IBM-Project-44412-1660724565

INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

PROJECT NAME :INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

TEAM ID : PNT2022TMID34762

TEAM MEMBERS : AKIL SASHYA A
ARUL DIKSHA A K
DAVIN JEGATH SONY D
SEREENA JERRY

BRANCH : INFORMATION TECHNOLOGY

Industry Mentor's Name: Santoshi

Faculty Mentor's Name: Mrs. N.Ansgar Mary

PROJECT REPORT FORMAT

INDUSTRY-SPECIFIC INTELLIGENT FIRE MANAGEMENT SYSTEM

CHAPTER 1

INTRODUCTION

1.1 Project Overview

Internet of Things(IoT)

The internet of things, or IoT, is a network of connected computing devices, mechanical and digital machinery, items, animals, or people that may exchange data across a network without needing human-to-human or human-to-computer contact. The term "internet of things" has been criticized because gadgets only need to be individually accessible and connected to a network, not the whole internet.

A person with a heart monitor implant, a farm animal with a biochip transponder, an automobile with a built-in sensor to warn the driver when tyre pressure is low, or any other natural or artificial object that can be given an IP address and has the ability to transfer data over a network can all be considered things in the internet of things.

Organizations across a range of sectors are increasingly utilizing IoT to run more smoothly, better understand their consumers to provide better customer service, boost decision-making, and raise the value of the company. The discipline has changed as a result of the confluence of several technologies, including machine learning, ubiquitous computing, commonplace sensors, and more powerful embedded systems. The Internet of things is enabled by the traditional disciplines of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and so on.IoT products are most often associated with the "smart home" in the consumer market because they support one or more common ecosystems and can be controlled by gadgets related to those ecosystems, like smart speakers and smartphones. These products include lighting fixtures, thermostats, home security systems, cameras, and other appliances. Systems for providing healthcare also leverage IoT.

Many people are worried about the risks associated with the development of IoT technologies and products, particularly in the areas of security and privacy. As a result, industry and governmental efforts to address these worries have started, including the creation of global and regional standards, guidelines, and regulatory frameworks.

Why is the Internet of Things (IoT) so important?

IoT has emerged in recent years as one of the most significant 21st-century technologies. Continuous communication between people, processes, and things is now feasible because of the ability to link commonplace items—such as household appliances, automobiles, thermostats, and baby monitors—to the internet via embedded devices.

Low-cost computers, the cloud, big data, analytics, and mobile technologies enable the sharing and collection of data by physical objects with a minimum of human interaction. Digital systems can record, monitor, and modify every interaction between linked entities in today's hyper connected environment. The physical and digital worlds collide, yet they work together.

What technologies have made IoT possible?

While the idea of IoT has been in existence for a long time, a collection of recent advances in a number of different technologies has made it practical.

- **Access to low-cost, low-power sensor technology.** Affordable and reliable sensors are making IoT technology possible for more manufacturers.

- **Connectivity.** A host of network protocols for the internet has made it easy to connect sensors to the cloud and to other "things" for efficient data transfer.
- **Cloud computing platforms.** The increase in the availability of cloud platforms enables both businesses and consumers to access the infrastructure they need to scale up without actually having to manage it all.
- **Machine learning and analytics.** With advances in machine learning and analytics, along with access to varied and vast amounts of data stored in the cloud, businesses can gather insights faster and more easily. The emergence of these allied technologies continues to push the boundaries of IoT and the data produced by IoT also feeds these technologies.
- **Conversational artificial intelligence (AI).** Advances in neural networks have brought natural-language processing (NLP) to IoT devices (such as digital personal assistants Alexa, Cortana, and Siri) and made them appealing, affordable, and viable for home use.

What is Industrial IoT?

Industrial IoT (IIoT) refers to smart devices used in manufacturing, retail, health, and other enterprises to create business efficiencies. Industrial devices, from sensors to equipment, give business owners detailed, real-time data that can be used to improve business processes. They provide insights on supply chain management, logistics, human resource, and production – decreasing costs and increasing revenue streams.

Let's look at existing smart industrial systems in different verticals:

Manufacturing

Enterprise IoT in manufacturing uses predictive maintenance to reduce unplanned downtime and wearable technology to improve worker safety. IoT applications can predict machine failure before it happens, reducing production downtime.

Wearables in helmets and wristbands, as well as computer vision cameras, are used to warn workers about potential hazards.

Automobile

Sensor-driven analytics and robotics increase efficiency in automobile manufacturing and maintenance. For example, industrial sensors are used to provide 3D real-time images of internal vehicle components. Diagnostics and troubleshooting can be done much faster while the IoT system orders replacement parts automatically.

Logistics and transport

Commercial and Industrial IoT devices can help with supply chain management, including inventory management, vendor relationships, fleet management, and scheduled maintenance. Shipping companies use Industrial IoT applications to keep track of assets and optimize fuel consumption on shipping routes. The technology is especially useful for tight temperature control in refrigerated containers. Supply chain managers make informed predictions through smart routing and rerouting algorithms.

Retail

Amazon is driving innovation in automation and human-machine collaboration in retail. Amazon facilities make use of internet-connected robots for tracking, locating, sorting, and moving products.

1.2 PURPOSE

IoT Applications in Manufacturing Industry

Below are a few of the useful application of IoT in the manufacturing sector:

1.Intelligent product enhancements

Similar to the other applications of IoT, IoT in manufacturing also enhances production quality. Previously, the creation of products would require a heavy market research and customer suggestions, with IoT, owners have access to large amounts of data and information. IoT acts as a reliable source of information about any product and hence ensures better profits.

2. Dynamic response to market demands

Supplying to market demands depends on a number of factors such as taste and preferences, income of the population, consumer expectations, country capital and so on. Keeping up with demands requires constant research and present supply could cause heavy losses to business and future decisions.

IoT stores and retrieves information continuously and does not require much human intervention. It controls supply chains because the information IoT gathers is accurate to a large extent

3. Improved facility service

IoT improves the conditions of workplaces and offers safety and security to any typical facility. Safety managers communicate through applications and access real-time information regarding threats and safety events.

This allows organizations to monitor events, enhance communication and increase production.

4. Product safety

Despite a complicated set of operations ensuring customer safety, hazards and dangers still find their way into the market. Unknown reasons may cause serious incidents.

IoT deploys sensibility, control and management techniques to track such incidents and raise alerts in case of potential threats.

5. Lower costs, optimized resource use and waste reduction

IoT replaces manual labor in various domains. It reduces the dependency on humans to perform background checks for products. Maintenance checks and tests usually require manual labor costs and are time consuming. With IoT, one can monitor the status of their organization remotely, through sensors and security webcams.

IoT offers ways to manage and optimize the usage of resources such as humans and minerals. It offers cost effective and feasible methods to complicated problems.

6. Quality control

IoT proposes real-time monitoring of appliances and products in the industry. Manufacturers can predict the breakdown of certain machinery parts and offer solutions instead of waiting for the machine to collapse. IoT benefits systems by monitoring the status of engines, machinery and their mechanism. The automation of certain processes reduces the dependency on manual labour.

7. Predictive maintenance

Traditionally, manufacturers use a time based approach to carry out maintenance checks on machinery and engines. However, with IoT in the picture, routine checks are automated. Meaning that the machines carry out their own maintenance without outside support and inform the users about threats via mobile applications.

Iot sensors monitor the operations and perform data analysis on the real time data in clouds.

IoT has led to the automation of various processes. Predictive maintenance is one such automation. It is where the device schedules a routine self maintenance check to keep a track of its functionality. It reports bugs and damages to its authorities who then take actions to fix the ongoing issues. As a result of which owners are not required to manually perform a maintenance check as the machine itself deploys a routine system check in intervals of time.

8. Inventory management

RFID and IoT can represent inventory management as a seamless and efficient process. Each inventory comes with an RFID tag and each tag generates its own Unique identification (UID).

The data that RFID tags collect plays a vital role in running most organizations these days. The systems monitor the output of RFID tags and send notifications to users in case of missing inventory.

9. Smart packaging

Smart packaging is an application of the internet of things that uses forms of technology to package products and does more than storing the products. It allows users to interact with the package and resolve their queries regarding the bread, product or delivery.

Iot and packaging work together include sensors, QR code and other options. The main goal is to interact with the consumer and collect necessary data.

10. Smart metering

This allows the consumption of resources in a more effective manner and reduces the wastage of these precious resources. Smart meters track the consumption of water, fuels and electricity. They measure the usage of these resources and deploy methods to consume these resources more efficiently.

11. Supply chain management

IoT devices trace and monitor the real-time data incoming from supply chains. Authorities can monitor and control machinery, equipment, and delivery systems from remote locations. Some IoT systems also offer ERP softwares that reduces the need for manually documenting the processes.

12. Workshop monitoring

Machine workshops are stores where the manufacturing of tools and substances is done. These workshops consume high energy with less efficiency. There exists a complicated energy flow in the manufacturing of these tools and leads to heavy energy consumption.

IoT designs an effective monitoring system to gather and trace the energy consumption by these workshops to improve the conditions. IoT manages the manufacturing process leading to reduction in costs and lesser consumption of energy.

13. Production flow monitoring

One of the important processes in manufacturing is production flow. Manually, it gets difficult to manage and track the production flow. IoT uses sensors that provide the owners with real-time data to monitor the prediction. These sensors give details about the parts of machines and generate service calls when they notice a breakdown or damaged parts.

14. Digital twins

Digital twins is the method of creating exact copies or replicas of actual, hardware devices by using cloud. IoT scientists and IT officials create these models for testing and deploying purposes before they publish the real life model. This technology is now being used in large buildings, construction sites and also in cities.

