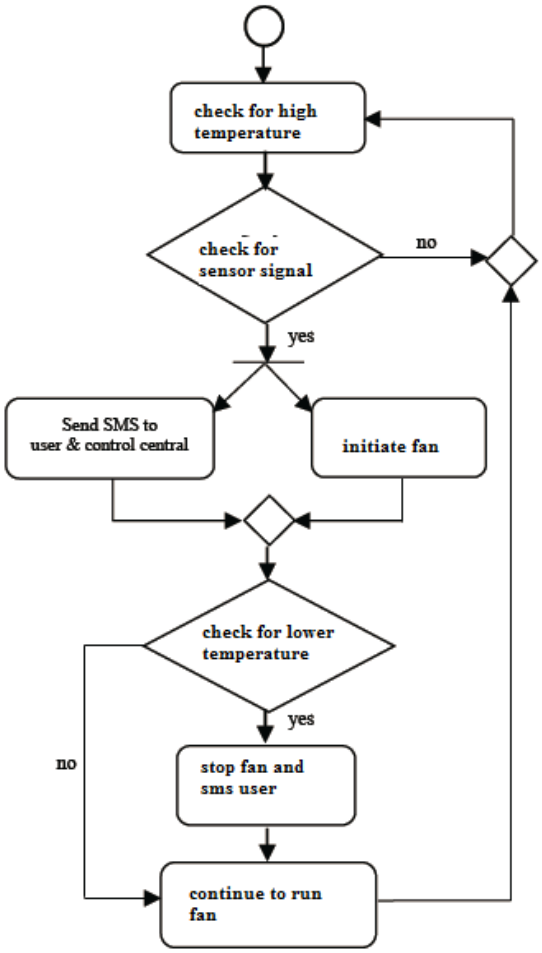


**Fig. 4.1 Fire Detection System Activity Diagram**

### Use Case Diagram

A UML use case diagram is the primary form of system/software requirements for a new software program underdeveloped. Use cases specify the expected behavior (what), and not the exact method of making it happen (how). Use cases once specified can be denoted both textual and visual representation (i.e. use case diagram). A key concept of use case modeling is that it helps us design a system from the end user's perspective. It is an effective technique for communicating system behavior in the user's terms by specifying all externally visible system behavior.

