INDUSTRY SPECIFIC FIRE MANAGEMNT SYSTEM

IBM NAALAIYA THIRAN

(TEAM ID:PNT2022TMID09807)

A PROJECT REPORT

Submitted by:

Team Leader : Gnanasekar.M

Team Member : Jeevarasan.M

Team Member : Dinesh.E

Team Member : Arun.K

Table of content

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 beexecuted 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 SoftwareDelivery 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.

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 alow cost yet efficient IoTsystem called Fire Not for warning and alerting fire

incidents. Fire Notis 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

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

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.

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

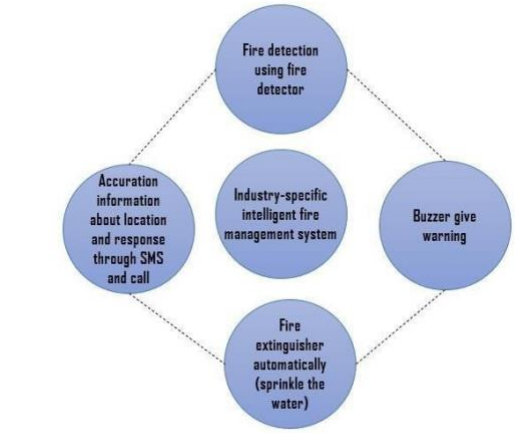
3. IDEATION & PROPOSED SOLUTION

Project Design Phase-I

Proposed Solution

Proposed Solution Template:

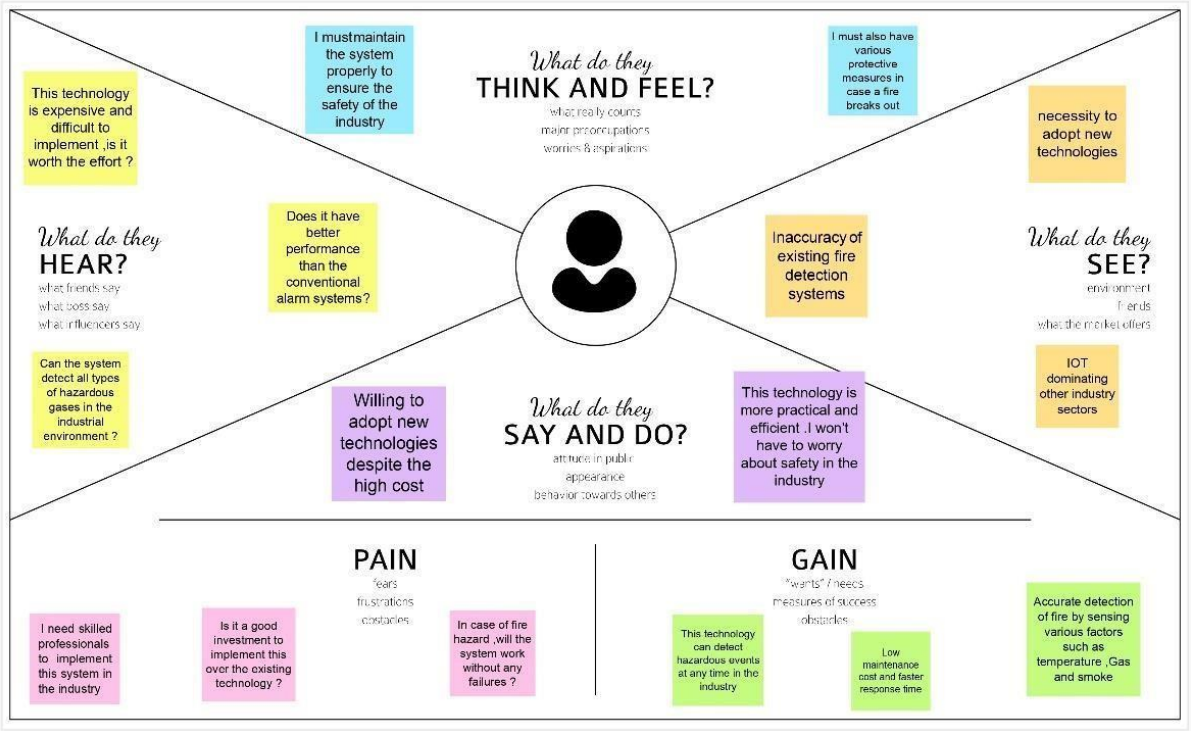
S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To improve the safety management system in industries. Improving the safety management system against the fire incidents in industries.
2.	Idea / Solution description	To implement the fire safety management in industry based on IOT using Arduino uno board with fire detection and fire extinguisher system. And using some sensors (Humidity sensor, Flame sensor, smoke sensor) with GPS tracking system.

