

Industry-Specific Intelligent Fire Management System

Nalaiya Thiran - Project Report

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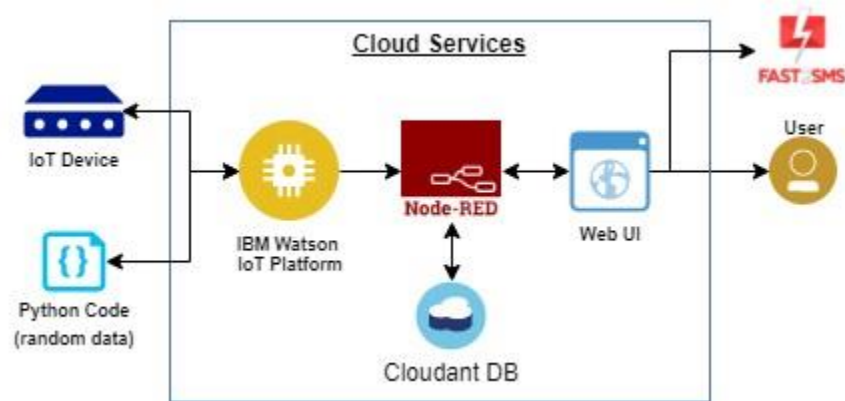
1.INTRODUCTION

Industrial intelligent fire management system that can control security and safety of the industry intelligently within the minimum time and the design of a system using wireless sensor networks, fire alarm sensor, and human detecting sensor to address the problems with existing disaster emergency response systems in times of fire hazard. To address this problem, this study aims to implement a smart fire detection system that would not only detect the fire using integrated sensors but also alert industry owners, emergency services, and local police stations to protect lives and valuable assets simultaneously. The proposed model of our project employs different integrated detectors, such as heat, smoke, and flame. The signals from those detectors go through the system algorithm to check the fire's potentiality and then broadcast the predicted result to various parties using GSM modem associated with the system. To get real-life data without putting human lives in danger, an IoT technology has been implemented to provide the fire department with the necessary data. Finally, the main feature of the proposed system is to minimize false alarms, which, in turn, makes this system more

a. Project Overview

- i. Sending random fire and temperature values will be sent to the IBM IoT platform
- ii. Sensors values can be viewed in the Web Application

- iii. Notifies the admin the random values cross the threshold value
- iv. Create and configure IBM Cloud Services
- v. Create IBM Watson IoT Platform
- vi. Create a device & configure the IBM IoT Platform
- vii. Create Node-RED service
- viii. Create a database in Cloudland to store location data
- ix. Develop a web Application using Node-RED Service.
- x. Develop the web application using Node-RED



b.Purpose

- i. To prevent and suppress unwanted fires by rendering prompt and efficient services so as to keep the loss of life and property to the minimum.
- ii. To reduce amounts of flammable and combustible materials.
- iii. To reduce ignition hazards.
- iv. To ensure safe emergency evacuation of occupants.
- v. To allow for quick emergency response.

2.LITERATURE SURVEY

The related work of the existing solutions were studied in the various technical papers and referred in the Research Publications.

1. Ahmed Imteaj et.al. Studied the problems faced by factory workers in times when fire breaks out. They proposed a system using Raspberry Pi 3 which is capable of detecting fire and providing information about area of fire. The Raspberry Pi controls multiple Arduino boards which are connected with several motors and cameras to capture the fire incident. In their proposed model, they discussed about the modern technology that can be used to reduce extremely unfortunate accidents caused by fire; designed the whole system and calculated its effectiveness.
2. Ondrej Krejcar proposed a model for location enhancement and personnel tracking using Wi-Fi networks. The project has represented the control system concept that is used in handling information of location and control unit operations. The location of the user present in the building, is obtained through Wi-Fi access points. From this point, it is to understand the usability

of the Wi-Fi networks in live tracking and then have utilized this functionality to track fire and give information about location of fire to various devices intimating people about the mishap.

3. “Design and Implementation of a fire detection and control system for automobiles using fuzzy logic” is used to get the safety features in home and industrial areas. They have designed new model using WSN. Not only have they incorporated temperature and humidity sensors but

also included fire and smoke sensors while developing the model. They present a preceding study of WSN is able to detect fire alarm. It is for setting up a wireless sensor network with three sensors. An application was developed for getting home information

4. Azka Ihsan Nurrahman, Kusprasapta Mutijarsa have proposed a prototype for a centralized management system for homes or offices which helps better in managing the safety features. In this, home management system is required. This system controls the room lights by turning on and off automatically, it keeps the record of use of electronic device status, turning on and off the ac regulator automatically, it displays the room temperature in home. If fire is detected in the house, it turn on sprinkler at home, it supervises at home via surveillance cameras, take photos and store them including recordings of surveillance at home, it detects the movements of people at home, and provide notification when someone enters the house
5. An efficient smart emergency responses system for fire hazards using IoT is explained in detail which provide a quality public safety and security services

to adopt leveraged data driven emergency responsesystems with urban IoT design standards.

6. An intelligent fire detection and mitigation system safe from fire is being specified in detail with proper safety system.
7. The design and Implementation of a fire detection and control system for automobiles using fuzzy logic is given with early detection and exact fire location detection using fuzzy logic.
8. The efficiency increase for electrical fire detection and alarm system through implementation of fuzzy expert systems is explained with high efficiency detection system.

a. Existing Problem

- i. On the edge of the system, there are pieces of hardware that detect the fire. The hardware includes- Fire Panel systems or sensors for smokes or gas leakages.
- ii. The next level in the architecture comprises of hardware that is responsible for communicating with the prior layer by the means of either wired means or wireless RF signals.

