International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

IOT Based Advanced Fire Safety System Using Pump Room Data

Dr. Anjanappa C[1], Vinay M N[2]

[1]*Associate Professor, Dept. of ECE, The National Institute of Engineering, Mysuru, Karnataka, India*
[2]*Student, Network and Internet Engineering, Dept. of ECE, The National Institute of Engineering, Mysuru, Karnataka, India*

Abstract - *With the rapid development in economic construction, intensive increasing of urban population and expansion of industries, objectively puts forward more severe challenge to fire protection. In order to adapt to the modern safety regulation, the real time remote-monitoring system of fire protection based on IoT using Raspberry Pi, MQTT protocol and Web application is proposed in this paper as an answer to unravel the above problem.*

Key Words: **Raspberry Pi**, **MQTT protocol**, **IoT**.

1.INTRODUCTION

The term "fire safety" refers to a series of procedures designed to reduce the amount of damage caused by fire. Procedures for preventing uncontrolled fires from igniting, as well as those for limiting the spread and damage of a fire once it has started, are all part of the fire safety package. Safety from fire accidents measures are those that are designed during the construction of a building or are already in place in existing structures. In this project we effectively try to utilize the already implemented safety system along with IoT and cloud monitoring system to detect any events that may cause fire accident and alert the authorized person immediately. Along with this we also maintain record of safety system and its equipment's. Send notification when servicing of system or equipment is due. Rule based system is implemented to monitor and manage the servicing and updating its record.

2. RELATED WORK

This paper presents the results of multiple surveys done for this project, which was built using a range of hardware components, software tools, new technologies, wired and wireless communication systems, and procedures.

The following are brief summaries of the journals used to complete this project.

1. The main objectives of this work were to design a smart fire detection system that reduces false positives using the wisdom of crowds, which was a voting system. The majority of the system's specifications were met. On the other side, establishing this was challenging owing to the testing environment, but the system did what it was supposed to accomplish in the end. Future development could include the provision of a GUI (graphical user interface) for customizing thresholds, as well as the possibility for residents to verify the quantity of SMSs received. In future we could also consider the autonomous calculation and secure verification of node location, which would assist in validating the position of the WSN node.

2. People are protected from harmful damage by fire safety standards. According to the study, 97 percent of respondents utilize a sensor node to detect fire, 50 percent use image processing to detect fire, and 20 percent use video processing to detect fire. The majority of fire safety methods monitor the surroundings and immediately extinguish the fire once it is ignited. The suggested approach will include measures to protect the fire cracker sector against fire-related incidents. The core cause of the fire is detected at the earliest possible stage, preventing serious fire incidents and loss of life. Based on the results of this study, our project focuses more on sensor integration than others.

3. A conceptional framework of an assistance system is proposed which provides several novel capabilities. The system automates inspection and monitoring tasks, provides up-to-date compliance status information based on multi-monitoring data, and suggests actions to enforce EHS compliance. Based on the assistance system, a closed-loop feedback control mechanism for EHS compliance management can be established. The system setup task required in order to obtain monitoring data in real-time from diverse monitoring devices may be viewed as a too strong prerequisite for the proposed approach. However, it can be assumed that the large number of currently ongoing development and standardization initiatives for enabling the industry for vision will significantly ease this system integration task. The rule-based system proposed here for monitoring and inspection is used in over project.

4. The technique used in this paper is at micro level, which means it will affect only the area under the influence of the fire and will not spoil any surrounding areas or equipment. In industries where sensitive machinery and electronics are required for implementation and operation, this approach can be extremely helpful and efficient. The total response time of the sensor to sense the location of the fire after sensing heat is 3 seconds, and the total response time to extinguish the fire is 5 seconds. It throws water until the fire is totally quenched after the target is locked. These improvements to the fire extinguishing system can be made in the future, such as range, which is one of the work's constraints. Because the range of a sensor is limited to one meter, sensors with sufficient range for industrial usage should be used. The number of points at which sensor gives temperature is only 8, so it can never target the middle point and can never get 100% accuracy. As the servo is rotated at selected angles so by smooth controlling of servo it can get 100% accuracy in target. The Pressure of the water pump can also be controlled with respect to the distance of the target. The projectile of the water jet can also consider in creating a better equipped extinguishing procedure. All of these

processes help to reduce the system's response time when it comes to detecting and extinguishing flames.

3. MOTIVATION

Safety from fire accidents is very important in any industry or commercial builds as many people work there and their safety cannot be compromised. And also protecting industrial property against any fire accidents is also very important. Using traditional way to tackle fire accident will lead to major loss to human life and property. So, to overcome this problem an automation in managing and maintaining from fire safety system is needed.

4. PROBLEM STATEMENT

In any industry, safety is a must. Precautions for fire safety mishaps should be implemented in all locations. Many fire incidents occur in industrial environments, and they do significant damage to both people and property. Many safety measures are now incorporated via the Internet of Things. But the problem is most of the fire detection method detects fire after it is triggered.

Another major issue is that the implemented safety system should work properly at the time of an accidents to limit the damage caused by fire. If the safety system and its equipment's are not regularly serviced, it might not be able to control spreading of fire, thus causing more loss of property and human life.

If a company owns more than one industry / commercial buildings, then it requires more man power to maintain and monitor safety of these industries and commercial building. If there was any way to monitor all these industries, commercial building at a single place we could reduce the man power required for safety management and maintenance process.

5. OBJECTIVE

The work's objectives are as follows.