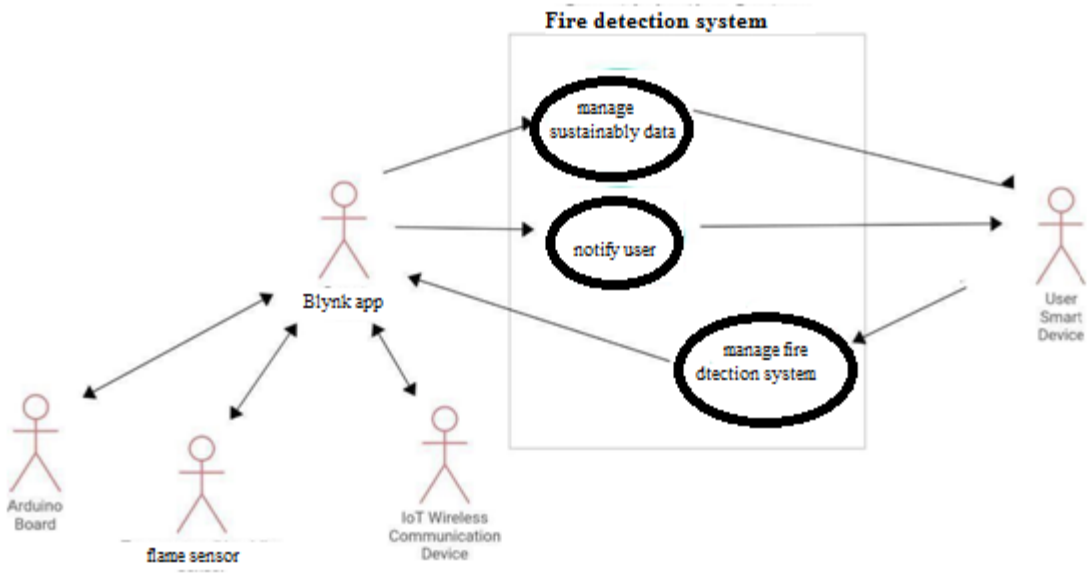


**Fig 4.2 Fire detection System Use Case Diagram**

## Class Diagram

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

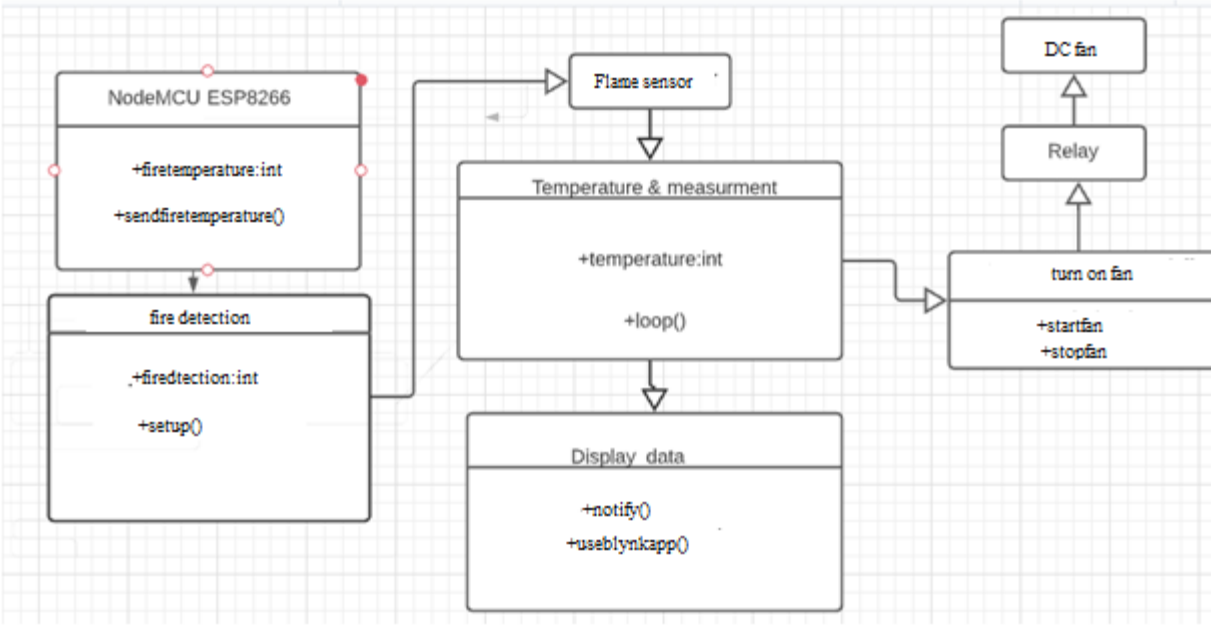


**Fig 4.3 Fire Detection System Class Diagram**

## Sequence Diagram

UML Sequence Diagrams are interaction diagrams that detail how operations are carried out. They capture the interaction between objects in the context of collaboration. Sequence Diagrams are time focus and they show the order of the interaction visually by using the vertical axis of the diagram to represent time what messages are sent and when.