- iii. RS-485 is an industrial specification that defines the electrical interface and physical layer for point-to-point communication of electrical devices.
- iv. Prior layer consists of hardware like Nodes, Hubs or Gateways and these hardware devices have Internet access by wired or wireless means.

b.Reference

1. Lakshmana Phaneendra Maguluri, Tumma Srinivasarao, Maganti Syamala, R. Ragupathy, N.J. Nalini, "Efficient Smart Emergency Response System for Fire Hazards using IoT", International Journal of Advanced Computer Science and Applications, Vol. 9, No. 1, 2018.
2. MD Iftekharul Mobin, MD Abid-Ar-Rafi, MD Neamul Islam and MD Rifat Hasan, "An intelligent fire detection and mitigation system safe from fire (sff)", International journal of computer applications (0975 - 8887), volume 133 - no.6, January 2016.
3. MS. Vidhy Khule, MS. Divya Dhagate and MS. Rajashree Kadam, "Design and Implementation of a fire detection and control system for automobiles using fuzzy logic", ISSN: 2277-9655, April, 2017.
4. Ionuț-Lucian Homeag, Radu Pârlog-Cristian and Mircea Covrig, "Efficiency increase for electrical fire detection and alarm systems

through implementation of fuzzy expert systems”, ISSN: 1454-234x, 2013.

5. Aiswarya Muralidharan and Fiji Joseph, “Fire Detection System Using Fuzzy Logic”, ISSN: 2277-9655, April, 2014.
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7. Li Da Xu, Wu He and Shancang Li, “Internet of Things in Industries: A Survey”, IEEE Transactions on Industrial Informatics, November 2014. [8]
Chang-Su Ryu, “IoT-based Intelligent for Fire Emergency Response Systems”, International Journal of Smart Home, 2015.
8. ZHANG Ying-cong, YU Jing, “A Study on the Fire IOT Development Strategy”, Procedia Engineering 52 (2013).
9. Vikshant Khanna, Rupinder Kaur Cheema, “Fire Detection Mechanism using Fuzzy Logic”, International Journal of Computer Applications (0975 – 8887), Volume 65– No.12, March 2013.

C. Problem statement Definition

There was an industry outside the town. One day the industry was on an fire accident, the employees stopped the machines and ran outside the industry and they informed the incident to the fire station around. Then the fire officer arrived the industry and they controlled the fire with a minimal damage.

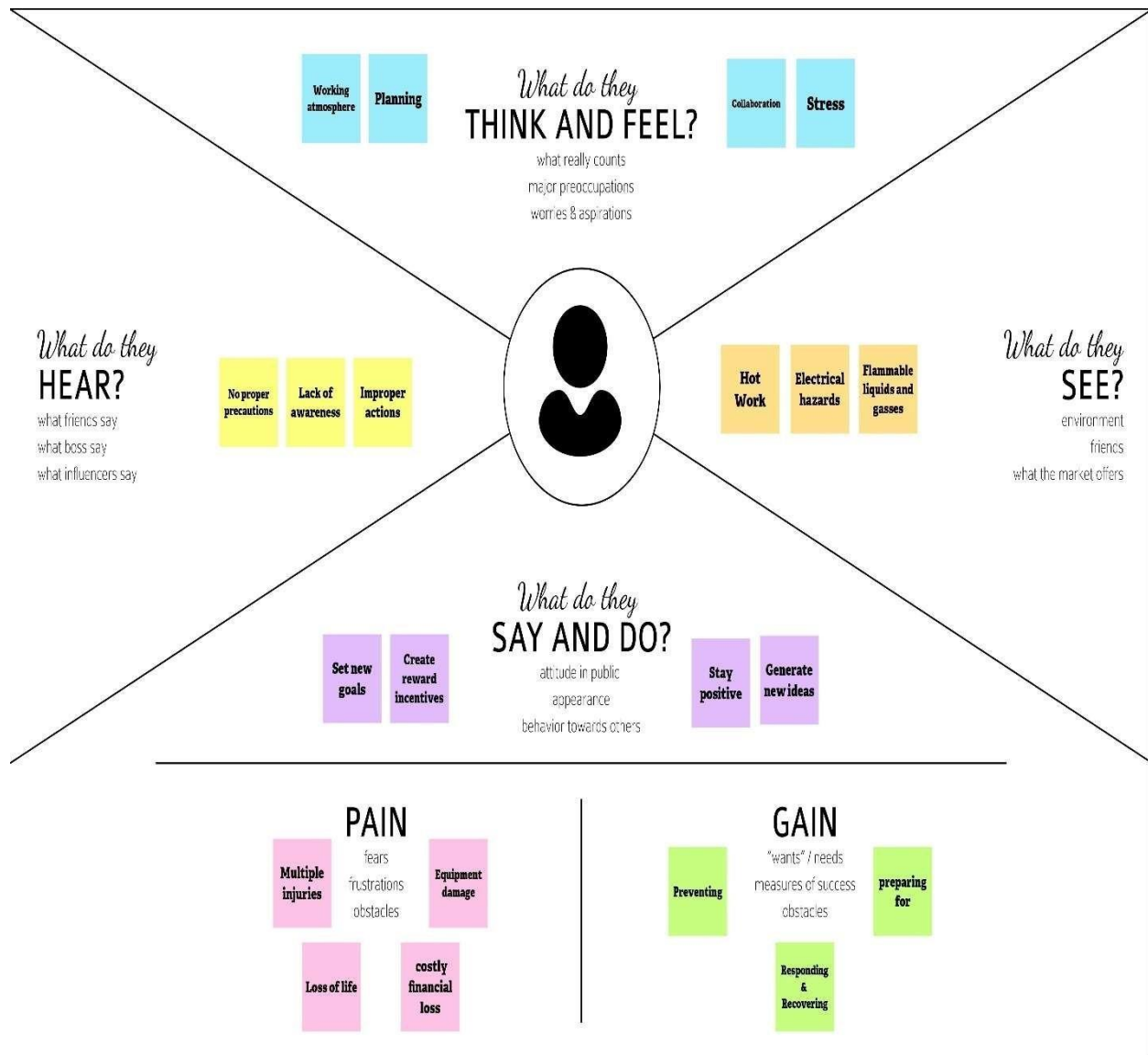
Who does the problem affect?	Working People, Proprietor, Share Holder, Loss of Life, Surrounding Environment etc
What are the boundaries of the problem?	Fire station, Hospitals, Industries
What is the issue?	Fire Alarms should be checked Periodically, Electrical Hazards, Combustible Dust, Hot Work, Flammable Liquids and Gasses, Equipment and Machinery, Smoking.
When does the issue occurs?	Lack of Awareness, Improper Maintenance, False Alarm
Where is the issue occurring?	Industry-Machinery place, Power control Room, Cooking Place.
Why is it important that we fix the problem?	It can help Avoid Injuries, Loss of Life, Costly Damages, Reduce Damage to Facility/building, Protect against Potential Fines, 24/7 Protection.