3.	Novelty / Uniqueness	An integrated system of temperature monitoring, gas monitoring, fire detection automatically fire extinguisher with accusation of information about locations and response through SMS notification and call.
4.	Social Impact / Customer Satisfaction	▪ It early prevents the accident cost by fire in industries. ▪ Nearby locations so maximum extend more accurate reliability. ▪ Compatibility design integrated system.
5.	Business Model (Revenue Model)	
6.	Scalability of the Solution	▪ This project can be used more efficiently with accurate information requiring. ▪ Easy operability and maintenance. Required low time for maintain Cost is reasonable value.

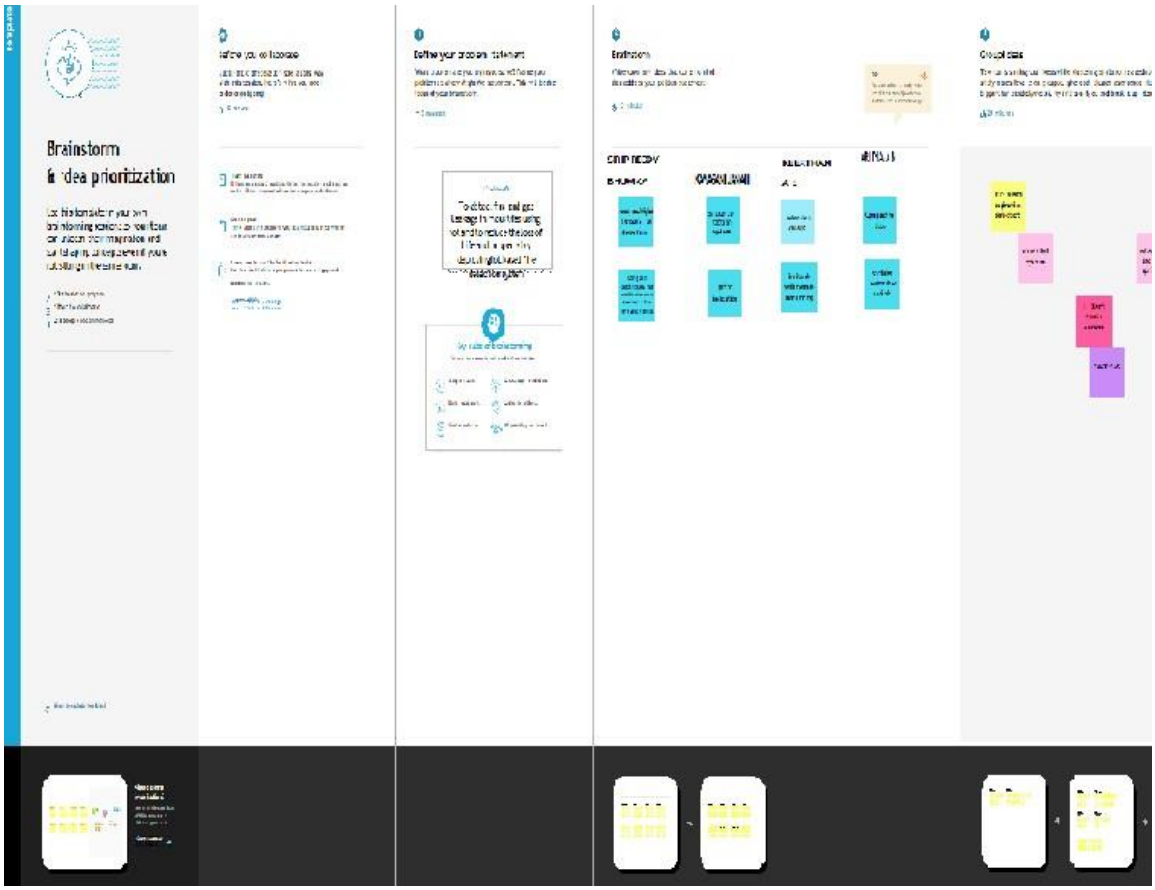
Empathy Map Canvas

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

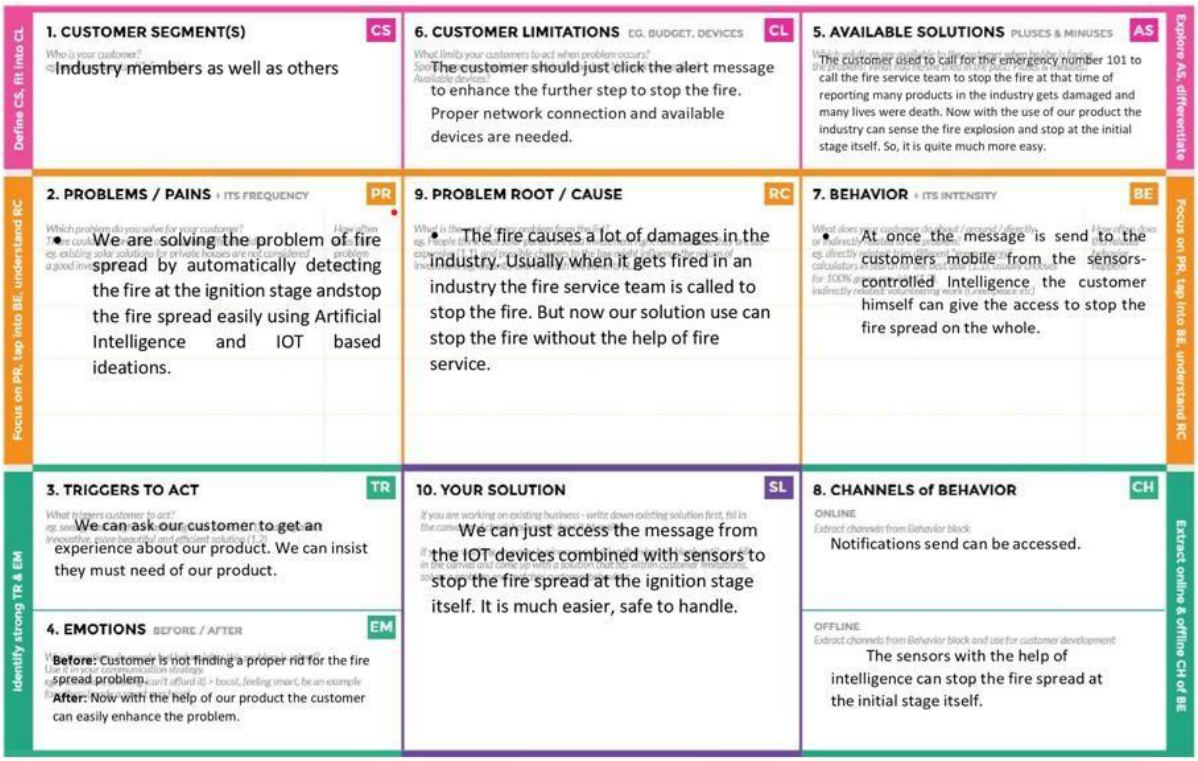


Proposed solution

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, RFIDtagged 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.

Problem Solution fit



4. Components used:

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

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 theferromagnetic 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:

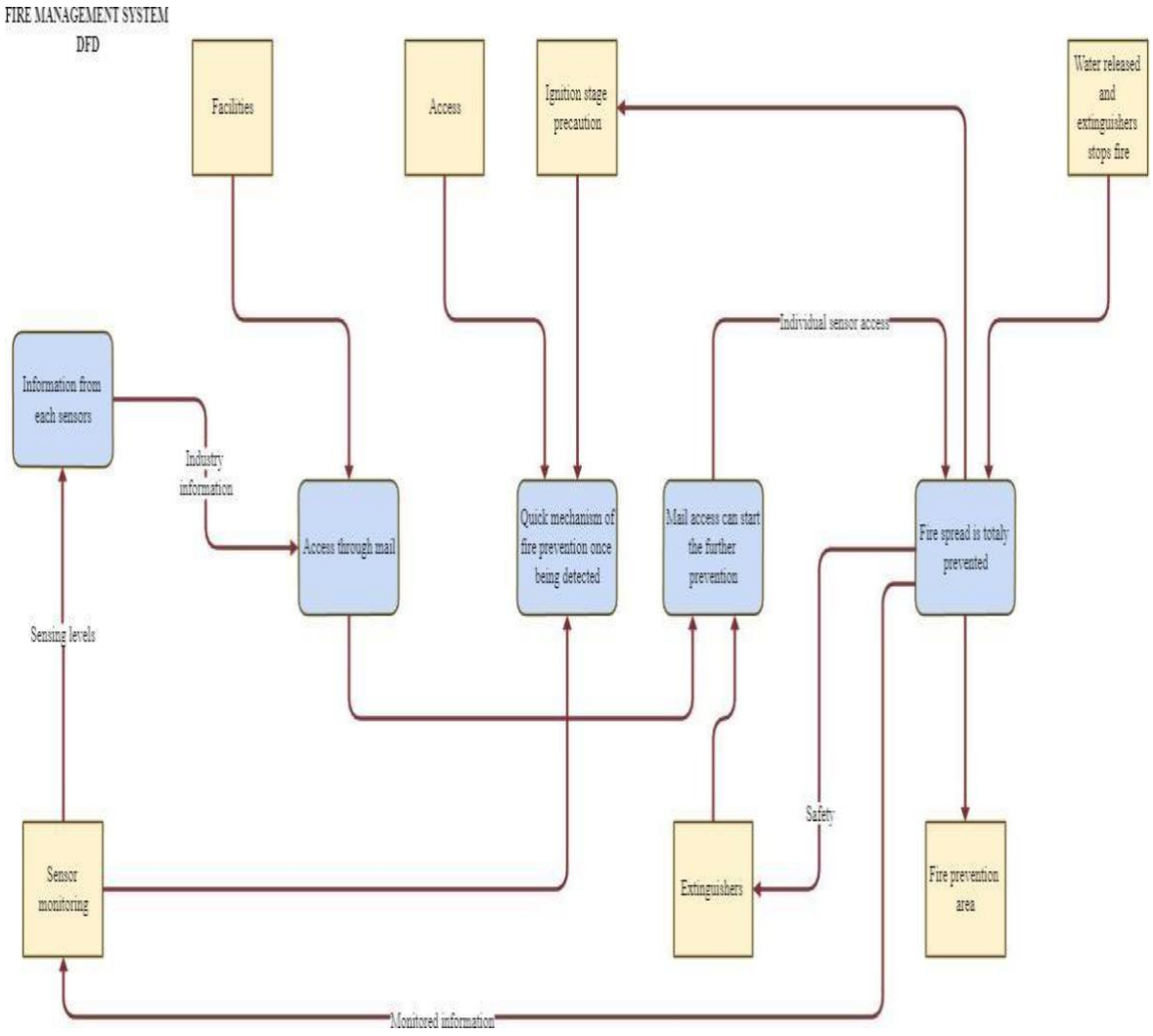
A power supply. A 12VDC power supply is a device that supplies electrical energy to a load. In other words, a power supply's primary purpose is converting electric current from the source into the required voltage, frequency, and current, which powers the load.

Led lights:

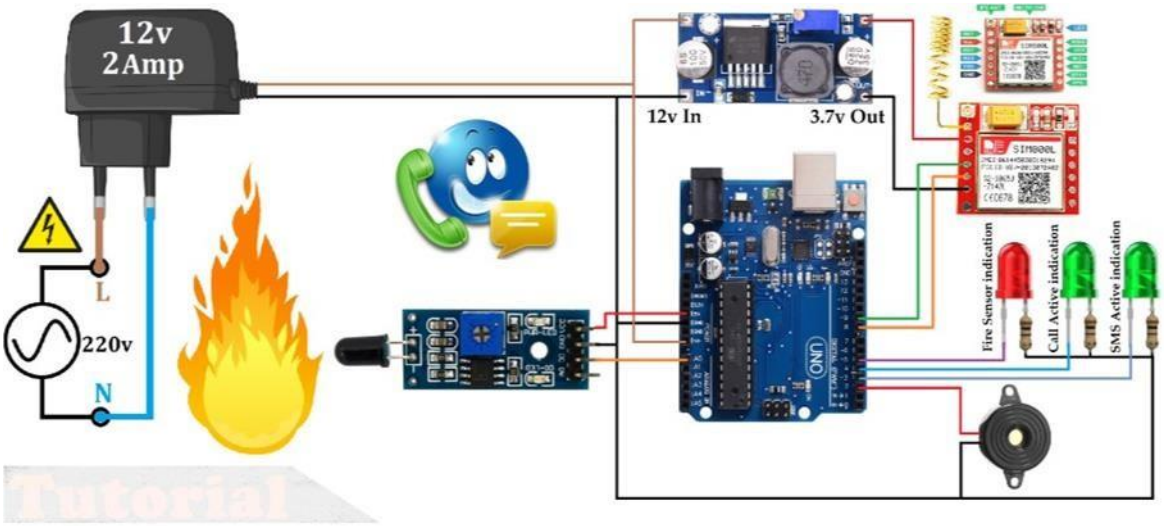
When it comes to safety notification you want a light that you can depend on. LEDs aren't just energy efficient, with low power consumption, operating on a very low voltage, they also have a long lifespan and high-intensity bright light output.