CHAPTER 2
LITERATURE SURVEY

2.1 Survey

1.IOT Based Fire Safety System -Meeral Dangrach,Sayed Mazhar Ali Shah, Agha Zain ul Abdin, Adeel Ali,Mukhtiar Ahmed(2021)

The Internet of Things (IoT) is a contemporary system made up of sensors and switches linked to a central hub (Arduino nano). In this project, we used flame sensors, gas sensors, temperature and humidity sensors, and NodMcu with Arduino device and actuators to automatically extinguish the fire and smoke, and the data will be sent to the webpage to let us know the situation and take any other desirable action, as system starts sensor senses the environmental conditions and sends to the central hub main controller board (Arduino nano)

The project consists of two parts. The first component is an Arduino Nano attached to a NodMcu ESP 8266 and connected to temperature and humidity sensors, gas sensors, flame sensors, and an LCD display. This component is powered by a 5V DC power supply. A four-channel relay communicates with the 12V DC motor pumps and exhaust fans in the second component. The relay is connected to an Arduino Nano. When sensors detect a change in their surroundings, they generate a signal and send it to an ESP8266 connected to an Arduino Nano. The ESP8266 actuated the relays and powered the motor pumps and exhaust fans to prevent a raging fire. The internet also provides a real-time updating status.

This is a semi-automatic, completely controllable project that uses an IOT interface with hardware. The job was effective, and such a way will be used in a department, households, and factories, among other places. When a fire starts, it appears that it may be extinguished immediately by a water pump and smoke by an exhaust fan, as well as by a user through IOT, to safeguard precious items from rain, fire, humidity, temperature, and smoke. It may be accessed from anywhere, but both the system and the user must be connected to the Internet. This project is designed in such a manner that if a fire or gas attack happens, the system will attempt to prevent it while also informing the user to safeguard precious items and sending humidity and temperature readings to the LCD and website as well. We had several issues with the circuit and IOT connectivity while working on this project, but after some practice and a few tests, we completed it successfully and offered a new solution to the market that was not previously accessible. This project was created with Arduino nano, 12v DC motor, 12v DC exhaust fan, IR Flame sensor, MQ5 & MQ135 Gas sensors, DHT-11 SENSOR, Nodmcu ESP8266, DHT-11, Arduino Software 1.8.5 & webpage, connecting wires, and other components as a model that could be further implemented and enhanced by project industries on a high level based on its benefits and requirements.

This project may be improved by connecting it to a wireless camera so that the person viewing the webpage can see the automated functioning. It may be improved in the future by creating the same system without Wi-Fi using any other technology. It can be improved by employing wireless sensors, which are better than wired systems and have a wider range of feeling.

2.An Intelligent Fire Warning Application Using IoT and an Adaptive Neuro-Fuzzy Inference System-Barera Sarwar, Imran Sarwar Bajwa, Noreen Jamil, Shabana Ramzan, and Nadeem Sarwar

Received 2019 June 10;Accepted Jul 15

A few fire warning and alarm systems that combine a smoke sensor and an alarm device to construct a life-safety system have been proposed.However, these fire alarm systems can occasionally make mistakes and respond to erroneous alarms that are false fire signs.High-quality and sophisticated fire alarm systems are required, and they must use a variety of sensor values (such as a signal from a flame detector, humidity, heat, and smoke sensors, etc.) to find actual fires.The maximum likelihood of the actual existence of fire is determined and a fire alert is generated in this paper using an Adaptive Neuro-Fuzzy Inference System (ANFIS). The innovative concept put out in this study is to use ANFIS to identify an actual fire occurrence by using the pace at which smoke, temperature, and humidity vary when there is a fire.The suggested concept also creates notifications, each of which includes a message delivered right to the user's smartphone.

The adaptive neural fuzzy interface system (ANFIS), a combination of the two crucial technologies fuzzy logic and artificial neural network (ANN), can logically generate fuzzy rules in accordance with training data to strengthen the system and create an intelligent fire detection system that can monitor the parameters necessary for the actual presence of fire so that false alarms can be reduced to a minimum level.In order to determine the likelihood of fire, a fire detection system is created employing the aforementioned technology and provided in this study.The ANFIS neural network continues to operate until the output value for the given input matches the intended value.An adaptive neuro-fuzzy interference system, a multi-sensor fire detection and warning system, is utilised to detect fires in light of these abilities.An Arduino UNO atmega328p micro-controller is used to embed the sensors.

In this study, a smart and intelligent fire warning system for smart buildings was proposed.In the event of an emergency or urgent situation, this technology not only analyzes the fire presence but also alerts the involved parties of extreme fire dangers.The suggested system uses widely accessible, lightweight, and reasonably priced sensors and is more dependable than traditional fire detection systems. The ANFIS architecture model increases the proposed system's efficiency, robustness,

and reliability while reducing false alarms.The system is commercially applicable, and the outcomes are repeatable.
This system's sensors are heavier and don't provide accurate signals for analysis.As the flame sensor is hypersensitive to sunlight and, secondly, the reading and training data may vary in open spaces, this system is specifically intended for indoor use.

3.A Survey on Fire Safety Measures for Industry Safety Using IOT-N. Savitha; S. Malathi 2018
Today, safety is a requirement across all industries. Because of this, fire safety measures ought to be put in place everywhere.There are many fire incidents that happen in industrial locations that seriously harm both people and property.In this study, several of the primary causes of fire accidents are examined, and safety precautions are examined depending on the technology available. Nowadays, many safety measures are applied via IOT.In that the cause of the fire must be identified in order to be prevented before it starts.Accidents involving this dangerous fire can be prevented, and many lives can be saved.
In this different sensors are used for monitoring the environmental conditions and for detecting the fire. In many cases they use image processing and video techniques to avoid false alarms.
Most of the time the process of fire detection method uses the sensor nodes for detecting the fire. In this there may be a chance of false fire detection also occurring. For that Gaurav Yadav, et al, developed a fire detection using image processing technique. In this they detect the flame by identifying the gray cycle pixel when there is smoke spread over the area. Through this the false detection can be identified.

One dangerous situation that can seriously harm both people and property is a gas leak. Manaswi Sharma and colleagues created a system in 2018 to track gas leaks and suggest safety measures if they occur. IoT plays a significant part in this system and uses some specialized sensors to find gas leaks.

People are protected from dangerous damage by fire safety procedures. According to the survey, the majority of fire protection measures monitor environmental conditions and automatically put out fires when they are activated. The fire safety measure for the firework sector will be implemented in the proposed system. The primary cause of the fire is found in this, and as a result, significant fire accidents and loss of life are prevented.

Fire location is one of the most important considerations in the current building design because of the quick and vast entirety of the destructive powers of flame.

4.Remote sensing information for fire management and fire effects assessment -Emilio Chuvieco, Eric S. Kasischke , First published: 19 January 2007

Over the past ten years, a lot of research has been done on the application of remote sensing and geographic information systems, which are advanced geospatial technologies, to the fields of fire science and fire management.A workshop organized by the Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) fire implementation team and the EARSEL special interest group (SIG) on forest fires focused on recent developments in these technologies.Here, we provide an overview of the main themes and conclusions of the papers that were submitted for this meeting and discussed in this particular section.These papers concentrate on the most recent developments in near real-time fire monitoring, fire hazard and danger prediction, fuel moisture monitoring, fuel type mapping, and postfire assessment of the effects of fires.Satellite monitoring of burning areas is based on two distinct physical theories.

On the one hand, fire generates light and can be identified using visible wavelengths of the electromagnetic spectrum on nocturnal satellite imagery [Cahoon et al., 1992; Elvidge, 2001].The middle infrared bands, particularly those based on the 3.7 m, are best for active fire detection because of the high temperatures that fires produce. The optical landscan sensor (OLS) on board the Defense Meteorological Satellite Program satellite series has been used to identify fire lights.The OLS has a very narrow geographical and temporal resolution, yet this system has supplied precise information on the spatial patterns of fire occurrence through differentiating between stable lights (cities, power stations) and dynamic lights (mostly fires) .However, the temporal frequency of sampling from these systems (at best twice per day) is low for many fire management activities, despite the fact that existing and future orbiting satellite systems offer valuable information on the location and extent of active fires.Data from the Geostationary Operational Environmental Satellite (GOES) system can be utilized to get around this restriction.Prins and Menzel [1992] first showed how useful these data were for monitoring fires in South America.The GOES satellite systems have shown to be effective at monitoring active fires because they can identify flames in their range of vision every 30 minutes [Prins et al., 1998].

It is now possible to predict the practical application of those satellite data relatively soon because of recent improvements in image processing of medium and low-resolution data.This is the case, for example, with the burn scar mapping that is currently being done in various nations.To address the various impacts of fire damages on postfire reflectance, particularly when forests are stratified in distinct vertical levels, further research is needed to differentiate between burn severity.Although greater issues are anticipated when water needs to be calculated as a function of dry weight rather than leaf area, the water content of fuels is also getting anywhere near to being operationally predicted.The current fuel type issues might possibly be resolved by the expanding data availability from new sensors like Lidar or interferometric radar.

The majority of fire scientists are aware of the need for more current and accurate spatial data to improve the decisions being made today for pre fire planning and postfire mitigation.The majority of environmental decision-makers recognise the value of fire for managing vegetation, hydrology, edaphics, and the atmosphere.

If we want to exploit remotely sensed data for operational purposes, new Earth observation missions need to address the technical constraints of the currently available sensors.In order to conduct a thorough assessment of fire risk and fire consequences, we should continue to provide validated products that are correctly integrated with information from other sources.

5.Research on The Fire Warning Program of Cotton-Warehousing Based on IoT Technology,Jia Jiang, ; Zhe Gao, ; Huanhuan Shen, ; Changsheng Wang, (2015)

A crucial aspect of cotton storage safety is the use of fire warning systems. This study proposed an IoT architecture-based application scheme for the cotton warehouse fire warning system based on an analysis of the current issues with the traditional wired fire warning system and combining them with the technical advantages and superiority of IoT.Then data was collected and transmitted using a ZigBee wireless sensor network as the foundation, and a warning was generated using a background intelligent fire analysis system. Last but not least, the application scheme created an efficient fire control by activating the appropriate joint fire action equipment by a scientific fire emergency decision system.

The primary functions of a fire warning system are data collection, information transmission, and background analysis. The design of the fire warning system in this study is based on Internet of Things (IoT) technology. The original independent fire fighting equipment uses ZigBee technology to establish a self-organized network, and data from the control center is transmitted through the GPRS network and the Internet. The overall design of the fire warning system is based on IoT technology.