3.IDEATION & PROPOSED SOLUTION

Ideation is the process where you generate ideas and solutions through sessions such as Sketching, Prototyping, Brainstorming, Brain writing, Worst Possible Idea, and a wealth of other ideation techniques. Ideation is also the third stage in the Design Thinking process.

Although many people might have experienced a “brainstorming” session before, it is not easy to facilitate a truly fruitful ideation session. In this article, we’ll teach you some processes and guidelines which will help you facilitate and prepare for productive, effective, innovative and fun ideation sessions. Ideation is often the most exciting stage in a Design Thinking project, because during Ideation, the aim is to generate a large quantity of ideas that the team can then filter and cut down into the best, most practical or most innovative ones in order to inspire new and better design solutions and products.

a. Empathy Map canvas



b. Ideation & Brainstorming



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

🕒 10 minutes to prepare
🕒 1 hour to collaborate
👤 2-8 people recommended

🗨️ Share template feedback



Need some inspiration?
See a finished version of this template to kickstart your work.
[Open example](#) →



Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes

A Team gathering
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B Set the goal
Think about the problem you'll be focusing on solving in the brainstorming session.

C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) →

1

Define your problem statement

There was an industry outside the town. One day the industry was on an fire accident, the employees stopped the machines and ran outside the industry and they informed the incident to the fire station around. Then the fire officer arrived the industry and they controlled the fire with an minimal damage

🕒 5 minutes



Key rules of brainstorming

To run an smooth and productive session:

- 😊 Stay in topic.
- 💡 Encourage wild ideas.
- 👂 Defer judgment.
- 👂 Listen to others.
- 🗣️ Go for volume.
- 👁️ If possible, be visual.

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⌚ 10 minutes

TIP
You can collect a sticky note and hit the pencil icon to sketch from to start creating!

HARIPRASAD**SATHEESH****ATHULRAJ****SELVARAM**

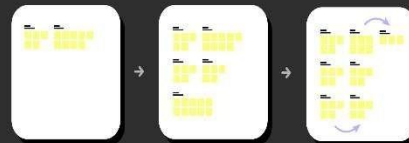
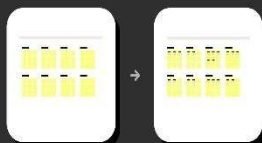
3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

⌚ 20 minutes

TIP
Add a sub-label to help to clarify notes to make it easier to find, browse options, and categorize or group functions as they relate to your goal.