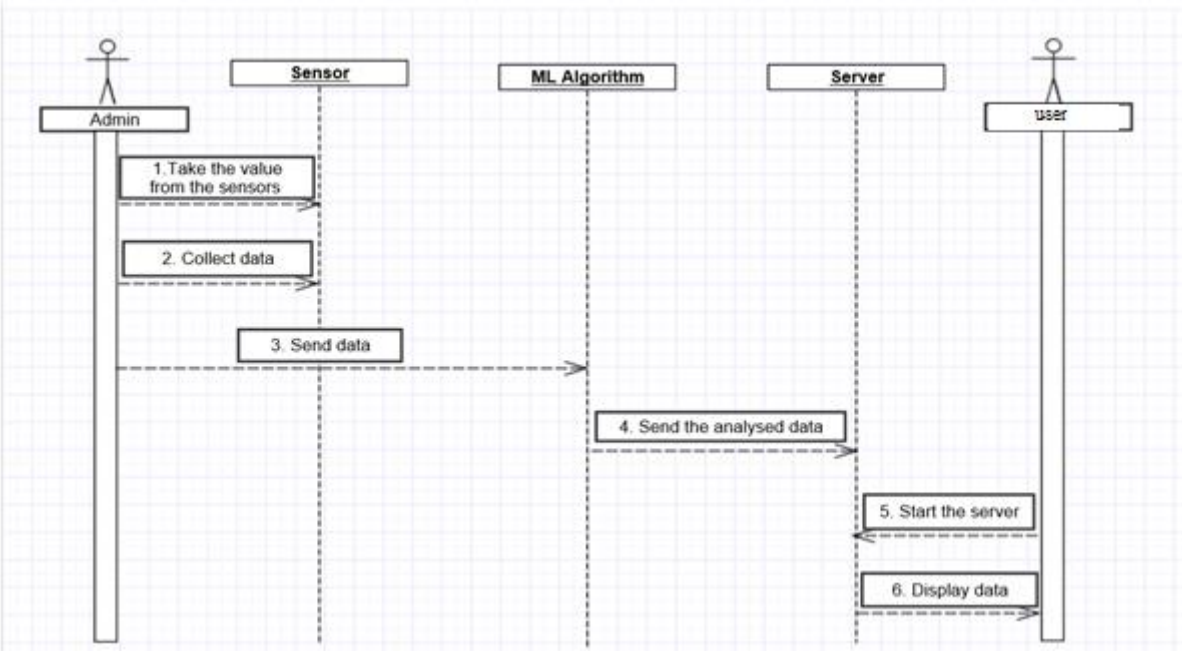


**Fig 4.4 Fire Detection System UML Sequence Diagram**

## State Diagram

Specifically, a state diagram describes the behavior of a single object in response to a series of events in a system. Sometimes it's also known as a Harrell state chart or a state machine diagram. This UML diagram models the dynamic flow of control from state to state of a particular object within a system.

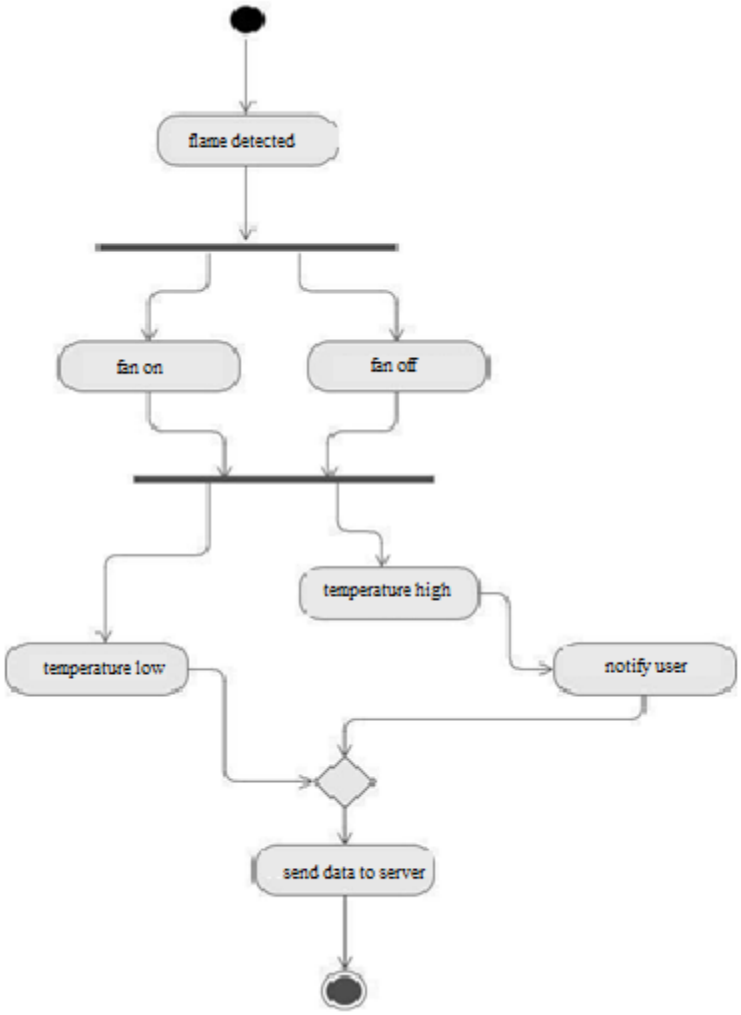


**Fig 4.5 Fire Detection System State Diagram**

## Block Diagram

A block diagram is a graphical representation of a system – it provides a functional view of a system. Block diagrams give us a better understanding of a system's functions and help create interconnections within it. Block diagrams derive their name from the rectangular elements found in this type of diagram. They are used to describe hardware and software systems as well as to represent processes. Block diagrams are described and defined according to their function and structure as well as their relationship with other blocks.