ZigBee tree network, which consists of management, sink, and sensor nodes, is used for the data acquisition network layer. First off, when the system is deployed, a certain number of sink nodes are placed in the monitoring area. Aggregation nodes serve as the region's routers and converge network information. Sensor nodes can then be randomly arranged to best suit the situation. As a result, a number of sensor nodes will keep sending sink nodes and convergence to management node data related to perception of the environment. Data will be stored by management nodes to a network server through GPRS and the Internet.The control center has access to network data stored on a server, and various regions, various sensor data may be processed and analyzed to accomplish intelligent fire identification. When a fire occurs, the early warning system can perform voice and flash alarms, start fire fighting equipment automatically, and achieve effective fire control, according to the control center.

The three-layer IoT architecture is based on the cotton warehouse fire warning system, and it uses ZigBee technology to finish data acquisition and transmission for the perception layer of monitoring the cotton warehouse environment. This effectively increases the capacity of the conventional fire warning system to conduct a thorough perception of the cotton warehouse environment, and it is adopted to ensure the real-time and reliability of data transmission.

The server, which can enrich and improve the traditional fire warning system, and effectively make up for the lack of the traditional fire warning system, is accessible through the control center. It can monitor data from cotton warehouses in real-time display, storage, query, and analysis. It can also improve the false alarm and missing alarm status, set the fire plan, and play a helpful role in controlling the center quickly.

6.IoT-Based Intelligent Modeling of Smart Home Environment for Fire Prevention and Safety-Faisal Saeed,Anand Paul,Abdul Rehman,Won Hwa Hong and Hyuncheol Seo

Received: 15 December 2017 / Revised: 29 January 2018 / Accepted: 2 February 2018 / Published: 2 March 2018

Homes are typically where fires start due of negligence and alterations in the environment.They pose dangers to the surrounding and may even cause deaths and property damage.Fire detection has grown to be a major problem because it has resulted in significant damage, including the death of people.These incidents can occasionally become more destructive if the fire spreads to the surrounding area.One efficient technique to prevent loss of life and minimize property damage is by early fire event detection.In this paper,they designed and evaluated a wireless sensor network using multiple sensors for early detection of house fires.In addition, they used the Global System for Mobile Communications (GSM) to avoid false alarms.

In this system,they divide their effort into four parts in this portion.The first unit defines the sensor that gathers data from the environment and sends it through the ZigBee protocol to the processing unit in the second unit.The GSM communication device, which serves as the third component, notifies users of the event.The alert is set off by the fourth unit.The proposed smart home fire detection system consists of four major parts sensor, processing unit as the main home sink, GSM communication system and alarm system.For each section of the smart homes, they deployed multi-sensors in the sensor unit, such as smoke, gas, and heat sensors.On the basis of the data gathered by the sensors and the user's response, the sink's decision to detect a fire is made.When a single sensor node transmits a fire alarm to the sink, the GSM communication is automatically activated, and an alert message is sent to the user.Based on the user's response or the alarm notice from the other sensors, the sink makes decisions.The sink generates an alarm after receiving confirmation of a fire occurrence from two or more sensors or from the user.The system simultaneously communicates event data with the local server and the cloud, assisting in the dissemination of that data to the basic service units.To update the other homes on the present situation, the local server is in contact with the neighbors.

GSM communication system is used to reduce the false alarms.The goal of GSM communication was to notify the user as soon as a fire was discovered.The main home sink, which was wirelessly connected to all the sensors, made judgments on fire detection.The user's answer or the sensor's results were used to make the choice.It was also calculated how much energy the deployed sensors were using, and the result was within acceptable bounds.

This system used multiple sensors to detect fires, and during a fire, a lot of data was produced by the sensors.Compared to the sensors in other rooms, the sensors in some rooms utilized a lot of energy.The morning, the afternoon, and the nighttime saw more energy consumption.

7.A smart fire detection system using IoT technology with automatic water sprinkler-Hamood Alqourabah, Amgad Muneer, Suliman Mohamed Fati 2021

In order to simultaneously preserve lives and precious properties, this project intends to build a smart fire detection system that would not only detect the fire using integrated sensors but would also warn property owners, emergency services, and local police stations.The model that is suggested in this research uses a variety of integrated detectors, including those for heat, smoke, and flame. The signals from those detectors are processed by the algorithm of the system to determine the likelihood of a fire, and the anticipated outcome is then broadcast to various parties via a GSM modem connected to the system.The fire service now has access to the essential data thanks to the use of an IoT technology, which allows for the collection of real-world data without endangering human lives. Finally, reducing false alarms is the major component of the suggested solution, making it more dependable. As the system leverages the Ubidots platform, which makes the data transmission faster and more reliable, the trial results demonstrated the superiority of our concept in terms of affordability, efficacy, and responsiveness.

The issue of slow response in fire accidents has been resolved by the development of smart fire detection systems with automatic water sprinklers. Sensors and a Wi-Fi module that serves as a transmitter for the sensor readings are examples of inputs that provide readings for the system to analyze. Sensor inputs include temperature, gas, and flame sensors. On the web page, the readings from the inputs are shown. LED and buzzer outputs reveal a fire. An Arduino-powered 12 V water pump that is managed by a 5 V relay powers the water system.The outermost point of water discharge is the sprinkler head.The level of the tank is determined by an ultrasonic sensor, which also indicates when it needs to be refilled. Batteries are also powering the pump and the circuits. Since the pump runs on 12 V, an Arduino cannot power it. To switch on and off the 12 V motor that pumps the needed water from the tank, a relay is employed. To address the lack of analogue and digital pins, a multiplexer is also employed in addition to the microcontroller.

The literature suggested fire detecting devices that provided fire stopping without regard for responsiveness. In order to collect data reliably and quickly, this study takes into account the challenges that are already present and develops an effective fire detection system based on IoT technology, gas, temperature, and smoke sensors. The central unit analyzes the data from the ongoing readings received over WIFI modules and starts the sprinklers. The effectiveness and efficiency of fire detection are improved by this system layout. Additionally, this system's use of the Ubidots platform sped up and improved the dependability of data interchange. The suggested method from this study, however, achieved an average response time of 5 seconds to find the fire and notify the property owner.

Therefore, incorporating machine learning into the system to forecast the likelihood of fire based on the information gathered from various sources is one of the enhancement directions. Instead of relying just on detection, machine learning could aid building operators in identifying and addressing potential points of vulnerability.

8.Review of Fiber Optic Sensors for Structural Fire Engineering-Yi Bao,Ying Huang,Matthew S. Hoehler, Genda Chen Published online 2019 Feb 20

Structures can suffer catastrophic destruction from fire.The negative impacts of temperature-induced deformations and deteriorated material properties at high temperatures can have a major impact on the strength and stability of structures.Different fiber optic sensor types regulate the transmitted light using various physical processes, giving each sensor its distinctive performance.

This study discusses different fiber optic sensors that have been used to make measurements in structure fires, including the sensing principles, fabrication, essential properties, and recently reported applications. It is written for structural engineers who are new to fiber optic sensors.They examine three types of fiber optic sensors: dispersed sensors, interferometer sensors, and grating-based sensors.Numerous issues with monitoring structures in hot conditions are resolved by fiber optic sensors, which operate on light signals.The research examines the sensing concept, fabrication, significant features, and current structural fire applications for each type of sensor.

This system used fiber optic sensors, high temperature, intelligent sensors, smart structure and structural fire engineering.It has been reported that fused silica fiber-based Fiber Bragg Grating (FBG) sensors can sense temperature and strain at temperatures as high as 1300 °C.Utilizing efficient and straightforward procedures, Long-Period Fiber Grating (LPFG) that is stable up to temperatures of 800 °C has been created.However, LPFGs have longer sensor lengths than FBGs, which leads to excellent spatial averaging. They are also more susceptible to environmental factors including the refractive index of the environment and optical fiber bending.It is now possible to monitor stresses up to 10% and temperatures up to 1200 °C with fiber optic interferometer sensors.Distributed fiber optic sensors enable the measurement of distributions along optical fibers in contrast to point sensors like grating and interferometric sensors.

Numerous issues with monitoring structures in hot conditions are resolved by fiber optic sensors, which operate on light signals.Due to its distinctive qualities, such as tolerance to electromagnetic interference (EMI), compact size, and durability in challenging situations, fiber optic sensors have attracted interest for the monitoring of structures in fire environments.

Since diverse types of fire produce different gasses, particular gas sensors need to be carefully chosen.While the presence of smoke and gas signals combustion, it may take some time for the smoke or gas to diffuse to the sensors from the site of the combustion.Although fiber optic sensors have been used extensively for temperature and strain monitoring in high-temperature applications, little is still known about how well they function in applications involving structural fire.

As opposed to the current applications of fiber optic sensors in fire safety, it is anticipated that the advancement of artificial intelligence would considerably accelerate the advancement of sensor technology.

9.IoT–Fog Enabled Framework for Forest Fire Management System-S Srividhya, Suresh Sankaranarayanan

The forest fires, one of the most serious disasters mostly brought on by global warming, are one of the most serious events.Environmental pollution increases this hazard because nature has the potential to wipe out both humans and itself.The department of forest management and wildlife is in charge of several issues, including the rehabilitation of wild animals and the movement of animals into populated areas.The trees' strength has significantly decreased. There haven't been many studies done recently on wireless sensor networks for managing forests. However, concerns with data quality and processing times persist in forest management using wireless sensor networks.Many applications for smart cities are currently using a large wave of IoT and Edge computing to process data locally, allowing for quicker response times than in the cloud.With Edge/Fog computing in IoT, issues with bandwidth, latency, and delay in data processing are also eliminated.We therefore suggest an IoT-based fog-based forest fire monitoring system using this as our foundation.For monitoring and alerting purposes to protect the trees and wildlife, the suggested IoT-based fog-based architecture for forest fire management system is deployed.The paper provides a full explanation of the architecture.

An IoT-enabled framework for managing forest fires has been proposed.

There has also been research on fog nodes that analyze data in real time while collecting it from sensor nodes.The data was then transferred to the cloud for storage.Additionally, efforts have been concentrated on developing routing protocols that leverage RPL routing protocol in order to maximize energy economy.Last but not least, an IoT framework with fog and cloud was proposed with six features, where data perception, fog computing, and fog gateway were combined into one portion, and fire prediction, cloud storage, and management layers were combined into one group.