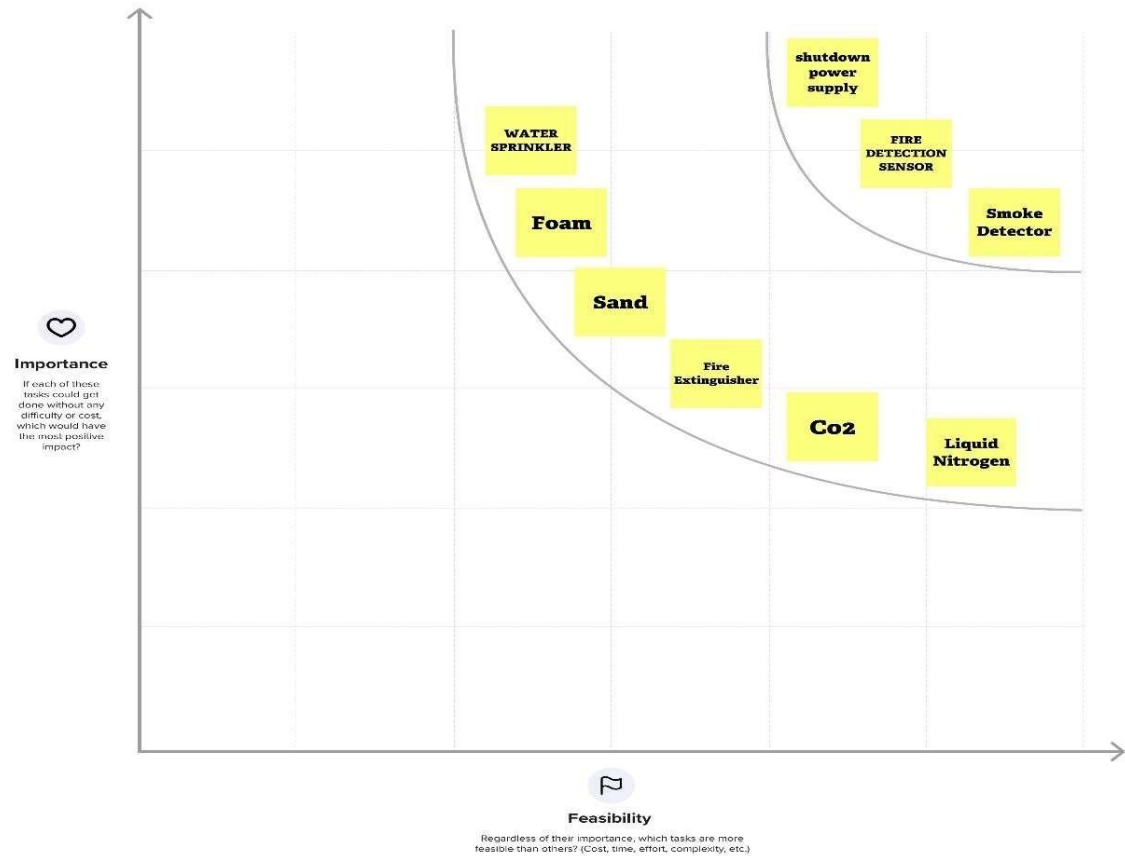


4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes



C. proposed Solution

Parameter	Description
Problem Statement (Problem to be solved)	There was an industry outside the town. One day the industry was on a fire accident, the employees stopped the machines and ran outside the industry and they informed the incident to the fire station around. Then the fire station team arrived the industry and they extinguished the fire witha minimal damage.

Idea / Solution description	<p>In an event of electrical fire accident , there are some precautionary measures that are to be followed ,</p> <ol style="list-style-type: none"> 1. The IoT based Circuit Breaker to be used.A circuit breaker is an electrical switch designed to protect an electrical circuit from damage caused by overcurrent/overload or short circuit. Its basic function is to interrupt current flow after protective relays detect a fault. 2. IoT security camera to be used for Monitor who is entering and leaving a building in real-time. The oxygen supply should be cut off in that place when there is no employee, which will completely shut down the fire in that place. If oxygen cannot be cut off when the employee is present in that place so, use sodium bicarbonate which can be used in the event of electric fire where we can't use water in such incident. These are all monitor and controlled by Iot.
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Novelty / Uniqueness	chemicals and halogenated hydrocarbons (Halogens), interrupt the flame-producing chemical reaction and stop flaming

Social Impact/ Customer Satisfaction	When a fireaccident takes placeyou should be in a position to extinguish the fire with minimal damagewhich will be the mainarea of the
---	--

	customer satisfaction.
--	------------------------

Business Model (Revenue Model)	<p data-bbox="792 195 1461 1123">Industrial-based intelligent smart emergency response system that can control security and safety of the industry intelligently within the minimum time and the design of a system using wireless sensor networks, fire alarm sensor, and human detecting sensor to address the problems with existing disaster emergency response systems in times of fire hazard. The system has decentralized control that can intelligently guide evacuees based on the detection of humans for removing them from industry to minimize the loss of human life and</p> <p data-bbox="792 1123 1461 1711">industrial assist. The existing system was able to secure the industry but not within enough time as the system was designed using various sensors but not as a single unit to address the problems in times of fire or any other. Each sensor was connected to the system separately and function individually which makes the system slow. The modified system can secure the industry intelligently within minimum time as the system is designed</p>
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using different sensors as a single unit to address the problems in times of fire or any other.

d. Problem Solution Fit

Problem-Solution fit canvas 2.0		Purpose / Vision	
Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids Large industries and enterprises like chemical industries, silk industries, hospitals, manufacturing factories etc.. are the main and prime customers of this project	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. The primary constraint of the fire detection system is to detect a developing fire prior to belt ignition, or as quickly as possible thereafter before the onset of rapid flame spread can begin. Smoke Detectors may not detect smoke in situations where smoke cannot reach the sensing chamber of the detector or when the amount of smoke present may not be adequate to trigger the alarm as the detectors are designed to trigger alarm at various smoke levels.	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking Nowadays industries use heat sensors, manual fire alarms and fire extinguishers are kept in the industries.
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. The primary purpose of fire alarm system is to provide an early warning of fire so that people can be evacuated & immediate action can be taken to stop or eliminate of the fire effect as soon as possible. Alarm can be triggered by using detectors or by manual call point (Remotely).	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. Fire in industries is a common thing. Hot work encompasses tasks like welding, sawing and drilling — anything that involves sparks or is a potential source for ignition. Fire and explosions can start from hot work when the sparks disperse and ignite any flammable items or substances nearby. Electrical hazards occur with exposed wiring, overloaded outlets or circuits and extension cords. These instances make for easy ignition. Any machinery that operates frequently or extensively can potentially be a fire and explosion hazard. Due to the friction of moving parts in machines and operations, these items can cause fires. Vehicles can run into similar fire and explosion risks as machinery. Some industrial and manufacturing vehicles break down due to poor maintenance or accidents.	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace) Increases response time. Reduces the amount of damage to the property. Automated response when fire is detected. Minimization of Costs. Easy to access.
3. TRIGGERS TR What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. If industries are installed with fire detection system, it will prevent from fire accident with minimal or no damage.	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. The system is built which uses this model. The industry is installed with that system and this will detect if there is any occurrence of fire in the industry, extinguish them and notify the particular manager about the occurrence of fire in the industry.	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7. The responsible person in the industry need to access the device. 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. Store the data and information being transferred.	
4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. If fire detection system installed in a industry, it will detect the fire at the initial stage and prevents a major loss to the particular industry			

