
# A PROJECT REPORT

ON

# INDUSTRY SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

## DEPARTMENT OF IT

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# 1.INTRODUCTION:

Internet of Things (IoT) initially appeared as an automation of processes, but smart IoT allows to achieve the paradigm of reaching the result, where the goal is a paramount and not methods for achieving it. IoT is a continues support
for a man by the things which surround him. IoT is a clarity of processes and focus on result. IoT is not to tell how to do, but what should be in the outcome.
Basically, things are agents for performing processes. Life cycle of things are quite simple. First, they collect the information from the real world, then they process it or in the other words, they plan some actions. The actions will be executed by commands. Application of IoT is not just limited to data analytics like smart warehousing, but for more useful application in agriculture and medical systems Agent of a man communicates with agents of things, giving them commands and exchanging information. This relationship between man and surrounding things can provide comfort in living, prevention of disasters and saving lives The safety of any person is the most important part of living. Recent advances in IoT based systems are responsible for one of the most critical applications like prevention of car accidents in outdoor as well as warehouses in indoor. Unfortunately, accidents and misfortune can happen even inside of any house. One of the threats is an open fire, which can take place due to uncontrolled cooking, unfinished smoking or simply due to electrical failure. There can be different reasons, but the outcome is always dangerous. Despite domestic fire alarms availability and installation inside premises, there are number of cases, when fire alarm does not function as supposed tour simply when nobody is around, when fire alarm goes off often

ending up in casualties. IoT based Fire Alerting System “Fire Not” is designed to give second cross check in alerting people of possible fire on the premises. When the system senses smoke or fire, it alerts the user through their mobile phone, giving them notification of possible fire on the location. From here, the user can take any additional steps and action to check the premises, ask somebody else to check, if the user is away from the premises, or even call the fire brigade. The system is designed to use modern day technologies of Internet of Things, such as Raspberry Pi minicomputer, compatible smoke sensitive sensors, all of which communicates to an Android mobile application via Google Cloud. There is no man-to-man or man-to-machine interaction involved, therefore, it provides efficient inexpensive solution for a cross check in case of fire. The diagram below shows the system architecture. The other aspect, which is added to a business value of the system, is affordability in terms of cost of hardware. The Internet of Things technologies, available today, gives flexibility in terms of functionality, supported pool of opensource knowledge, scalability, robustness and continues development. There is adefinite demand for this type of solution for every household or business premise. Target audience include basically every layer of society. The development is decided to use Agile Software Delivery methodology due to most suitable project methodology available for software delivery. Its flexibility, clarity and absence of work overload provides great opportunity for successful delivery of the project within the timeframe. The main goal of the project is to provide the efficiently working system, which will be detecting any fire/smoking activity taking place on the premises, and alerting the user, who is located distantly, or in case of failure of fire alarms.

## 1.1. PROJECT OVERVIEW:

Internet of Things (IoT) based systems have revolutionized the way real-world systems are inter-connected through internet. At present the application of IoT based systems is extend to real time detection and warning system. However, cost has been a major factor for development and implementation of IoT systems. Considering the cost, ease of implementation, this paper proposes a low cost yet efficient IoT system called Fire Not for warning and alerting fire incidents. Fire Not is a cloud based system that uses sensors (hardware) to detect fire and alert the user through internet and is maintained and monitored using a simple Android app. The Fire Not system uses Raspberry Pi programmed through Python language and utilizes Google API for location detection. This paper practically demonstrates the FireNot system through extensive testing on various operations and the FireNot system is proven to be efficient

## 1.2. PURPOSE

Once fire is detected by a node, it sends a signal to a centralized node that is triggered to send an SMS to the registered number , call the user and alert the house by producing a local alarm. The user can also get information about the status of his home via sending an SMS to the system.

# 2. LITERATURE SURVEY

## 2.1. EXISTING PROBLEM

Current system uses hard wired interconnection which is having disadvantage of cost expensive, long time consuming and disruptive. A hard-wired system is also very difficult to maintain and too expensive to reconfigure when circumstances change, If the methods used at the design of the wireless system and the components employ revolve around a compromise between effectiveness, compactness, low power requirements and cost.