Within the suggested IoT guided framework for forest fires using fog management, the workload for computing, and data analysisFog, aggregator, and operations are evenly distributed.middle cloud layer a significant number of weakly powered wireless In a woodland region, diverse sensor nodes have been set up.Data continual observation of the data obtained from the sensors aggregator nodes individually. There are several benefits of Low bandwidth and latency in fog computing communication and computation with heterogeneous data makes it necessary to compute metrics linked to forests.Finally, the cloud layer assists in managing all fire-related notifications, alerting the forest office and nearby residents.In order for IoT sensor nodes to communicate with aggregators and gateways in the future, work will need to be done on an optimized energy-efficient routing protocol. Additionally, efforts must be made to position the Fog node in the environment optimally for effective use in performing more advanced analytics for monitoring forest fires.

10.Fire safety management in public health-care buildings: issues and possible solutions-Nuzaihan Aras Agus Salim, Naziah Muhamad Salleh, Mastura Jaafar, Mohd Zailan Sulieman, Norhidayah Md Ulang, Andrew Ebekozien 11 October 2021

There have been an increasing number of fires that have broken out frequently in different hospitals around the world, having a terrible impact on both people and other resources.Due to the annual increase in fire outbreaks, stakeholders in the healthcare industry are concerned.However, it has been demonstrated that fire safety management is a viable platform for reducing fire in healthcare settings.In-depth research on Malaysia's public health-care infrastructure is still pending.The purpose of this study is to examine the problems with fire safety management and provide potential fixes to increase security in public healthcare facilities from the viewpoint of the operators.

The objectives were achieved through a combination of case studies of five selected Malaysia's public hospitals and a qualitative approach. Thematic analysis with the assistance of MAXQDA (software program designed for computer-assisted qualitative and mixed methods data) 2018, a type of qualitative data analysis software was used to analyze the collated data which emerged from the knowledgeable participants.

The article states that training of key staff members in accident reaction and recovery during fire emergencies should be encouraged as one of the paper's implications. It also suggests that modern technology be used to strengthen fire protection systems.The enforcement and execution of a fire safety management strategy can help with this.As a result, this study is promoting the adoption and sustainability of a fire safety management strategy for healthcare facilities

throughout Malaysia.This may be the first in-depth study on fire safety management in public health care institutions that involved operators in Malaysia, to the best of the author's knowledge.This article also suggests workable policy options for enhancing the fire safety management strategy in public health-care facilities.

The scope of this essay is restricted to examining the problems with fire safety management and outlining potential fixes to increase security in public healthcare facilities as seen by the operators.The advancement of fire safety management in public hospital facilities and the potential creation of a qualitative model based on a general fire response model both call for further study.Additionally, to look into the degree of adherence to a fire safety management plan's standards and perhaps create a thorough fire safety plan for Malaysia's public healthcare facilities.

2.1 EXISTING SYSTEM

Every industry has a requirement for safety. The most unwelcome disaster that results in numerous losses is fire. Both ambient conditions and fire detection are tracked using several sensors. Numerous devices were invented to detect fire in buildings and in enterprises.To automatically put out fires and extinguish smoke, numerous systems used a variety of devices, including flame sensors, gas sensors, temperature and humidity sensors, and NodMCU with Arduino devices.There are two sections to the IOT Based Fire Safety System project. The initial element consists of an Arduino Nano coupled to a NodMcu ESP8266, together with temperature, humidity, gas, and flame sensors, as well as an LCD display. The second component's 12V DC motor pumps and exhaust fans are connected via a four-channel relay. An Arduino Nano is linked to the relay. An ESP8266 is wired to an Arduino Nano and receives signals from sensors when they detect a change in their environment. To put out a blazing fire, the ESP8266 activated the relays and ran the motor pumps and exhaust fans. Additionally, the internet offers a real-time updated status.In order to protect priceless goods from rain, fire, humidity, temperature, and smoke, it appears that a fire can be put out right away by a water pump, smoke by an exhaust fan, as well as by a user through IOT. It can be accessible from anywhere, but the user's computer and the system both need to be online.

Fuzzy logic and artificial neural networks (ANN) are combined in the adaptive neural fuzzy interface system (ANFIS), which can logically generate fuzzy rules in accordance with training data to strengthen the system and create an intelligent fire detection system that can monitor the parameters necessary for the actual presence of fire while minimizing false alarms.The ANFIS neural network keeps running until the output value for the specified input is the same as the desired value. In light of these capabilities, a multi-sensor adaptive neuro-fuzzy interference system is used as a fire detection and warning system. The micro-controller used to integrate the sensors is an Arduino UNO atmega328p.

Different sensors are used in A Survey on Fire Safety Measures for Industry Safety to keep track of environmental variables and spot fires. They frequently employ image processing and video algorithms to prevent erroneous warnings.

The majority of the time, the method of fire detection uses sensor nodes to detect the fire. There is a potential for misleading fire detection in this situation. For this, Gaurav Yadav and colleagues created a fire detection method based on image processing. In this, when there is smoke present across the scene, the flame is located by recognising the grey cycle pixel. This allows for the identification of erroneous detection.

In Remote sensing information for fire management,they identified fire using visible wavelengths of the electromagnetic spectrum on nocturnal satellite imagery [Cahoon et al., 1992; Elvidge, 2001]. Due to the high temperatures that fires generate, the middle infrared bands, especially those based on the 3.7 m, work well for active fire detection. Fire lights have been recognised using the Defense Meteorological Satellite Program satellite series' optical landscan sensor (OLS). The OLS has a fairly limited spatial and temporal resolution, but by distinguishing between stable lights (like towns or power plants) and dynamic lights (mainly fires), it has provided detailed information on the spatial patterns of fire occurrence.Even while current and future orbiting satellite systems provide useful information on the location and extent of active flames, the temporal frequency of sampling from these systems (at best twice per day) is poor for many fire management actions.

The data acquisition network layer uses a ZigBee tree network, which comprises of administration, sink, and sensor nodes. First off, a specific number of sink nodes are placed in the monitoring region when the system is implemented. The routers for the area are the aggregation nodes, which also converge network data. Then, to best suit the circumstance, sensor nodes can be randomly arranged. As a result, a number of sensor nodes will continue to transfer data relating to perception of the environment to sink nodes and convergence to management nodes.Management nodes will transmit data to a network server over GPRS and the Internet for storage. In order to identify fires intelligently, the control center has access to network data that is saved on a server and various locations, as well as various sensor data that may be processed and evaluated. According to the control center, the early warning system can perform voice and flash alerts during a fire, launch fire fighting equipment automatically, and achieve effective fire management.

In IoT-Based Intelligent Modeling of Smart Home Environment for Fire Prevention and Safety they split their labour into four sections according to this strategy in this section. The sensor that collects environmental data and transmits it over the ZigBee protocol to the processing unit in the second unit is defined in the first unit. Users are informed of the incident through the GSM communication device, which is the third element. The fourth unit activates the alert. The suggested smart house fire detection system is made up of four basic components: an alarm system, a GSM communication system, and a processing unit that serves as the main home sink. They installed multiple sensors in the sensor unit, including smoke, gas, and heat sensors, for each component of the smart homes.The sink decides whether to detect a fire based on the information acquired by the sensors and the user's response. A user alert is sent when a single sensor node sends a fire alarm to the sink, activating the GSM communication automatically. The sink makes judgments based on the user's response or the alarm notification from the other sensors. After obtaining evidence of a fire from two or more sensors or from the user, the sink triggers an alarm.

Fiber optic sensors, high temperatures, intelligent sensors, intelligent structures, and structural fire engineering were all used in the system. Fused silica fiber-based Fiber Bragg Grating (FBG) sensors are said to be capable of detecting temperature and strain at temperatures as high as 1300 °C. Long-Period Fiber Grating (LPFG), which is stable up to temperatures of 800 °C, has been made using effective and simple processes.Fiber optic sensors, which work with light signals, are able to solve a slew of issues with monitoring structures in hot environments. Fiber optic sensors have generated interest for the monitoring of structures in fire conditions because of its unique features, such as their tolerance to electromagnetic interference (EMI), small size, and durability in difficult circumstances.

It has been suggested to use an IoT-enabled architecture to control forest fires.

Fog nodes that collect data from sensor nodes and analyze it in real time have also been the subject of investigation.After that, the data was uploaded to the cloud for storage.In order to enhance energy efficiency, efforts have also been focused on creating routing protocols that use RPL routing protocol.These gadgets were already used in the systems that were currently in existence.

2.2 REFERENCES

REFERENCES	
[1]	Saeed, Faisal, Anand Paul, Abdul Rehman, Won Hwa Hong, and Hyuncheol Seo. "IoT-based intelligent modeling of smart home environments for fire prevention and safety." Journal of Sensor and Actuator Networks 7, no. 1 (2018): 11.
[2]	Sarwar, Barera, Imran Sarwar Bajwa, Noreen Jamil, Shabana Ramzan, and Nadeem Sarwar. "An intelligent fire warning application using IoT and an adaptive neuro-fuzzy inference system." Sensors 19, no. 14 (2019): 3150.
[3]	Savitha, N., and S. Malathi. "A survey on fire safety measures for industry safety using IOT." In 2018 3rd International Conference on Communication and Electronics Systems (ICCES), pp. 1199-1205. IEEE, 2018.
[4]	Chuvieco, Emilio, and Eric S. Kasischke. "Remote sensing information for fire management and fire effects assessment." Journal of Geophysical Research: Biogeosciences 112, no. G1 (2007).
[5]	Jiang, Jia, Zhe Gao, Huanhuan Shen, and Changsheng Wang. "Research on the fire warning program of cotton warehousing based on IoT technology." In 2015 International Conference on Logistics, Informatics and Service Sciences (LISS), pp. 1-4. IEEE, 2015.
[6]	Saeed, Faisal, Anand Paul, Abdul Rehman, Won Hwa Hong, and Hyuncheol Seo. "IoT-based intelligent modeling of smart home

	environments for fire prevention and safety." Journal of Sensor and Actuator Networks 7, no. 1 (2018): 11.
[7]	Alqourabah, Hamood, Amgad Muneer, and Suliman Mohamed Fati. "A smart fire detection system using IoT technology with an automatic water sprinkler." International Journal of Electrical & Computer Engineering (2088-8708) 11, no. 4 (2021).
[8]	Bao, Yi, Ying Huang, Matthew S. Hoehler, and Genda Chen. "Review of fiber optic sensors for structural fire engineering." Sensors 19, no. 4 (2019): 877.
[9]	Srividhya, S., and Suresh Sankaranarayanan. "IoT–Fog enabled framework for forest fire management system." In 2020 fourth world conference on smart trends in systems, security and sustainability (WorldS4), pp. 273-276. IEEE, 2020.
[10]	Salim, Nuzaihan Aras Agus, Naziah Muhamad Salleh, Mastura Jaafar, Mohd Zailan Sulieman, Norhidayah Md Ulang, and Andrew Ebekozien. "Fire safety management in public health-care buildings: issues and possible solutions." Journal of Facilities Management (2021).