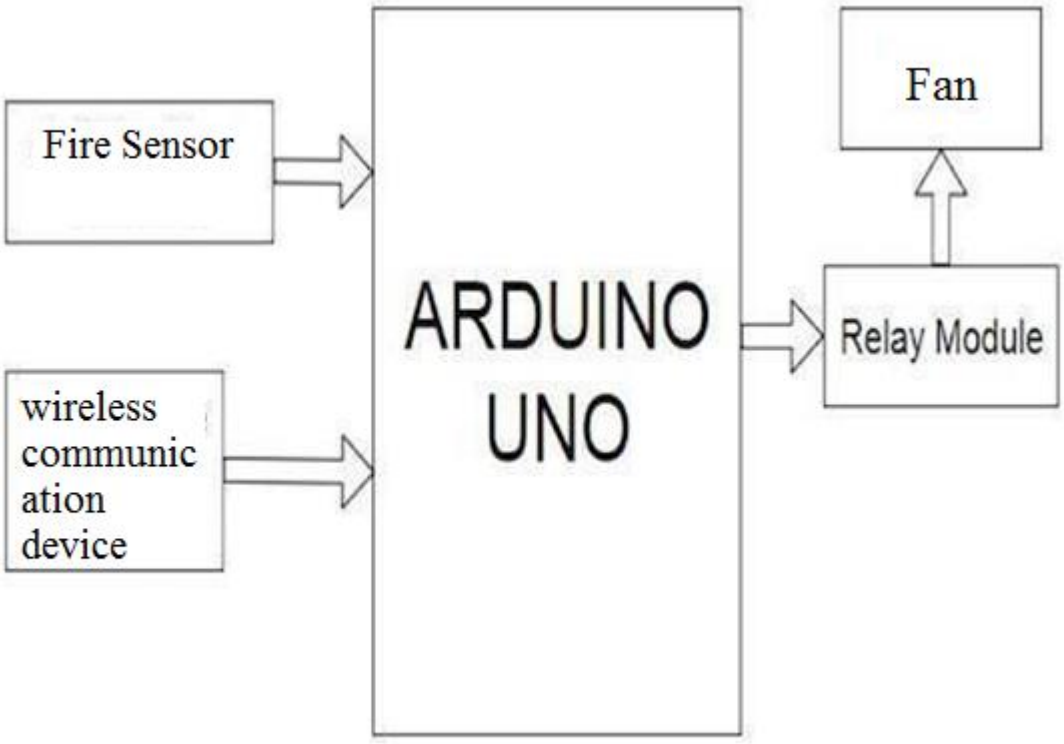


**Fig 4.6 Fire Detection System Block Diagram**

# CHAPTER 5

# SOFTWARE AND PROGRAMMING

## 5.1 Description

The Arduino Integrated Development Environment (IDE) is the main text editing program used for Arduino programming. It is where you'll be typing up your code before uploading it to the board you want to program. Arduino code is referred to as **sketches**. Arduino programs can be divided in three main parts: **Structure, Values** (variables and constants), and **Functions**. Software structure consists of two main functions−

- Setup () function
- Loop () function

**1) Setup (): - T**he **setup ()** function is called when a sketch starts. Use it to initialize the variables, pin modes, start using libraries. The setup function will only run once, after each power up or reset of the Arduino board.

**2) Loop (): -**After creating a **setup ()** function, which initializes and sets the initial values, the **loop ()** function does precisely what its name suggests, and loops consecutively, allowing your program to change and respond. Use it to actively control the Arduinoboard.