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 email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
	Dashboard	USN-3	As a user, I	I can register	Low	Sprint-2

			can register for the application through internet	&access the dashboard with Internet login		
		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

Sprint Planning & Estimation

Sprint Delivery Schedule

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Product Backlog, Sprint Schedule, and Estimation (4 Marks)Use the below template to create product backlog and sprintschedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Login	USN-1	As a customer , I might ensure login credentialthrough gmail ease manner for the purpose of sending alert message to the owner.	2	High	Gnanasekar
Sprint-1	Registration	USN-2	As a user , I have to registered my details and tools details in a simple and easy manner in case of fire incident, this registered system sends notification to the industrialist.	2	High	Jeevarasan
Sprint-2	Dashboard	USN-3	As a user, In case of Fire in the industry I need the sprinkler to spray water on the existingfire automatically.	2	Low	Dinesh
Sprint-1	Dashboard	USN-4	As a user , I need to safeguard my properties as well as and it will be better to send alertmessage to the fire department.	2	Medium	Arun
Sprint-1	Dashboard	USN-5	As a user , Its good to have a IOT based system to extinguish the fire without humanpresence.	2	High	Gnanasekar

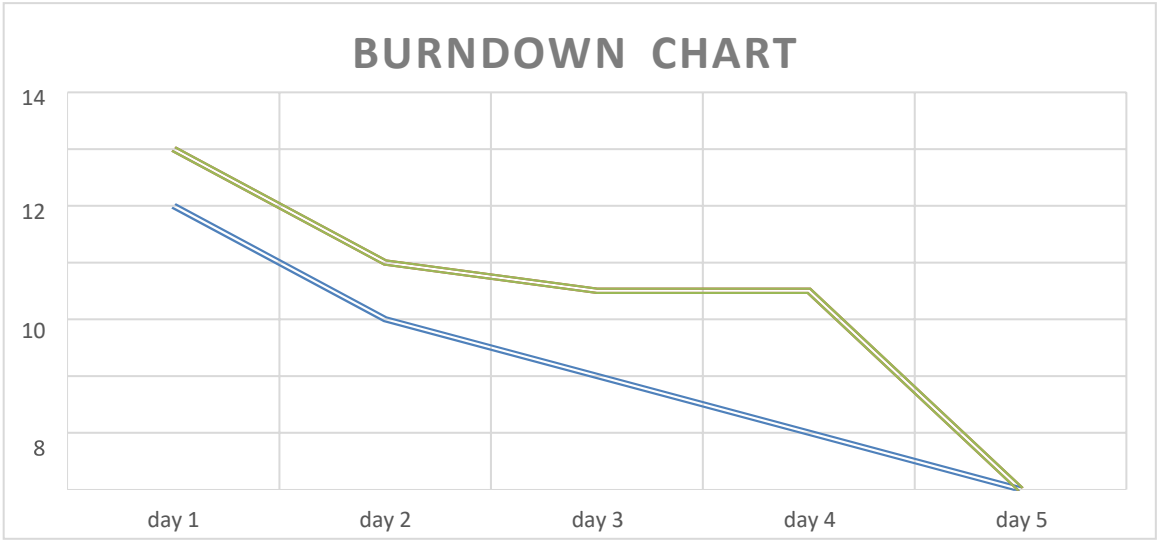
Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as onPlanned End Date)	Sprint Release Date(Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity(AV) perliteration unit (story points per day



TESTING

Test Cases

User Acceptance Testing

Acceptance Testing

UAT Execution & Report Submission

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the Industry-specific intelligent fire management system project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	0	0	1	8
Totals	24	14	13	26	70

3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print the Sensor values	7	0	0	7
Client Mobile Application	51	0	0	51
Security	2	0	0	2

Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

ADVANTAGES & DISADVANTAGES

Advantages

- Reduced man power
- Economical
- Improvised solution
- Accurate and faster actionDisadvantages
- Timely monitoring
- Prone to natural actions
- Low range
- Limited access of users

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” .