2.3 Problem Statement Definitions:

Many buildings still use outdated fire safety systems that can't even activate the sprinkler system, and they all wouldn't communicate with each other properly to prevent false alarms. Implementations are also employed to monitor the entire system. The fire management systems in houses and businesses are not very reliant, efficient, or cost-effective, and they lack features like automatic alert systems for admin and authorities.

PS-1:

PS-2:

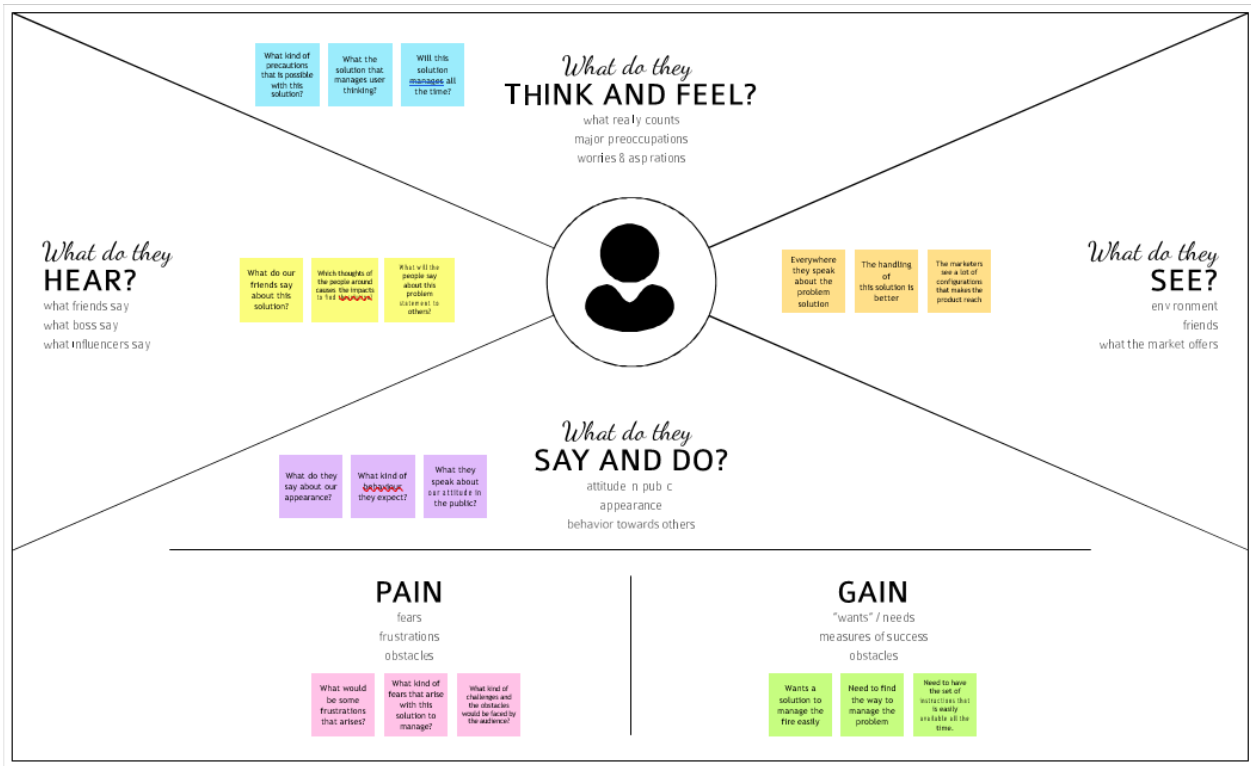
Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel

PS-1	an owner	Implement a fire management system.	The solutions are costly and do not have smart solution.	They are not made up of IoT.	Outraged
PS-2	An employee	Work in an industry	It is not safe	There is no fire management system.	Scared

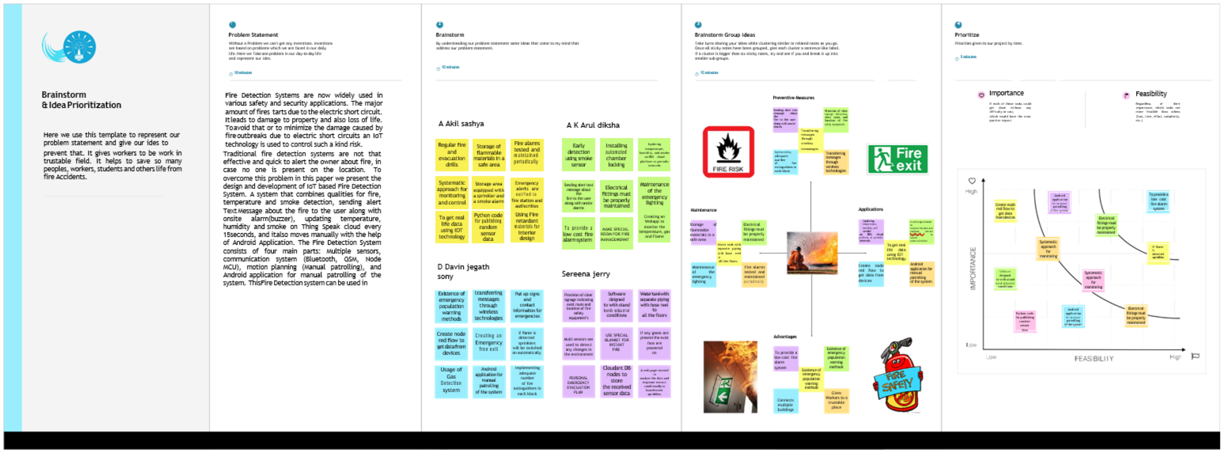
CHAPTER 3

IDEATION AND PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS:



3.2 Ideation and Brainstorming:


Brainstorm
& Idea Prioritization
Here we use this template to represent our problem statement and give our ides to prevent that. It gives workers to be work in trustable field. It helps to save so many peoples, workers, students and others life from fire Accidents.
Problem Statement
Without a Problem we can't get any inventions. Inventions are based on problems which we are faced in our daily life. Here we Take one problem in our day-to-day life and represent our ides.
10 minutes
Fire Detection Systems are now widely used in various safety and security applications. The major amount of fires tarts due to the electric short circuit. It leads to damage to property and also loss of life. To avoid that or to minimize the damage caused by fire outbreaks due to electric short circuits an IoT technology is used to control such a kind risk.
Traditional fire detection systems are not that effective and quick to alert the owner about fire, in case no one is present on the location. To overcome this problem in this paper we present the design and development of IoT based Fire Detection System. A system that combines qualities for fire, temperature and smoke detection, sending alert Text Message about the fire to the user along with onsite alarm(buzzer), updating temperature, humidity and smoke on Thing Speak cloud every 15seconds, and it also moves manually with the help of Android Application. The Fire Detection System consists of four main parts: Multiple sensors, communication system (Bluetooth, GSM, Node MCU), motion planning (Manual patrolling), and Android application for manual patrolling of the system. This Fire Detection system can be used in
Brainstorm
By understanding our problem statement some ideas that come to my mind that address our problem statement.
10 minutes
A Akil sashya
Regular fire and evacuation drills
Storage of flammable materials in a safe area
Fire alarms tested and maintained periodically
Systematic approach for monitoring and control
Storage area equipped with a sprinkler and a smoke alarm
Emergency alerts are notified to fire station and authorities
To get real life data using IOT technology
Python code for publishing random sensor data
Using Fire retardant materials for interior design
A K Arul diksha
Early detection using smoke sensor
Installing automated chamber locking
Electrical fittings must be properly maintained
Maintenance of the emergency lighting
Creating an Webapp to monitor the temperature, gas and Flame
To provide a low cost fire alarm system
MAKE SPECIAL ROOM FOR FIRE MANAGEMENT
D Davin jegath sony
Existence of emergency population warning methods
transferring messages through wireless technologies
Put up signs and contact information for emergencies
Create node red flow to get data from devices
Creating an Emergency fire exit
Usage of Gas Detection system
Android application for manual patrolling of the system
Sereena jerry
Software deigned to with stand harsh industrial conditions
Water tank with separate piping with hose reel to all the floors
USE SPECIAL BLANKET FOR INSTANT FIRE
PERSONAL EMERGENCY EVACUATION PLAN
Cloudant DB nodes to store the received sensor data
Brainstorm Group Ideas
15 minutes
Preventive Measures
FIRE RISK
Fire exit
Maintenance
Applications
Advantages
FIRE SAFETY
Prioritize
Priorities given to our project by time.
5 minutes
Importance
Feasibility
High
IMPORTANCE
Low
FEASIBILITY
High

3.3 Proposed Solution:

SI.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 accuration of information about locations and response through SMS notification and call.

4.	Social Impact / Customer Satisfaction	It prevents accidents caused by fire in industries. Nearby locations so maximum extend more accurate reliability.Compatibility design integrated system
5.	Business Model (Revenue Model)	This product can be utilized by industries. This can be thought of as a productive and helpful item as industries are currently rescuing people and machines from the fire accident.
6.	Scalability of the Solution	It is trying to execute this technique as we need to introduce an Arduino gadget which was modified with an Arduino that takes received signals from sensors. Easy reliability and maintenance. Required low time for maintenance. Cost is reasonable.