## 5.1.1 PROGRAM CODE

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
int LED = D2;
int RELAY = D4;
int Flame_sensor = D1;
int Flame_detected;
BlynkTimer timer;
char auth[] = "jovd0wly3APhqOwX6XJzwN4j0m6wpTwR"; //Auth code sent via Email
char ssid[] = "Alsan";
char pass[] = "12345678";
void notifyOnFire()
{
  Flame_detected = digitalRead(Flame_sensor);
  Serial.println(Flame_detected);
  //delay(100);
  if (Flame_detected == 0) {
    Serial.println("Flame detected...! take action immediately.");
    Blynk.notify("Alert : Fire detected...! take action immediately.");
    digitalWrite(LED, HIGH);
    digitalWrite(RELAY, LOW);
    delay(500);
  }
  else
  {
    Serial.println("No Fire detected. stay cool");
    digitalWrite(LED, LOW);
    digitalWrite(RELAY, HIGH);
  }
}
void setup()
{
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  pinMode(LED, OUTPUT);
  pinMode(RELAY, OUTPUT);
  digitalWrite(RELAY, HIGH);
  pinMode(Flame_sensor, INPUT_PULLUP);
  timer.setInterval(1000L, notifyOnFire);
}
void loop()
{
  Blynk.run();
  timer.run();
}
```

# CHAPTER 6

## SYSTEM DEVELOPMENT AND WORKING

### Project Development

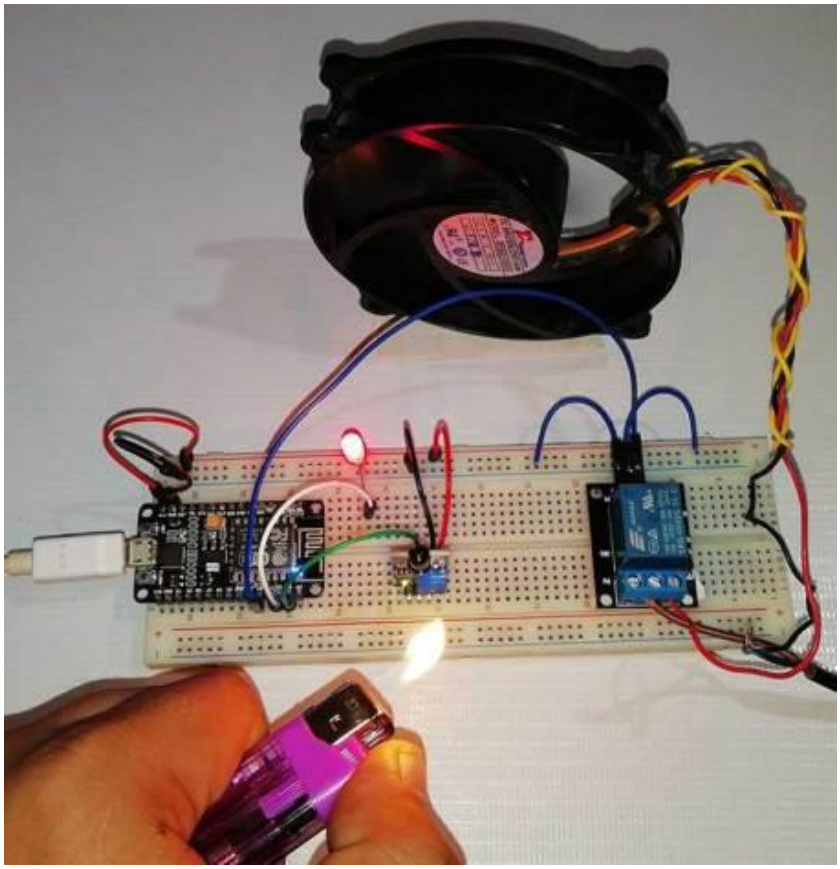

**Fig 6.1.1 Project Development**

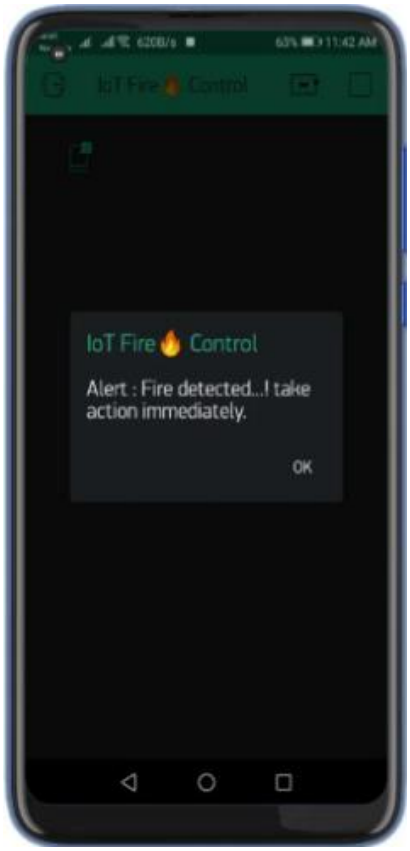


**Fig 6.1.2 Project Development**

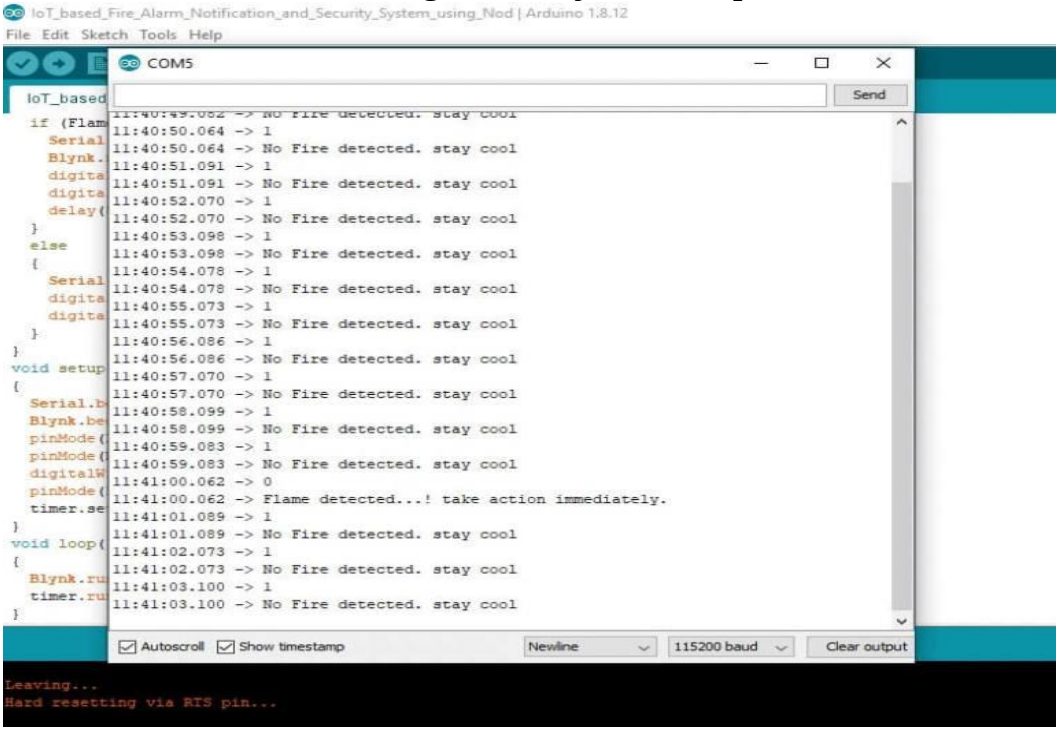


**Fig 6.1.3 Project Development**

## Project Working

In IOT based Fire Detection and Controlling System we are showing live Data on Blynk application.

The flame sensor sends digital signal 1(indicates fire detected) to ESP8266 wi-fi module after detecting any fire near it and then ESP executes the code. After the execution of the code relay gets clipped and it turns on our 12v dc fan that helps to extinguish the fire. Also it send the notification to the user via Blynk application that "Alert fire detected" after the fire gets extinguish the flame sensor again sends a digital signal 0(indicates fire not detected) to the ESP module and then again relay gets clipped and fan stops. Also it sends a notification to the user that "Fire extinguished stay calm" and that's how our IOT based fire detection and controlling system works.

## Project Advantages

1. Save a ton of money by reducing damage
2. Long term durable
3. Helps you prepare for the future of cause
4. Fire Detection helps you reduce loss
5. Notifies at same time of fire detection