Problem-Solution fit canvas is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 license
 Created by Daria Negriakhina / Amaltama.com

AMALTAMA

4. REQUIREMENT ANALYSIS

Requirement Analysis, also known as Requirement Engineering, is the process of defining user expectations for a new software being built or modified. In software engineering, it is sometimes referred to loosely by names such as

requirements gathering or requirements capturing. Requirements analysis encompasses those tasks that go into determining the needs or conditions to meet for a new or altered product or project, taking account of the possibly conflicting requirements of the various stakeholders, analyzing, documenting, validating and managing software or system requirements.

a. Functional Requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Confirmation	Confirmation via Email
FR-3	Resource discovery	Find devices and services of interest to the requesting entity
FR-4	Resource management	Planning, Scheduling and allocating technology to a program
FR-5	Code management	Integrating sensors to web UI
FR-6	Event management	Integrating data to the users

b. Non-Functional Requirement

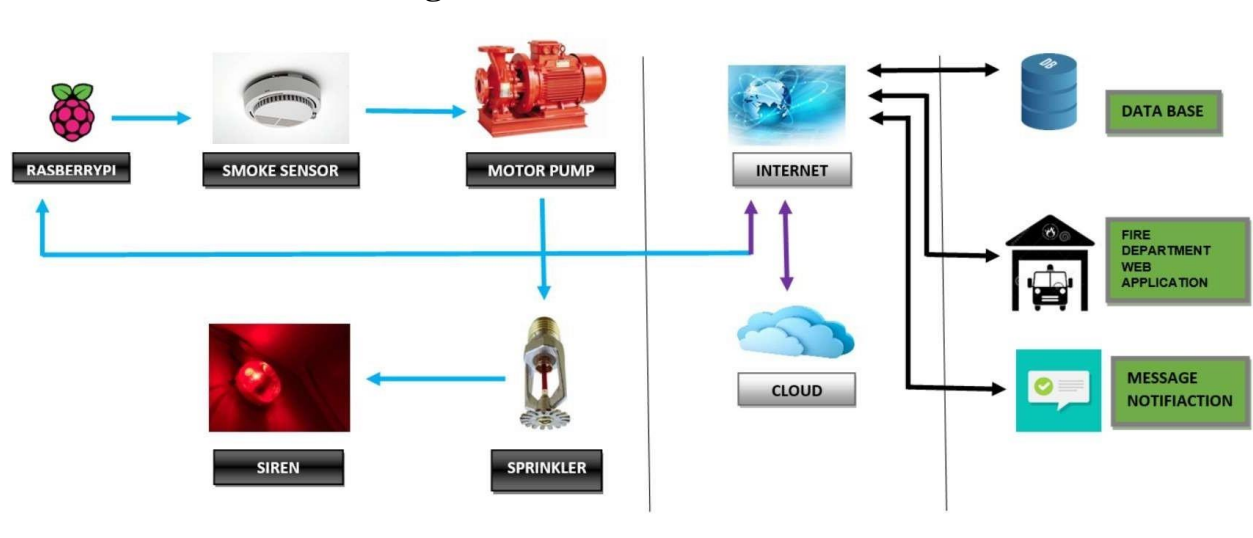
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The Application perform the tasks safely, Effectively, and efficiency
NFR-2	Security	Assuring all data inside the systemor its part will be protected againstmalware attacks or unauthorized access.

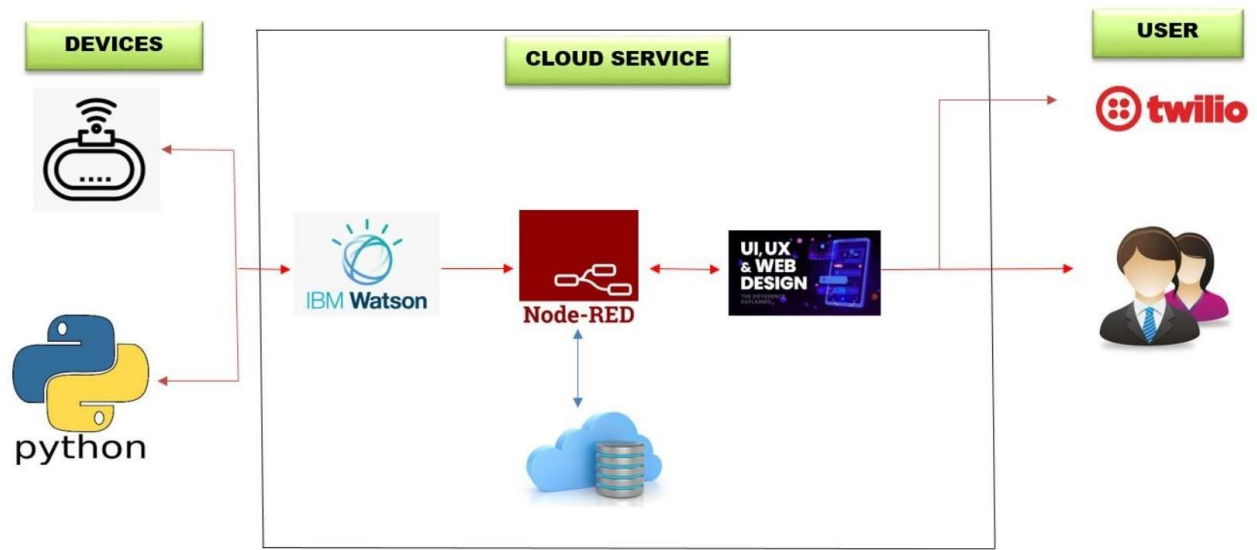
NFR-3	Reliability	The Application does not recover from failure quickly, it takes time as the application is running in single server.
NFR-4	Performance	Response Time and Net Processing Time is Fast
NFR-5	Availability	This application is available to all the time
NFR-6	Scalability	The fire and smoke detectors has a responsetime of 0.013 minutes which is more effective than normalsystem