3.4 Problem Solution Fit:

5

1.CUSTOMER SEGMENT(S)

Industry members as well as others.

6. CUSTOMER

The customer should just click the alert message to enhance the further step to stop the fire. Proper network connection and available devices are needed.

5.AVAILABLE SOLUTIONS

The customer used to call for the emergency number 101 to call the fire service team to stop the fire at that time of reporting many products in the industry gets damaged and many lives were death. Now with the use of our product the industry can sense the fire explosion and stop at the initial stage itself. So, it is quite much easier.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS

- We are solving the problem of fire spread by automatically detecting the fire at the ignition stage and stop the fire spread easily using Artificial Intelligence and IOT based ideations.

9. PROBLEM ROOT CAUSE RC

. • The fire causes a lot of damages in the industry. Usually when it gets fired in an industry the fire service team is called to stop the fire. But now our solution use can stop the fire without the help of fire service.

7. BEHAVIOUR BE

- At once the message is send to the customers mobile from the sensors-controlled Intelligence the customer himself can give the access to stop the fire spread on the whole.

Focus on J&P, tap into BE, understand RC

3. TRIGGERS TR

We can ask our customer to get an experience about our product. We can insist they must need of our product.

4. EMOTIONS: BEFORE / AFTER EM

Before: Customer is not finding a proper rid for the fire spread problem.
After: Now with the help of our product the customer can easily enhance the problem.

10. YOUR SOLUTION SL

We can just access the message from the IOT devices combined with sensors stop the fire spread at the ignition stage itself. It is much easier, safe to handle.

8. CHANNELS OF BEHAVIOUR CH

ONLINE:
Notifications send can be accessed.

OFFLINE:
The sensors with the help of intelligence can stop the fire spread at the initial stage itself.

CHAPTER 4

REQUIREMENT ANALYSIS:

The Intelligent Fire Management System (IFMS) is a comprehensive system designed to manage fire safety in buildings and other structures. The system uses advanced technologies to detect and extinguish fires, and to provide decision makers with real-time information about the status of fires and the building's occupants.

The system is composed of four main subsystems:

1. The Fire Detection and Suppression System (FDSS)
2. The Building Management System (BMS)
3. The Emergency Communications System (ECS)
4. The Fire Safety Management System (FSMS)

4.1 Functional Requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through website or application Registration through Social medias (like Instagram, Facebook) Registration through LinkedIN

FR-2	User Confirmation	Verification via Email Verification via OTP
FR-3	User Login	Login through website or App using the respective username and password
FR-4	User Access	Allows the app requirement
FR-5	User Guide	Guides the basic steps of using the application
FR-6	User Upload	User should be able to send the data
FR-7	User Solution	Data report should be generated and delivered to user for per every 24 hours
FR-8	User Data Sync	API interface to increase to invoice system

4.2 Non-functional Requirements:

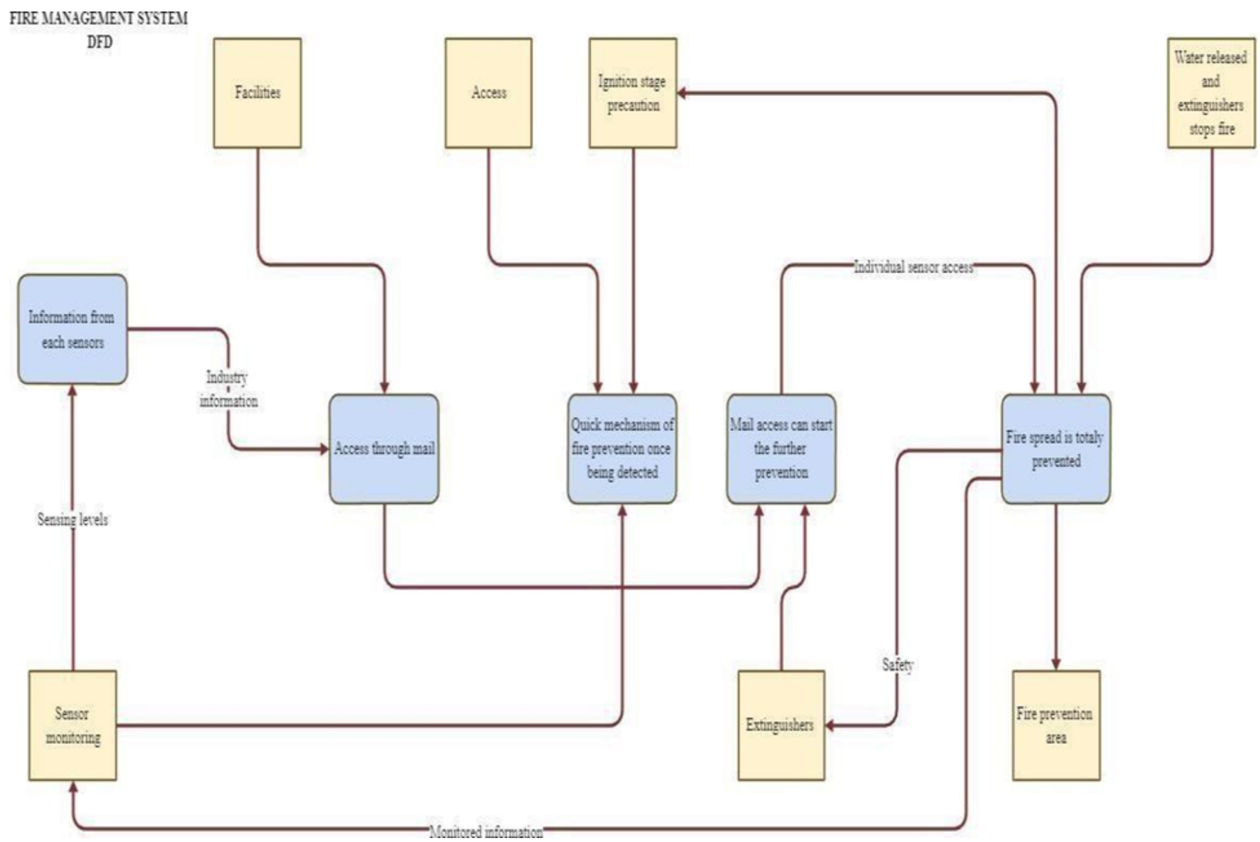
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Usability requirements can consider language barriers and localization tasks. Usability can be assessed from the below functions. Efficiency of use. Low perceived workload. Easy and simple UI.
NFR-2	Security	Access permissions for the particular system information may only be changed by the system's data administrator.
NFR-3	Reliability	The database update process must roll back all related updates when any update fails.
NFR-4	Performance	The front-page load time must be no more than 2 seconds for users that access the website using a VoLTE mobile connection.

NFR-5	Availability	New module deployment mustn’t impact front page, product pages, and check out pages availability and mustn’t take longer than one hour. The rest of the pages that may experience problems must display a notification with a timer showing when the system is going to be up again.
NFR-6	Scalability	We can increase scalability by adding memory, servers, or disk space. On the other hand, we can compress data, and use optimizing algorithms. The website attendance limit must be scalable enough to support 500,000 users at a time.

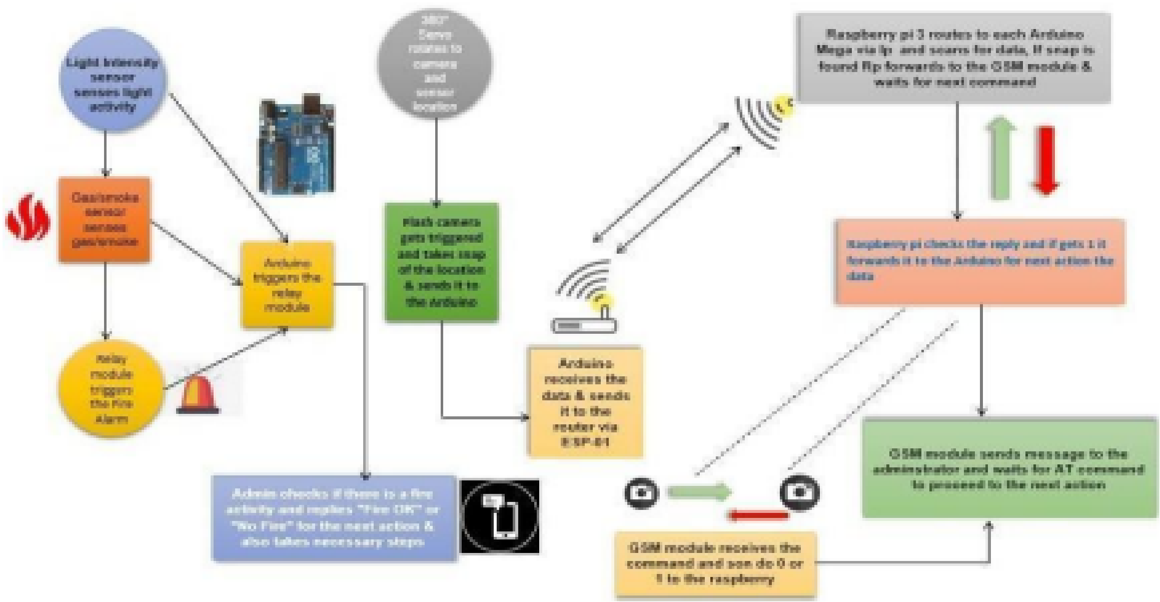
CHAPTER 5

PROJECT DESIGN:

5.1 Data Flow Diagram:



5.2 Solution & Technical Architecture:



5.3 User Stories:

User Type	Functional requirement	User story number	User story/task	Acceptance criteria	Priority	Release
Customer (Mobile user, Web user, Customer 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 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

CHAPTER 6

PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning And Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Hardware or Simulation Software	USN-1	Making Hardware device or Using Working Connect Temperature, Flame, Gas sensor to Arduino with python script	2	High	Akil sashya, Arul diksha, Davin jegath sony, Sereena jerry.
Sprint-2	Cloud Software	USN-2	Create Device in the IBM Watson IOT Platform and link it to Noad-red	2	High	Akil sashya, Arul diksha, Davin jegath sony, Sereena jerry.
Sprint-3	MIT app invertor or Website	USN-3	Develop a Mobile application using MIT app invertor or Web UI	2	High	Akil sashya, Arul diksha, Davin jegath sony, Sereena jerry.
Sprint-4	linking	USN-4	Link Device, IBM cloud and the developed application	2	High	Akil sashya, Arul diksha, Davin jegath sony, Sereena jerry.
Sprint-4	Dashboard	USN-5	Design the Modules and Test the mobile application	2	High	Akil sashya, Arul diksha, Davin jegath sony, Sereena jerry.