# CHAPTER 7

# TESTING

## Formal Testing

Software testing is the process of executing a program or application with the intent of finding the software bugs. It can also be stated as the process of the validity and verifying the software program or a product. It meets the business and technical requirements that guided its design development.

A formal technical review is a software quality assurance activity performed by software engineers. The objectives of FTR are –

1. To uncover the error in function, logic, implementation for representation of the product.
2. To verify that the product under review meets its requirement.
3. To ensure that the hard ware has been represented according to predefined standards.
4. To achieve project that is developed in uniform manner.
5. To make project more manageable.

The FTR also serves to promote backup and continuity because a member of people becomes familiar with the parts that they may not have otherwise seen. The FTR is actually a set of reviews that includes walkthrough, inspection, etc. Each FTR is conducted as a meeting and will be successful only if it is properly planned, controlled and attended. In the section that follow, guideline similar to those for a walkthrough are presented as a representative formal technical.

## Test Plan

The test plan identifies the following: -

1. Items required for testing.
2. Instructions to set up the items that will be used during the test.
3. General description for how to operate the systems under test.
4. Specifications and events that will take place during the test.

## Testing

**What is Testing?**

Testing is the process of evaluating a system or its component(s) with the intent to find whether it satisfies the specified requirements or not. In simple words, testing is executing a system in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements.

## Hardware/Software Testing

Hardware testing is usually more detailed and thorough than verification. Testing is needed to ensure that every component of a system is operating as it should, and that the system Is performing exactly in accordance with the specific local requirements.

A comprehensive structured testing program is one that ensures that all aspects of a system are tested. This is especially important for key systems such as electronic voting systems. Testing measures that could be followedinclude:

1. Developing a set of test criteria. Applying 'non-operating' tests to ensure that equipment can stand up to expected levels of physical handling, such as transit drop tests.
2. Examining if appropriate any code 'hard wired' in hardware (this code is sometimes known as firmware) to ensure its logical correctness and to ensure that appropriate standards are followed.