## 2.2. REFERENCES

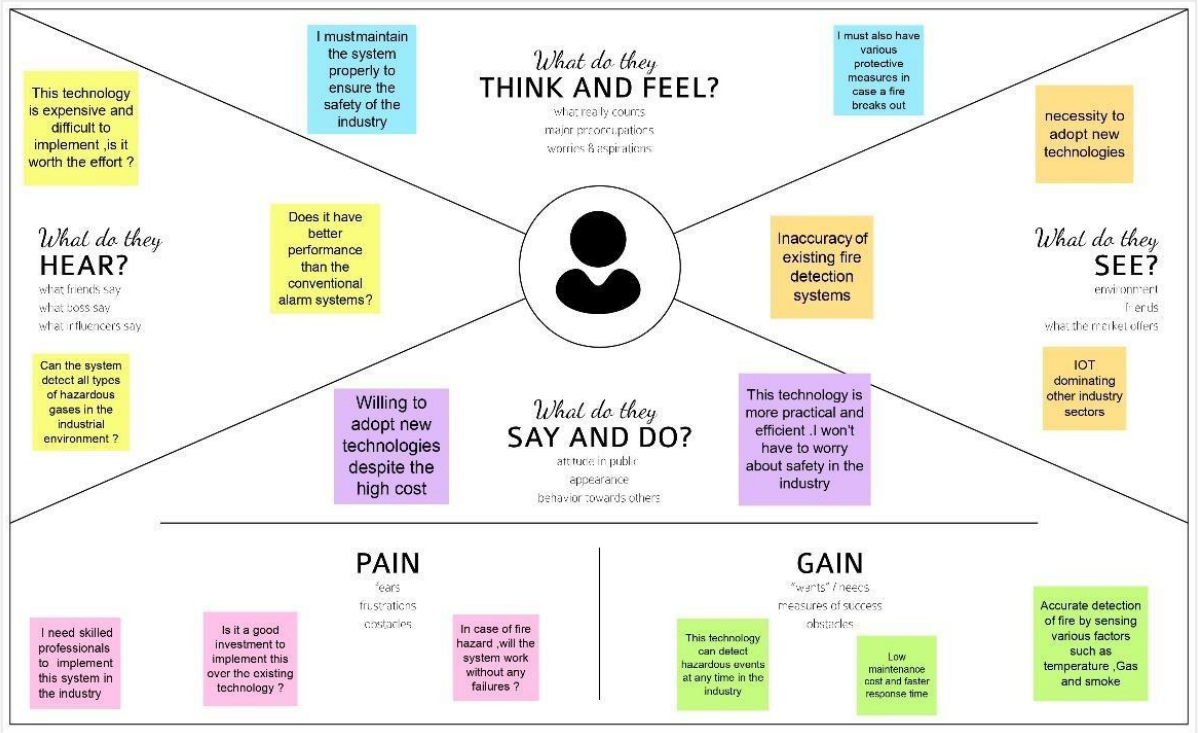
## 2.3. PROBLEM STATEMENT

| Problem Statement (PS) | I am | I'm trying to | But | Because | Which makes me feel |
|---|---|---|---|---|---|
| PS-1 | A worker | Work in a petrol bunk | It is not safe | Public are using mobile phones in petrol bunk which leads to fire explosion | Insecure and scary |
| PS-2 | An employee | Work in a cracker company | It is not safe | There are no safety measures to avoid fire accidents | Unsafe and scary |

# 3.IDEATION & PROPOSED SOLUTION

## 3.1. EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



## 3.1. IDEATION & BRAINSTORMING

## 3.2. PROPOSED SOLUTION

This paper review about the current research, technologies and applications of IoT in fire related industries. This paper done a survey of identifying research trends and challenges in fire industries and summarizes systematically. The fire IoT aims to connect different things over the networks related with fire. Service Oriented Architecture is applied to support fire IoT. In that layers interact each other for monitoring fire and products. This paper functionally realizes some of the layer required for fire monitoring and industry.

Sensing layer is functionally realized with WSN node with sensors, RFID tagged device and Video node for fire and product monitoring. All things such as sensor network, mobile network are connected together in the network layer. Service layer and interface layer are used to realize Mobile node data, WSN node data display and graph display for the fire related parameters.

## 3.3. PROBLEM SOLUTION FIT

# 4. COMPONENTS USED:

- Arduino uno
- Esp32
- Flame sensor
- Buzzer
- Jumper wires
- 12v power supply adapter
- Led lights
- Smoke sensor
- Sprinkler

## ARDUINO UNO:

Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

## ESP32:

ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces.