6.2 Sprint Delivery Schedule:

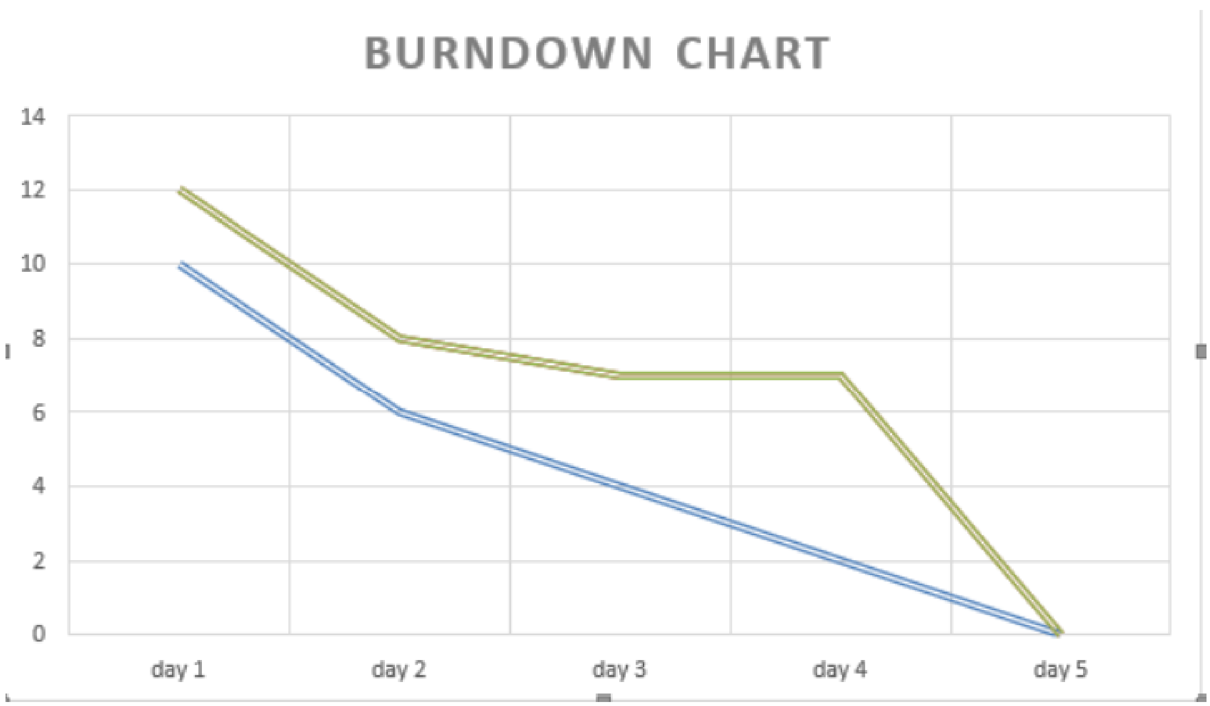
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022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

Velocity:

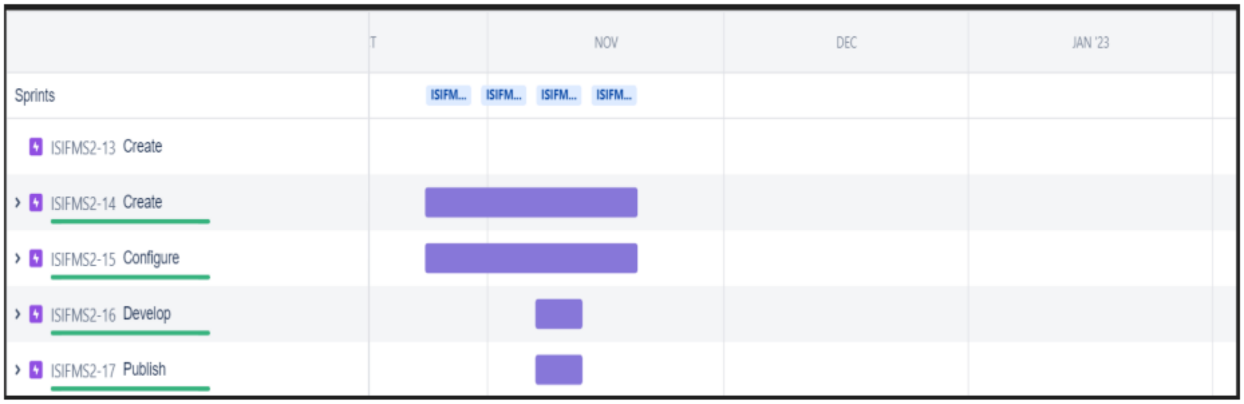
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

Burndown Chart:

A burndown chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.3 Reports from JIRA:


T
NOV
DEC
JAN '23
Sprints
ISIFM...
ISIFM...
ISIFM...
ISIFM...
ISIFMS2-13 Create
ISIFMS2-14 Create
ISIFMS2-15 Configure
ISIFMS2-16 Develop
ISIFMS2-17 Publish


Velocity report
How to read this rep
Commitment
The amount of work in the sprint when it began.
Completed
The amount of work done during the sprint.
Story point
20
15
10
5
0
ISIFMS2 Sprint 1
ISIFMS2 Sprint 3
ISIFMS2 Sprint 2
ISIFMS2 Sprint 4

CHAPTER 7

CODING & SOLUTIONING

7.1 Feature 1:

source code.py - C:\Users\HP\Desktop\source code.py (3.7.0)

File Edit Format Run Options Window Help

```
import time
import sys
import ibmiotf.application
import ibmiotf.device
import random


#Provide your IBM Watson Device Credentials
organization = "s8ov1q"
deviceType = "abcd"
deviceId = "12345"
authMethod = "token"
authToken = "12345678"

# Initialize GPIO
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
    status=cmd.data['command']
    if status=="sprinkleron":
        print ("Sprinkler is on")
    elif status == "sprinkleroff":
        print ("Sprinkler is off")
    elif status == "exhaustfanon":
        print ("Exhaust Fan ON")
    elif status == "exhaustfanoff":
        print ("Exhaust Fan OFF")

    #print(cmd)

try:
        deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}
        deviceCli = ibmiotf.device.Client(deviceOptions)
        #...............................................

except Exception as e:
        print("Caught exception connecting device: %s" % str(e))
        sys.exit()

# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times
deviceCli.connect()

while True:
        #Get Sensor Data from DHT11

        temp=random.randint(0,100)
        flame_level=random.randint(0,100)
        gas_level = random.randint(0,100)

        data = { 'Temperature' : temp, 'Flame_Level' : flame_level, 'Gas_Level' : gas_level }
        #print data
        def myOnPublishCallback():
            print ("Published Temperature = %s C" % temp, "Flame_Level = %s %%" % flame_level, "Gas_Level = %s %%" %gas_level ,"to IBM Watson")

        success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0, on_publish=myOnPublishCallback)
        if not success:
            print("Not connected to IoTF")
        time.sleep(1)

        deviceCli.commandCallback = myCommandCallback

# Disconnect the device and application from the cloud
deviceCli.disconnect()
```

7.2 Feature 2:

Python 3.7.0 Shell

File Edit Shell Debug Options Window Help

```
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:59:51) [MSC v.1914 64 bit (AMD6
4)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
================ RESTART: C:\Users\HP\Desktop\source code.py ================
2022-11-19 09:33:07,008   ibmiotf.device.Client      INFO    Connected successfu
lly: d:s8ovlq:abcd:12345
Published Temperature = 87 C Flame_Level = 46 % Gas_Level = 7 % to IBM Watson
Published Temperature = 22 C Flame_Level = 49 % Gas_Level = 23 % to IBM Watson
Published Temperature = 77 C Flame_Level = 9 % Gas_Level = 95 % to IBM Watson
Published Temperature = 28 C Flame_Level = 99 % Gas_Level = 99 % to IBM Watson
Published Temperature = 10 C Flame_Level = 82 % Gas_Level = 19 % to IBM Watson
Published Temperature = 48 C Flame_Level = 46 % Gas_Level = 54 % to IBM Watson
Published Temperature = 43 C Flame_Level = 72 % Gas_Level = 90 % to IBM Watson
Published Temperature = 68 C Flame_Level = 48 % Gas_Level = 37 % to IBM Watson
Published Temperature = 34 C Flame_Level = 93 % Gas_Level = 96 % to IBM Watson
Published Temperature = 94 C Flame_Level = 18 % Gas_Level = 27 % to IBM Watson
Published Temperature = 48 C Flame_Level = 2 % Gas_Level = 16 % to IBM Watson
Published Temperature = 35 C Flame_Level = 90 % Gas_Level = 17 % to IBM Watson
Published Temperature = 37 C Flame_Level = 99 % Gas_Level = 39 % to IBM Watson
Published Temperature = 50 C Flame_Level = 67 % Gas_Level = 11 % to IBM Watson
```