3. Applying functional tests to determine whether the test criteria have been met. Applying qualitative assessments to determine whether the test criteria have been met.
4. Conducting tests in both 'laboratory' conditions and in a variety of 'real life' conditions.
5. Conducting tests over an extended period of time, to ensure systems can perform consistently.
6. Conducting 'load tests', simulating as closely as possible a variety of 'real life' conditions and using or exceeding the amounts of data that could be expected in an actual situation.
7. Verifying that 'what goes in' is 'what comes out', by entering known data and checking that the output agrees with the input.

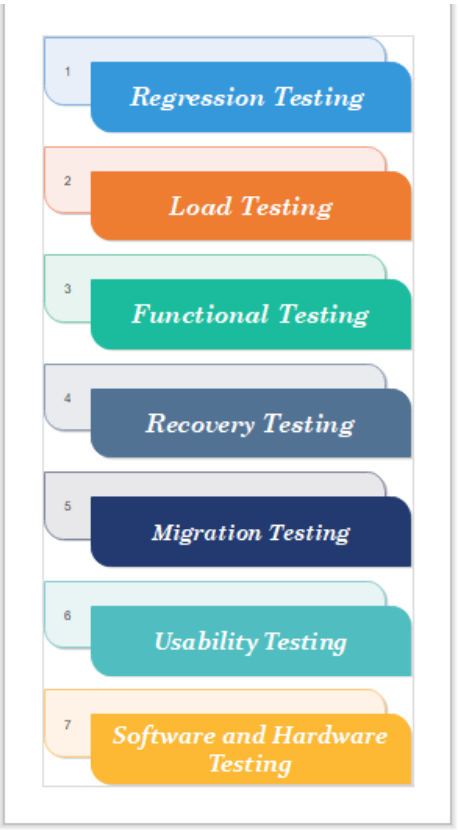


**Fig. 7.1 Types of Hardware Testing**

## Test cases

A TEST CASE is a set of conditions or variables under which a tester will determine whether a system under test satisfies requirements or works correctly. The process of developing test cases can also help find problems in the requirements or design of an application.

Following are test cases for "IOT Based fire detection and controlling System"

| Test case No | Test case objective | Pre requisites | Steps | Input | Actual result | Expected result |
|---|---|---|---|---|---|---|
| 1.) | to check The Arduino working or Not | Device should be available | 1.) connect wire to Arduino<br>2.) give power supply to it | Give Power Supply | Arduino Showing Light | Arduino Showing Light |
| 2.) | to check ESP8266 Node working or Not | Device should be available | 1.)connect ESP8266with Arduino<br>2.) give power supply to it | Give Power Supply | ESP8266 show light | ESP8266 show light |
| 3.) | to check right Data is display on Blynk | Internet must be on | 1.)go to Application of Blynk<br>2.)open it<br>3.)install properly | Click To open | right website Open | Right website Open |
| 4.) | to check Proper installation of Arduino Ide | Internet must be on | 1.)go chrome Search Arduino ide click to Download<br>2.)download it | click To Down Load | Arduino ide Installed | Arduino ide Installed |
| 5.) | To check Project Required Libraries Are installed in Arduino ide or not | Internet must be on | 1.)go at Arduino ide<br>2.)install the Required libraries for Project | Click To Install | Libraries are Installed | Libraries are Installed |
| 6.) | To make Proper connections | All device Connection block diagram should be Ready | 1.)collect all device and Wires<br>2.)make the Connection | Make connection | All connection Ready | All Connections are ready |
