Literature Survey On Industry-Specific Intelligent Fire Management System

TEAM LEADER : AKIL SASHYA A
TEAM MEMBER 1: A K ARUL DIKSHA
TEAM MEMBER 2: D DAVIN JEGATH SONY
TEAM MEMBER 3: SEREENA JERRY

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

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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 analyses 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

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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 analyses 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.

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