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

APPENDIX

Source Code

```
#include
"DHTesp.h
"
```

```
#include <cstdlib>
#include <time.h>
#include <WiFi.h>
#include <PubSubClient.h>
#define ORG "b7ywuf"
#define DEVICE_TYPE "abcd"
#define DEVICE_ID "12"
#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);
const int DHT_PIN = 15;
bool is_ventilator_on = false;
bool is_sprayer_on = false;
float temperature  = 0;
int gas_ppm = 0;
int blaze = 0;
int flow = 0;
String blaze_status = "";
String hazard_status = "";
String sprayer_status = "";
```

```
DHTesp dhtSensor;
void setup() {
  Serial.begin(99900);
  /**** sensor pin setups ****/
  dhtSensor.setup(DHT_PIN, DHTesp::DHT22);

   wifiConnect();
   mqttConnect();
}
void loop() {
  TempAndHumidity  data = dhtSensor.getTempAndHumidity();

  srand(time(0));
  //initial variable activities
  temperature  = data.temperature;
  gas_ppm = rand()%1000;
  int flamereading = rand()%1024;
  blaze = map(flamereading,0,1024,0,1024);
  int flamerange = map(flamereading,0,1024,0,3);
  int flow = ((rand()%100)>50?1:0);
  //set a blaze status based on how close it is.....
  switch (flamerange) {
  case 2:    // A fire closer than 1.5 feet away.
    blaze_status = "Close Fire";
    break;
  case 1:    // A fire between 1-3 feet away.
    blaze_status = "Distant Fire";
    break;
  case 0:    // No fire detected.
    blaze_status = "No Fire";
    break;
  }
  //toggle the fan according to gas in ppm in the room
  if(gas_ppm > 100){
    is_ventilator_on = true;
  }
  else{
    is_ventilator_on = false;
  }
  //find the hazard status 'cause fake alert may be caused by some mischief
activities
  if(temperature < 40 && flamerange ==2){
    hazard_status = "need auditing";
    is_sprayer_on = false;
  }
  else if(temperature < 40 && flamerange ==0){
```

```
  hazard_status = "nothing found";
  is_sprayer_on = false;
 }
 else if(temperature > 50 && flamerange == 1){
  is_sprayer_on = true;
  hazard_status = "moderate";
 }
 else if(temperature > 55 && flamerange == 2){
  is_sprayer_on = true;
  hazard_status = "severe";
 }else{
  is_sprayer_on = false;
  hazard_status = "nil";
 }
 //send the sprayer status
 if(is_sprayer_on){
  if(flow){
   sprayer_status = "working";
  }
  else{
   sprayer_status = "not working";
  }
 }
 else if(is_sprayer_on == false){
  sprayer_status = "now it shouldn't";
 }
 else{
  sprayer_status = "something's wrong";
 }
 //Obivously the output.It is like json format 'cause it will help us for future
sprints
 String payload = "{\"sensor_values\":{";
 payload+="\"gas_ppm\":";
 payload+=gas_ppm;
 payload+=",";
 payload+="\"temperature\":";
 payload+=(int)temperature;
 payload+=",";
 payload+="\"blaze\":";
 payload+=blaze;
 payload+=",";
 payload+="\"flow\":";
 payload+=flow;
 payload+="},";
 payload+="\"output\":{";
```

```
payload+="\"is_ventilator_on\":"+String((is_ventilator_on)?"true":"false")+","
;
  payload+="\"is_sprayer_on\":"+String((is_sprayer_on)?"true":"false")+"";
  payload+="},";
  payload+="\"messages\":{";
  payload+="\"fire_status\":\""+blaze_status+"\",";
  payload+="\"flow_status\":\""+sprayer_status+"\",";
  payload+="\"hazard_status\":\""+hazard_status+"\"";
  payload+="}";
  payload+="}";
  //Serial.println(payload);

  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