CHAPTER 8

TESTING

8.1 Test cases:

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID
TC_001	Functional	IBM cloud	Create the IBM Cloud services which are being used in this project	IBM Cloud login ID &password	Go to IBM cloud signup page.Enter e-mail id and other credential.Enter a password	https://cloud.com/login	Login/Signup popup should display	Working as expected	Pass	results verified	No	
TC_002	Functional	IBM cloud	Configure the IBM cloud services which are being used in completing this project	IBM Cloud login ID &password	Go to Cloud login.Enter user id & password.verify the login by the popup display	https://cloud.com/login	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	Pass	results verified	No	
TC_003	Functional	IBM Watson IOT Platform	IBM WAtson IOT platform acts as mediator to connect the web application to IOT devices, so create the IBM WAtson	IBM Watson IOT Platform login id &password	login to IBM cloud . click catalog. search IOT and click create.Go to resourse list and search IOT platform	https://vg4nsy.internetofthings.ibmcloud.com/dasboard/	User should navigate to user account homepage	Working as expected	Pass	results verified	No	
TC_004	Functional	IBM Watson IOT Platform	To create a devicein the IBM Watson IOT platform and get the device credential	IBM Watson IOT Platform login id &password	login to IBM Watson platform click Add Device Enter the details and click finish . Note down the Device ID,device name,authentication key,organisation name	Device credentials	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No	
TC_005	Functional	IBM cloud	configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IOT platform	Node-RED installation	search node-red in catalog wait for some time to completely configure the node-red	https://cloud.ibm/developer/appservice/create-app?starterkit=59c9d5bd-4d31-3611-897a-f94eea80bc9f&defaultLanguage=undefined	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No	
TC_006	Functional	Node Red	create a Node-Red service	Node-RED installation	select IBM IOT input in node in IBM IOT watson platform go to apps and click on generate api keys copy and paste generated api key and token in IBM IOT input after after entering all details click the done button	values of sensors and button for alarm & sprinkler ON/OFF is displayed	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No	

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID
TC_004	Functional	IBM Watson IOT Platform	To create a devicein the IBM Watson IOT platform and get the device credential	IBM Watson IOT Platform login id &password	login to IBM Watson platform click Add Device Enter the details and click finish . Note down the Device ID,device name,authentication key,organisation name	Device credentials	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No	
TC_005	Functional	IBM cloud	configure the connection security and create API keys that are used in the Node-RED service for accessing the IBM IOT platform	Node-RED installation	search node-red in catalog wait for some time to completely configure the node-red	https://cloud.ibm/developer/appservice/create-app?starterkit=59c9d5bd-4d31-3611-897a-f94eea80bc9f&defaultLanguage=undefined	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No	
TC_006	Functional	Node Red	create a Node-Red service	Node-RED installation	select IBM IOT input in node in IBM IOT watson platform go to apps and click on generate api keys copy and paste generated api key and token in IBM IOT input after after entering all details click the done button	values of sensors and button for alarm & sprinkler ON/OFF is displayed	Application should show 'Incorrect email or password ' validation message.	Working as expected	Pass	results verified	No	
TC_007	Functional	python 3.7.0	Develop a python script to publish	python 3.7.0 (64 bit)installation	and install python3.7.0 ,develop py	ython.org/downloads/release/python-370/		Working as expec	Pass	results verified	No	
TC_008	Functional	python 3.7.0	After developing python code,com	python 3.7.0 (64 bit)installation	ython3.7.0 ,develop python code,op	et the output from the cloud		Working as expec	Pass	results verified	No	
TC_009	Functional	oudant Depl	Store the sensor values-Temperatu	IBM cloud Account	e python code,verify the displayed o	utput from the python code		Working as expec	Pass	results verified	No	
TC_010	Web UI	Node RED&MIT inventor	Create Web UI in Node-Red	MIT Inventor Login ID & password	Go to node red select http in &http response.Add functions and select another http in and http response.connect them to IBM IOT output function.Print the command statements such as sprinkler ON/OFF,Alarm ON/OFF and sensor	sensor values and command values is displayed in the debug window and in the application		Working as expected	Pass	results verified	No	
TC_011	Functional	IBM Cloudant DB	Configure the Node-RED flow to receive data from the IBM IOT platform and also use cloudant DB nodes to store the received sensor data in the cloudant DB	IBM Cloud login ID &password	Go to IBM cloud,search cloudant in catalog, Add new dashboard, go to Node-red,connect to cloudant and verify the results	cloudant is connected in the Node-red	user should be able to connect the cloudant and node-red and be able to see the created and database with the sensor values	Working as expected	Pass	results verified	No	

8.2 User Acceptance Testing:

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).

Defect Analysis:

Section	TotalCases	NotTested	Fail	Pass
Print the Sensor values	7	0	0	7
Client MobileApplication	51	0	0	51
Security	2	0	0	2

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

Test Case Analysis:

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

Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final ReportOutput	4	0	0	4

CHAPTER 9

RESULTS

9.1 Performance Matrices:

NFT - Risk Assessment

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
1	Receiving sensor va	Existing	Moderate	No Changes	Moderate	No	>5 to 10%	ORANGE	As we have seen the changes
2	Sprinkler ON/OFF	Existing	Low	No Changes	Low	No	>5 to 10%	GREEN	As we have seen the changes
3	Exhaust Fan ON/OFI	Existing	Low	No Changes	Low	No	>5 to 10%	GREEN	As we have seen the changes
4	Fast SMS	New	Low	No Changes	No Changes	No	>5 to 10%	GREEN	As we have seen the changes
5	Cloudant DataBase	New	No Changes	No Changes	No Changes	No	>5 to 10%	GREEN	As we have seen the changes

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	sumptions/Dependencies/Ri	Approvals/SignOff
1	Python 3.7.0	Developing Python Scri	Depends on the code	https://www.python.org/psf/sponsors/#heroku
2	IBM Watson IoT Platform	Creating and configuri	Depends on the Device Cred	https://4aqwut.internetofthings.ibmcloud.com/dashboard/
3	Node-Red	Creating Web-UI	Depends on the sensor valu	https://nodered.org/
4	MIT App Devoloper	Developing Mobile ap	Depends on the Sensor valu	https://appinventor.mit.edu/about/termsofservice
5	Cloudant DB	Storing Sensor values	Depends on the Sensor valu	https://2587b83c-debe-4618-8ea6-c3bdd6111fb4-bluemix.cloudant.com/dashboard.html

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	lame sensor and te	This is done by devel	Met	Pass	GO	Code working properly	Closed	https://www.python.org/psf/sponsors/#heroku
2	Based on the temp	This is done by creat	Met	Pass	GO	Sprinkler is turning on and o	Closed	http://159.122.183.108:32627/red/#flow/51cd2ad32ac08578
3	If any flame is dete	This is done by creat	Met	Pass	GO	Exhaust fan is turning on an	Closed	http://159.122.183.108:32627/red/#flow/51cd2ad32ac08578
4	Emergency alerts are notified to the auth		Met	Pass	GO	Emergency alerts are send vi	Closed	https://www.fast2sms.com/dashboard/sms/bulk

CHAPTER 10

ADVANTAGES AND DISADVANTAGES:

The Advantages of this Industry-Specific Intelligent Fire Management system are as follows

1. The user need not require expertise knowledge to control this system. This system is simple. The user can easily view the sensor values and take control actions.
2. The control actions are taken automatically.
3. If it is implemented in hardware, then the cost of implementation will be affordable.
4. As we are sensing the sensor values continuously, any slight change in the environment is detected.
5. This system is in User-Friendly format.

The Disadvantages of this Industry-Specific Intelligent Fire Management system are as follows:

1. This system will not be able to detect the origin of fire.
2. This system will not provide an escape route if there is a fire outbreak.
3. If The Industry has specific changes in the environment, then this system will give false alarm.

CHAPTER 11

CONCLUSION

An understanding and having Fire Management system in the industry is of utmost importance.This project is a fire management system that can be user in the industry based on IOT.This system creates a simulation device credentials in IBM WATSON IOT PLATFORM.In node-red,necessary nodes are installed and used.These nodes are installed and used.These nodes are deployed and the data is collected.In the event of fire, this system can issue sprinkler on,exhaust fan on.This remote user monitoring system can monitor the system status of each node in real time.This system monitors the data continuously so that the any slight change in the environment can be easily detected.This ensures good control accuracy .This Industry- Specific Intelligent Fire Management ensures the protection of property, asset and the processes are cost effective and the automatic measures are in control.

CHAPTER 12

FUTURE SCOPE

The future scope of this project is to add additional features like triggering the extinguisher automatically, predict the escape route if the fire outbreaks and to implement this system in real time using hardware.

CHAPTER 13

APPENDIX

13.1 Source Code:

```
import time
import sys
 import ibmiotf.application
 import ibmiotf.device
 import random
 #Provide your IBM Watson Device Credentials
organization = "s8ov1q"
 deviceType = "abcd"
 deviceId = "12345"
 authMethod = "token"
authToken = "12345678"
 # Initialize GPIO
def myCommandCallback(cmd):
 print("Command received: %s" % cmd.data['command'])
 status=cmd.data['command']
 if status=="sprinkleron":
  print ("Sprinkler is on")
 elif status == "sprinkleroff":
  print ("Sprinkler is off") elif status == "exhaustfanon": print ("Exhaust Fan ON")
elif status == "exhaustfanoff":
print ("Exhaust Fan OFF")
 #print(cmd)
 try:
```

```
     deviceOptions = {"org": organization, "type": deviceType, "id": deviceId,
"auth-method": authMethod, "auth-token": authToken}
     deviceCli = ibmiotf.device.Client(deviceOptions)
#..............................................
except Exception as e:
       print("Caught exception connecting device: %s" % str(e))
     sys.exit()
 # Connect and send a datapoint "hello" with value "world" into the cloud as an
event of type "greeting" 10 times
 deviceCli.connect()

while True:
 #Get Sensor Data from DHT11

 temp=random.randint(0,100)
 flame_level=random.randint(0,100)
gas_level = random.randint(0,100)
 data ={ 'Temperature' : temp, 'Flame_Level' : flame_level, 'Gas_Level' : gas_level
}
#print data
def myOnPublishCallback():
     print ("Published Temperature = %s C" % temp, "Flame_Level = %s %%" %
flame_level, "Gas_Level = %s %%" %gas_level ,"to IBM Watson")
success = deviceCli.publishEvent("IoTSensor", "json", data, qos=0,
on_publish=myOnPublishCallback)
 if not success:
    print("Not connected to IoTF")
```

```
time.sleep(1)
  deviceCli.commandCallback = myCommandCallback
# Disconnect the device and application from the cloud
 deviceCli.disconnect()
```

13.2 GitHub & Project Demo Link

GitHub

IBM-EPBL/IBM-Project-44412-1660724565