5. PROJECT DESIGN Project design is an early phase of a project where the project's key features, structure, criteria for success, and major deliverables are planned out. The aim is to develop one or more designs that can be used to achieve the desired project goals. Stakeholders can then choose the best design for the execution of the project. The project design steps might generate various outputs, such as sketches, flowcharts, site trees, HTML screen designs, prototypes, photo impressions, and more. The project design includes everything from who is responsible for completing the project to a description of the project, its goals, outcomes and objectives. It describes when these goals, outcomes and objectives will be reached, and the major deliverables, products or features that will be completed

a. Data Flow Diagrams



b. Solution & Technical Architecture



5.3.User Stories

UserType	Functional Requirement (Epic)	User Story Number	UserStory / Task	Acceptance criteria	Priority	Release
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As a user, I can register for the application I can access

Customer	Registration	USN-1	by entering my email, password, and confirming my password.	my account / dashboard	High	Sprint-1
	User Confirmation	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
			As a user, I can log			

	Login	USN-3	into the application		High	Sprint-1

			by entering email & password			
Sensing	Sensor	USN-4	In industry, sensor sense the fire and smoke.	Indicate by sensor	High	Sprint-2
Extinguish	Actuators	USN-5	If the sensor detected the fire, next step is extinguishi ng the fire with the help	Extinguish the fire	High	Sprint-2
			All the values are			

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Intimation	Siren	USN-7	If the fire is detected, employee should evacuate by the intimation by Siren/Buzzer.	Evacuate	High	Sprint-4
Notification	Event management	USN-8	Notification message will be sent to the fire department, proprietor.	Notify	Medium	Sprint-4

Data	Cloud	USN-6	stored in the cloud database	Store data	High	Sprint-3
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6. PROJECT PLANNING & SCHEDULING

Planning and scheduling of your resource plays a key role in project management. It helps you understand the scope of the project ahead of time and manage/assign your resource accordingly. Besides, it provides an overview of who's

responsible for delivering what and by when. A comprehensive process that outlines the project phases, tasks under each stage, and dependencies is known as project scheduling. It also considers skills and the number of resources required for each task, their order of occurrence, milestones, interdependencies, and timeline. Compare two scenarios— one, where your project details are all over the place, and second, where you maintain a centralized data repository of your project plan. This is what a project schedule does. It brings together all the project-related information in one place that opens doors for seamless communication between the project manager and stakeholders.

6.1.Sprint Planning& Estimation

Sprint	Functional Requirement (Epic)	User Story Number	UserStory / Task	Story Points	Priori ty
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Sprint-1	Registration & Login	USN-1	As a user, I can register for the application by email, and entering my password, confirming my password.	6	High
		USN-2	As a user, I will receive confirmation email,once I have registered for the application	7	High
		USN-3	As a user,I can log into the application by entering email & password	7	High

Sprint-2	Sensor & Actuators	USN-4	In industry, sensor sense the fire and smoke.	10	High
		USN-5	If the sensor detected the fire, next step is extinguishing the fire with the help of Sprinkler.	10	High
Sprint-3	Cloud	USN-6	All the values are stored in the cloud database.	20	High
Sprint-4	Siren & Event management	USN-7	If the fire is detected, employee should Evacuate by the intimation by Siren/Buzzer.	10	High

		USN-8	Notification messagewill be sentto the fire Department, proprietor.	10	High
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a. Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed	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	05Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19Nov 2022

b. Reports from JIRA:

The IoT based intelligent fire management system aims to provide a comprehensive solution for fire safety in commercial and industrial buildings. It uses a variety of sensors to detect fire hazards and automatically triggers the fire suppression system. It also has a user interface that allows the user to monitor the status of the system and make changes to the settings.

1. The system should be able to automatically detect and extinguish fires.

2. The system should be able to provide real-time alerts to the authorities in case of a fire.
3. The system should be able to monitor the environment and provide data that can be used to improve fire safety.
4. The system should be able to provide accurate and up-to-date information about the location of fires.
5. The system should be able to provide information about the cause of fires.

1. CODING

```
#include <WiFi.h>//library for wifi
```

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

```
#include "DHT.h"// Library for dht11
```

```
#define DHTPIN 15    // what pin we're connected to
```

```
#define DHTTYPE DHT22
```

```
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr of  
dht connected
```

```
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
```

```
//-----credentials of IBM Accounts-----
```

```
#define ORG "iigqje"//IBM ORGANITION ID
```

```
#define DEVICE_TYPE "Safety"//Device type mentioned in ibm watson IOT
```