## FLAME SENSOR:

A flame detector is a type of sensor that can detect and respond to the presence of a flame. These detectors have the ability to identify smokeless liquid and smoke that can create open fire. For example, in boiler furnaces flame detectors are widely used, as a flame detector can detect heat, smoke, and fire The IR flame sensor is used to detect the presence of fire or other infrared source (Flame or a light source of a wavelength in the range of 760 nm to 1100 nm can be detected).

## BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short).

Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. The fire alarm will only sound when a fire broke out so it'll need to be loud and alarming to evacuate the people. When a voltage is applied across the two electrodes, the piezoelectric material mechanically deforms due to the applied voltage. This movement of the piezo disk within the buzzer creates sound in a similar manner as the movement of the ferromagnetic disk in a magnetic buzzer or the speaker cone mentioned above.

## JUMPER WIRES:

Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering. You can use jumper wires to modify a circuit or diagnose problems in a circuit. jumpers are mostly used to replace the need for bulky wires to connect multiple points but are not in many cases, always necessary. However, they do make the job much easier.

## 12V POWER SUPPLY ADAPTER:

A power supply. A 12VDC power supply is a device that supplies electrical energy to a load. In other words, a power supply's primary purpose is converting electric current from the source into the required voltage, frequency, and current, which powers the load.

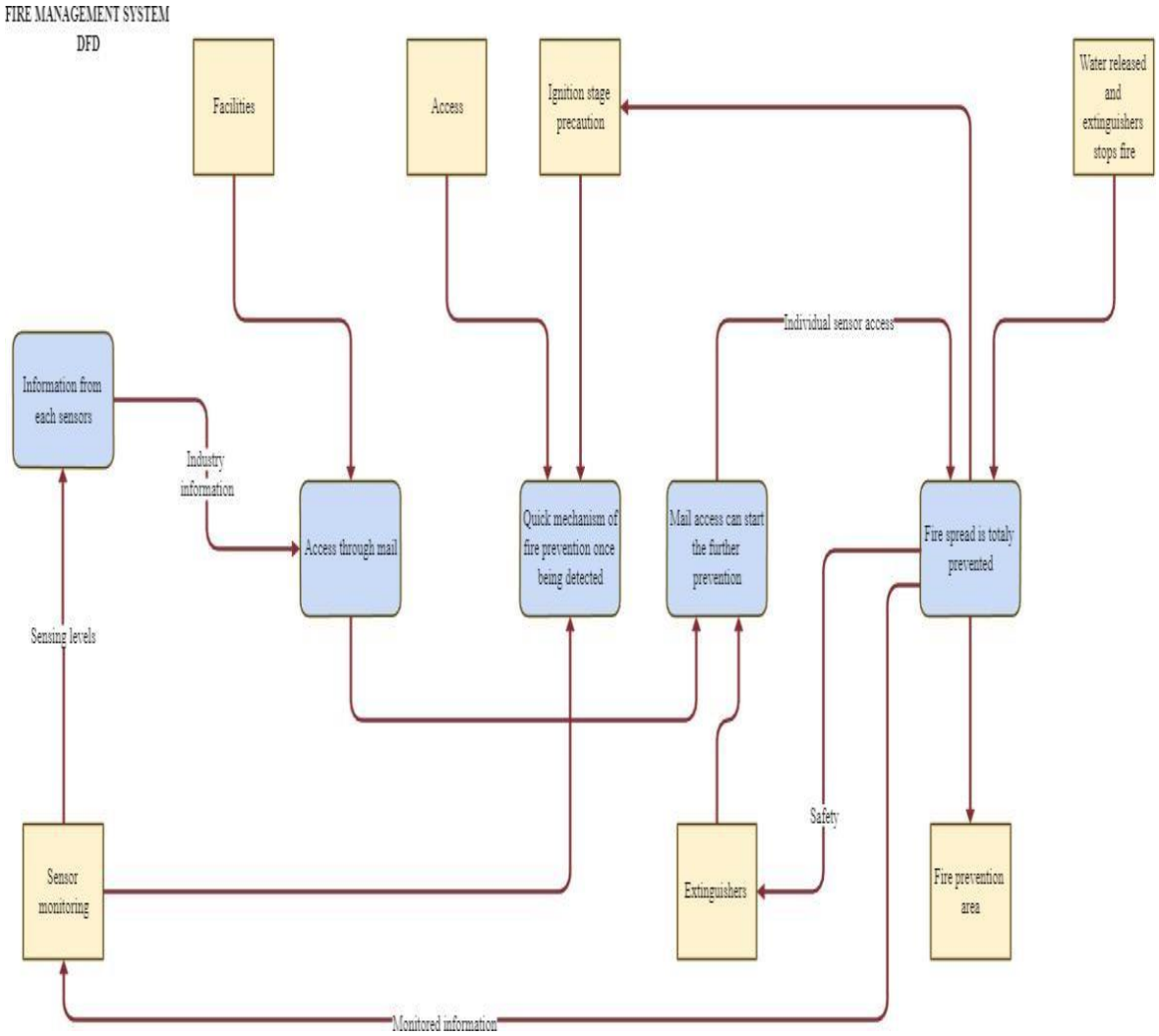
## LED LIGHTS:

When it comes to safety notification you want a light that you can depend on. LEDs aren't just energy efficient, with low power

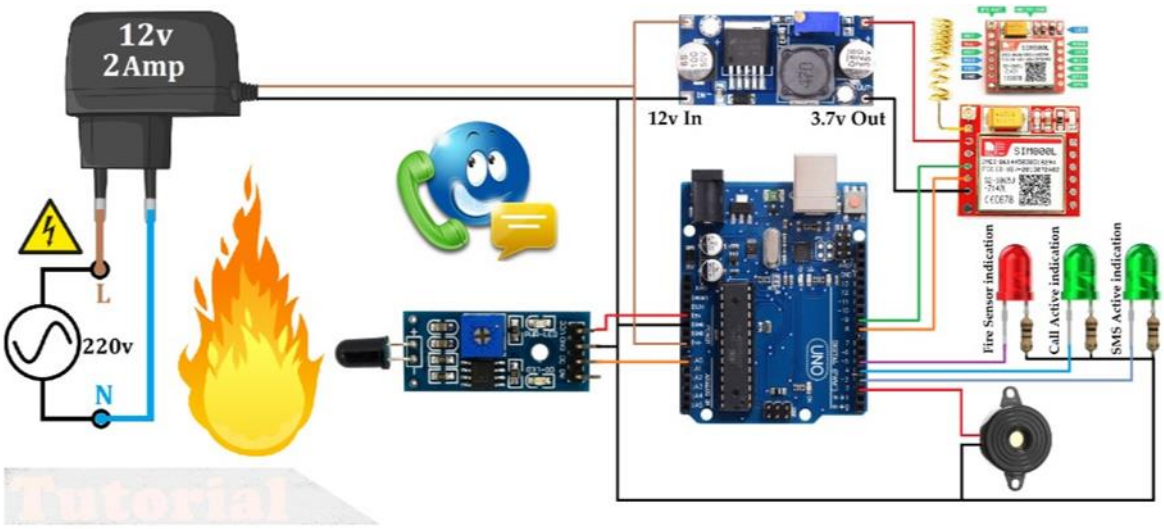
consumption, operating on a very low voltage, they also have a long lifespan and high-intensity bright light output.

# 5. PROJECT DESIGN

## 5.1.DATA FLOW DIAGRAMS



# CIRCUIT DIAGRAM




# 5.2. USER STORIES

| User Type | Functional requirement | User story number | User story/task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Mobile user, Web user, Care executive, Administrator) | Registration | USN-1 | As a user, I can register for the application by entering my mail, password, and confirming my password | I can access my account/ dashboard | High | Sprint-1 |
| | | USN-2 | As a user, I will receive confirmation | I can receive confirmation email & click | High | Sprint-1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | email once I have registered for the application | confirm | | |
| | Dashboard | USN-3 | As a user, I can register for the application through internet | I can register & access the dashboard with Internet login | Low | Sprint-2 |
| | | USN-4 | As a user, I can register for the application through Gmail | I can confirm the registration in Gmail | Medium | Sprint-1 |
| | Login | USN-5 | As a user, I can log into the application by entering email & password | I can login with my id and password | High | Sprint-1 |

# 6. PROJECT PLANNING AND SCHEDULING

## 6.1. SPRINT PLANNING & ESTIMATION

## 6.2. SPRINT DELIVERY SCHEDULE

## 6.3. REPORTS FROM JIRA

# 7. CODING & SOLUTIONING

## 7.1. FEATURE 1

## 7.2. FEATURE 2

# 8. TESTING

## 8.1. TEST CASES

## 8.2. USER ACCEPTANCE TESTING

# 9. RESULTS

## 9.1. PERFORMANCE METRICS

# 10. ADVANTAGES & DISADVANTAGES

### ADVANTAGES

- Reduced man power
- Economical
- Improvised solution
- Accurate and faster action