| 7.) | To upload Proper Code | Code should be ready | 1.)check the Code<br>2.)make correction in Code<br>3.)upload it into esp32 with help of Wire | Click To Upload | Proper code Uploaded | Proper code Uploaded |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8.) | To check if all library Are working properly or not | Ardunioshould be installed | signup to Ardunio with Gmail account | Signup | Showed a file from library was missing | While compiling the code no library related error should be shown | pass |
| 9.) | To checking if the Sensor Value is corret or Not | 1) Ardunio should be installed 2) To make Proper connection by using circuit diagram | 1.)signup to ardunio With Gmail account 2)proper Setup of ardunio | flame sensor | Showed value correct | While monitoring the value must high or low | Pass |
| 10) | To check the value of sensor is accurate | 1)Ardunio should be installed | 1)signup to ardunio With Gmail account 2)proper Setup of ardunio | flame sensor | The output of the flame sensor is displayed in digital value | While monitoring the flame sensor the value must shown in digital format | Pass |
| 11.) | To check Proper installation of Blynk app | Internet must be on Project | 1)go chrome Search Blynk click to Download 2.)download it 3) SignUp with proper Gmail account | Click to Download | Blynk Installed | Blynk installed | Pass |
| 12.) | To check Fan is On | All Requirement should be | flame sensor sow properly | flame sensor | fan will be Start | fan started | Pass |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | When Sensor Data Is high | Completed required for Project | | | | | |
| 13) | To check Sensor properly get data | To make Proper connection by using circuit diagram | flame sensor sow properly | flame sensor | Properly give data to Blynk | Properly give data to Blynk | pass |

# CHAPTER 8
# ACTUAL PROJECT SNAPSHOT

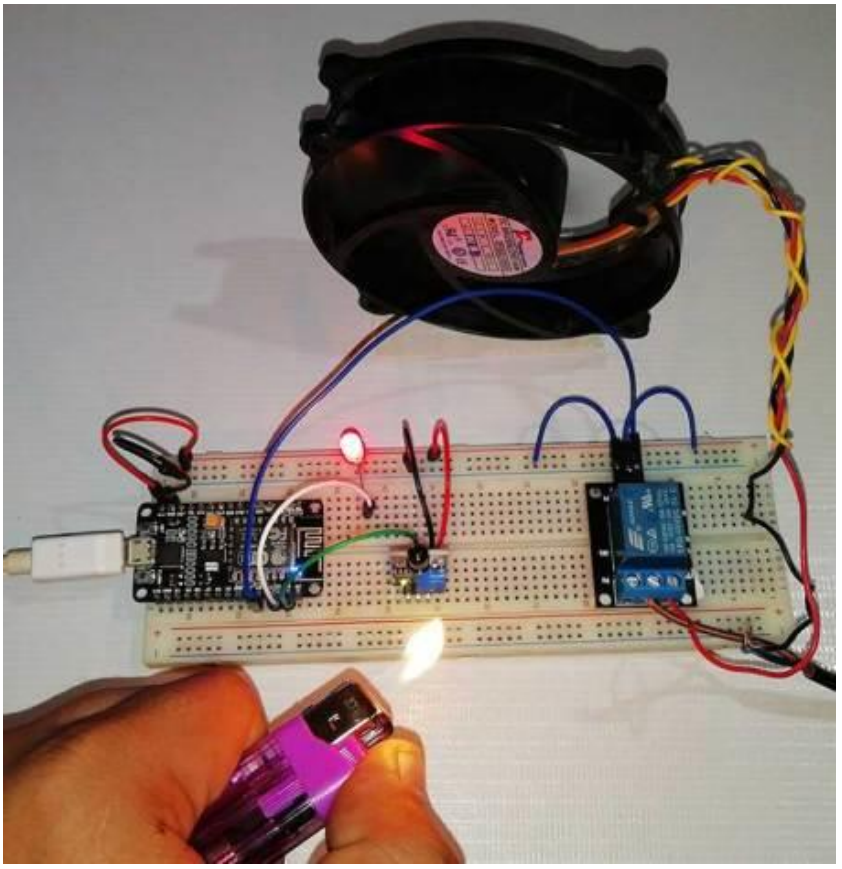

**Fig 8.1 Actual Project Snapshot**

# CHAPTER 9
# CONCLUSION

This project task is the execution of fire detection and controlling system using IOT (sensor, wi-fi module). This system satisfies the fire control and detects it when senses the fire nearby. Hoping that this IOT based fire detection and controlling system could help society to overcome the situation of bad fire management and could be the best device to reduce fire accidents hence it's a good project.

# CHAPTER 10
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