Platform

```
#define DEVICE_ID "Fire1"//Device ID mentioned in ibm watson IOT Platform
```

```
#define TOKEN "123456789"
```

```
//Token String data3; float Humidity,
```

```
Temp;
```

```
//----- Customise the above values ----- char server[] = ORG
```

```
".messaging.internetofthings.ibmcloud.com";// Server Name char publishTopic[]
```

```
= "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in
```

```
which data to be send char subscribetopic[] = "iot-2/cmd/command/fmt/String";//
```

```
cmd REPRESENT command type AND COMMAND IS TEST OF FORMAT
```

```
STRING
```

```
char authMethod[] = "use-token-auth";// authentication method char
```

```
token[] = TOKEN;
```

```
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;//client id
```

```
//-----
```

```
WiFiClient wifiClient; // creating the instance for wificlient
```

```
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined  
client id by passing parameter like server id,portand wificredential
```

```
void setup()// configuring the ESP32
```

```
{
```

```
  Serial.begin(115200);
```

```
  dht.begin(); delay(10);
```

```
  Serial.println();
```

```
  wificonnect();
```

```
  mqttconnect();
```

```
}
```

```
void loop()// Recursive Function
```

```
{
```

```

Humidity = dht.readHumidity();
Temp = dht.readTemperature();
Serial.print("Temp:");
Serial.println(Temp);
Serial.print("Humidity:");
Serial.println(Humidity);

```

```

PublishData(Temp,Humidity);
delay(1000); if (!client.loop())
{   mqttconnect();
    } }

```

```

/*.....retrieving to Cloud.....*/

```

```

void    PublishData(float    Temp,    float    Humidity)    {
mqttconnect();//function call for connecting to ibm
/*    creating the String in in form JSon to update the data to ibm
cloud    */
    String payload = "{\"Temp\":";
payload += Temp;  payload +=
",\" \"Humidity\":";  payload
+= Humidity;  payload += "}";

```

```

Serial.print("Sending payload: ");
Serial.println(payload);

```

```

if (client.publish(publishTopic, (char*) payload.c_str())) {

```

Serial.println("Publish ok");// if it sucessfully upload data on the cloud then it will print publish ok in Serial monitor or else it will print publish failed

```
} else {  
    Serial.println("Publish failed");  
}
```

```
}
```

```
void mqttconnect() {    if  
(!client.connected()) {
```

```
    Serial.print("Reconnecting      client      to      ");  
Serial.println(server);
```

```
    while (!!!client.connect(clientId, authMethod, token)) {  
Serial.print(".");    delay(500);  
    }
```

```
    initManagedDevice();
```

```
    Serial.println();
```

```
} } void wificonnect() //function defination for  
wificonnect
```

```
{
```

```
    Serial.println();
```

```
    Serial.print("Connecting to ");
```

WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establish the connection

```
    while (WiFi.status() != WL_CONNECTED)  
{    delay(500);    Serial.print(".");  
    }
```

```
    Serial.println("");
```

```
    Serial.println("WiFi connected");
```

```
    Serial.println("IP address: ");
```

```
    Serial.println(WiFi.localIP());
```

```
}
```

```
void initManagedDevice() { if  
(client.subscribe(subscribetopic)) {  
Serial.println((subscribetopic));  
    Serial.println("subscribe to cmd OK");  
} else {  
    Serial.println("subscribe to cmd FAILED");  
}  
}
```

```
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength) {  
  
    Serial.print("callback invoked for topic: ");  
    Serial.println(subscribetopic); for (int i =  
0; i < payloadLength; i++) {  
//Serial.print((char)payload[i]);    data3 +=  
(char)payload[i];  
    }  
  
}
```

WOKWI

SAVE SHARE sprint3.ino Docs

sprint03.ino diagram.json libraries.txt Library Manager

```

1 #include <WiFi.h> //library for wifi
2 #include <PubSubClient.h>
3 #include "DHT.h" // Library for dht11
4 #define DHTPIN 15 // what pin we're connected to
5 #define DHTTYPE DHT22
6 DHT dht (DHTPIN, DHTTYPE); // creating the instance by passing pin and type
7
8 void callback(char* subscribetopic, byte* payload, unsigned int payloadLength) {
9
10 //-----credentials of IBM Accounts-----
11
12 #define ORG "iigqje" //IBM ORGANIZATION ID
13 #define DEVICE_TYPE "Safety" //Device type mentioned in ibm watson IOT Platform
14 #define DEVICE_ID "Fire1" //Device ID mentioned in ibm watson IOT Platform
15 #define TOKEN "123456789" //Token
16 String data3;
17 float Humidity, Temp;
18
19 //----- Customise the above values -----
20
21 char server[] = ORG ".messaging.internetofthings.ibmcloud.com"; // Server
22 char publishTopic[] = "iot-2/evt/Data/fmt/json"; // topic name and type of event
23 char subscribetopic[] = "iot-2/cmd/command/fmt/String"; // cmd REPRESENTATION
24 char authMethod[] = "use-token-auth"; // authentication method
25 char token[] = TOKEN;
26 char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID; //client id