### DISADVANTAGES

- Timely monitoring
- Prone to natural actions
- Low range
- Limited access of users

# 11. CONCLUSION

The project deals with providing an improvised solution to the society to safeguard them from the hazards of fire. the product produced has so many

improvised and better form of solution compared to the existing fire alarms in the market. In the fire alarm system when there is a breakdown of fire In the given range the fire alarm senses the danger and produces a high pitch sound on the buzzer which alerts the people nearby and also the led light blinks and indicates the place of the fire break down along with these actions the alarm kit has a feature in which it sends the user connected with the system the fire warning message which alerts the person who has set the alarm for example the owner of the house/building , banks and offices etc. Thus helps in reducing the damage caused by the fire like the quote says “prevention is better then cure” .

## 12. FUTURE SCOPE

In every industry or apartment or a house there is always danger of fire breakdown so in order to prevent major damages and to alert the people fire alarms are used very importantly. as there is lot of advancement in technologies the society also demands for advanced ideas. This project of industry specific intelligent fire

management system is developed using very economical components unlike the other fire alarm system it doesn't only buzz but it also sends message to the user who is installing via SMS or iot based liked cloud and notifies the user. so even in remote areas or properties on island can be protected from heavy loss due to breakdown of fire and early notification will be received to the user. since the project has extra added features and it budget friendly prices the project will become a big success in the society and be beneficial to the people

# 13. APPENDIX

## SOURCE CODE

```
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>

#define ORG "wt19pm"
#define DEVICE_TYPE "NodeMCU"
#define DEVICE_ID "12345"
#define TOKEN "12345678"

char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-
2/evt/data/fmt/json";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;

WiFiClient wifiClient;
PubSubClient client(server, 1883, wifiClient);

float temperature  = 0;
```

```
int gas = 0;
int flame = 0;

String flame_status = "";
String Gas_status = "";
String exhaust_fan_status = "";
String sprinkler_status = "";


void setup() {
  Serial.begin(99900);
   wifiConnect();
   mqttConnect();
}

void loop() {

  srand(time(0));

    //initial variables and random generated data

    temperature = random(-20,125);
    gas = random(0,1000);
    int flamereading = random(200,1024);
    flame = map(flamereading,200,1024,0,2);

    //set a flame status

    switch (flame) {
    case 0:
        flame_status = "No Fire";
        break;
    case 1:
        flame_status = "Fire is Detected";
        break;
    }

    //send the sprinkler status

    if(flame==1){
        sprinkler_status = "Working";
    }
    else{
        sprinkler_status = "Not Working";

    }

    //toggle the fan according to gas reading
```

```
    if(gas > 100){
        Gas_status = "Gas Leakage is Detected";
        exhaust_fan_status = "Working";

    }
    else{
        Gas_status = "No Gas Leakage is Detected";
        exhaust_fan_status = "Not Working";
    }

    //json format for IBM Watson

    String payload = "{";
    payload+="\"gas\":";
    payload+=gas;
    payload+=",";
    payload+="\"temperature\":";
    payload+=(int)temperature;
    payload+=",";
    payload+="\"flame\":";
    payload+=flamereading;
    payload+=",";
    payload+="\"fire_status\":\""+flame_status+"\",";
    payload+="\"sprinkler_status\":\""+sprinkler_status+"\",";
    payload+="\"Gas_status\":\""+Gas_status+"\",";
    payload+="\"exhaust_fan_status\":\""+exhaust_fan_status+"\"}";

    if(client.publish(publishTopic, (char*) payload.c_str()))
    {
        Serial.println("Publish OK");
    }
    else{
        Serial.println("Publish failed");
    }
    delay(1000);


    if (!client.loop())
    {
      mqttConnect();
    }
}


void wifiConnect()
{
  Serial.print("Connecting to ");
  Serial.print("Wifi");
  WiFi.begin("Wokwi-GUEST", "", 6);
```

```
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.print("WiFi connected, IP address: ");
  Serial.println(WiFi.localIP());

}


void mqttConnect()
{
  if (!client.connected())
  {
    Serial.print("Reconnecting MQTT client to ");
    Serial.println(server);
    while (!client.connect(clientId, authMethod, token))
    {
      Serial.print(".");
      delay(500);
    }

    Serial.println();
  }
}
```

# GITHUB & PROJECT DEMO LINK

https://github.com/IBM-EPBL/IBM-Project-49882-1660882154