```

Simulation

IBM Watson IoT Platform

713319H017@smartinternz.com ID: iigqje

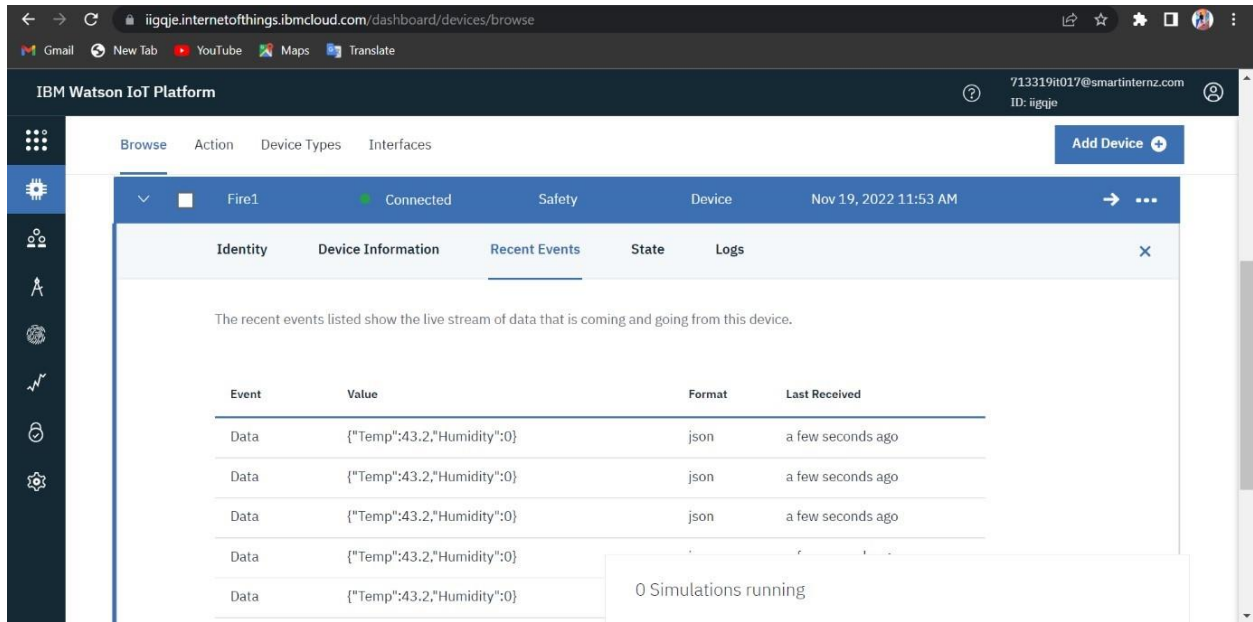
Browse Action Device Types Interfaces Add Device

Search by Device ID Device Simulator

	Device ID	Status	Device Type	Class ID	Date Added
>	Fire	Disconnected	Safety	Device	Nov 14, 2022 8:48 PM
>	Fire1	Disconnected	Safety	Device	Nov 19, 2022 11:53 AM
>	ultra	Disconnected	node	Device	Nov 1, 2022 8:07 PM

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0 Simulations running



2. TESTING

Testing is the process of evaluating a system or its component 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.

a. Test cases

Count	Inputs	Outputs	Results
1	Temperature:70 Humidity:30	Sprinkler & Exhaustfan Off	Normal condition

2	Temperature:90	Sprinkler & Exhaustfan	Normal condition
	Humidity:20	Off	
3	Temperature:100 Humidity:5	Sprinkler & Exhaust fan ON and alert Messagesend	Critical condition
4	Temperature:50 Humidity:35	Sprinkler & Exhaustfan Off	Normal condition
5	Temperature:99 Humidity:9	Ready to Sprinkler & Exhaust fan On	Critical condition
6	Temperature:80 Humidity 25	& Exhaustfan Sprinkler Off	Normal condition
7	Temperature:50 Humidity:35	& Exhaustfan Sprinkler Off	Normal condition
8	Temperature:65 Humidity 39	& Exhaustfan Sprinkler Off	Normal condition
9	Temperature:98 Humidity:9	Ready to Sprinkler & Exhaust fan On	Critical condition
10	Temperature:40 Humidity:36	Sprinkler & Exhaustfan Off	Normal condition

b. User Acceptance Testing

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By design	12	5	3	20	40
External	5	3	12	10	30
Fixed	8	2	0	20	30
NotReproduc ed	3	7	8	15	25
Skipped	3	5	2	1	11
Won't Fix	2	1	7	5	15
Totals	33	23	32	71	159

Test Case Analysis

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

Section	Totalcases	NotTested	Fail	Pass
----------------	-------------------	------------------	-------------	-------------

Client Application	4	0	0	4
Security	2	0	0	2
Exception Reporting	11	0	0	11
Final Report Output	5	0	0	5

3. RESULTS

a. Performance Metrics

CPU usage

The Python V3.7.0 is make the best use of the CPU. For every loop the program runs in $O(1)$ time, neglecting the network and communication. The program sleeps for every 1 second for better communication with MQTT. As the program takes $O(1)$ time and the compiler optimizes the program during compilation there is less CPU load for each cycle. The upcoming instructions are on the stack memory, so they can be popped after execution.

Memory usage

The sensor values, networking data are stored in sram of the ESP32 . It's a lot of data because ESP32 has only limited amount of memory (520 KB) .For each memory

cycle the exact addresses are overwritten with new values to save memory and optimal execution of the program

Garbage collection

In the server-side garbage collection is done by the Node framework. In the IoT device, python does not have any garbage collection features. But it is not necessary in this scenario as the memory is used again for storing the data. Any dangling pointer or poorly handled address space is not allocated.

b. ADVANTAGES & DISADVANTAGES

Advantages

- All device status can be shown in a dashboard
- Automatic alerting of admin as well as fire authorities using SMS
 - Automatically turning on/off sprinkler as well as exhaust fan when the temperature reaches a threshold value.
- Authentication is required to turn on/off of sprinkler and exhaust fan as well as sending SMS alert manually
- Users can see the dashboard using a web application as well as MIT app inventor

Disadvantages

- Need large database since many data is stored in cloud database every second.

- If the physical device is damaged the entire operation is collapsed.
- Always need to connect with the internet.

11.CONCLUSION

This project depicts the necessity and an efficient solution for fire safety. Internet of Things was the main concept used and the project mainly builds on the techniques which are already presents and also it has overcome many obstacles present in the previous systems. But still there are few tweaks and remodelling required to get a more efficient and working model.

12.FUTURE SCOPE

The existing devices can be modified to work in different specialized environment as well as scale to house use to big labs Since fire accidents can cause major loss in human lives in homes to big industries as well as it can be used in public places , vehicles.