1. To manage fire hydrant pump and fire hydrant system maintenance of single or multiple industries and commercial building at a single place.
2. Design a unit of automatic sensing system with dedicated apparatus or by using already installed sensing system.
3. Send the information regarding pump room data to server using Raspberry Pi.
4. To provide a MQTT-based gateway for secure communication with a restricted Internet Protocol (IP).
5. Developing web application to show all these data in a visual format and also provide interface for user to manage and monitor the fire accidents system remotely.

6. METHODOLOGY

System block diagram as shown in figure as sensor module which consists of Pressure sensor, motor rpm sensor, temperature sensor. This sensor module consists of LoRa module which is used to send the sensor data to controller module.

Controller module consist of Raspberry pi 4 with LoRa module to receive the data sent for sensor modules. From controller, sensor data is sent to server using Wi-Fi or Lan internet connection using MQTT protocol.

In MQTT protocol, this controller module is MQTT client which publishes the data to MQTT Broker. Further MQTT Broker will publish this data to all the subscribers. One of the subscribers is time-series database where the data is stored. From this time series database, stored data is queried for analytics and graphs.

Cloud server is where the handling of request from web application and sending appropriate response to request is done. Here we use ASP.NET core web framework to handle web requests. Sensor data which is stored in database is queried, processed and sent to web application. Here we also monitor incoming data from controller module which is stored in time series database for any unusual or irregular data spike. If any irregularity or spike in rate of fluid, gas is noticed the application immediately alerts the authorized person, if he does not respond then it alerts the higher authorities. If possible, we can also stop flammable fluid flow so that further damage can be controlled / stopped.

A web application (referred to as a web app) is an application that runs on a web server. The user uses a web browser with an active network connection to access web apps. All the information about the pump room, fluid flow data, safety equipment details with their maintenance history all are shown using web application. This is part where the user interacts, views all the information and also sensor data is shown in visual format so that it is easy for the user to know what is happening.

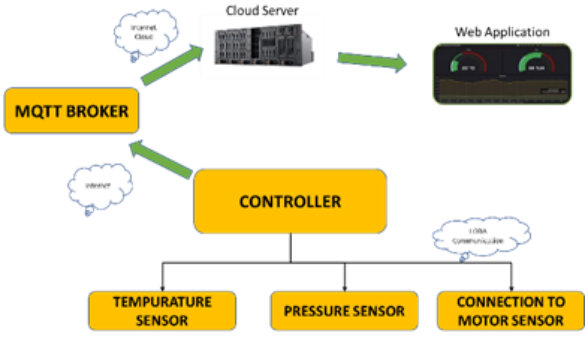

Figure 1.1: Advanced Fire Safety System Block Diagram

Design Requirements

The hardware components required for this project.

1. Raspberry Pi 4.
2. Pressure Sensor.

3. Fire Alarm Control Panel.
4. Temperature Sensor.

7. FLOWCHART

Sensor Module: First we initialization the sensor, check if it is connected and working correctly. Then read the data from sensor and then send this data using LoRa.

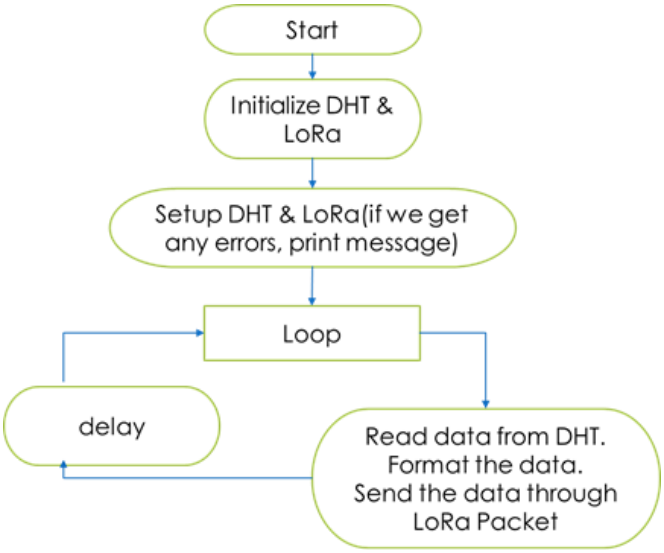

Figure 2.1: Sensor Module

Controller Module: First we initialization the LoRa module, check it's working. Then wait for incoming data from sensor module. Read the received data. Then publish that data to MQTT broker.

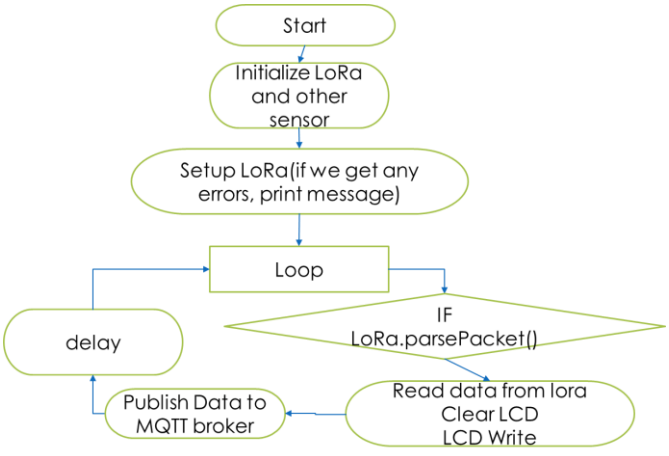

Figure 2.2: Controller Module

Web Application: First we check if user is logged in, then allow the user to access the web application. The user can use all the feature in he has authorization to use that feature. The below flow chart represents basic flow of web application.

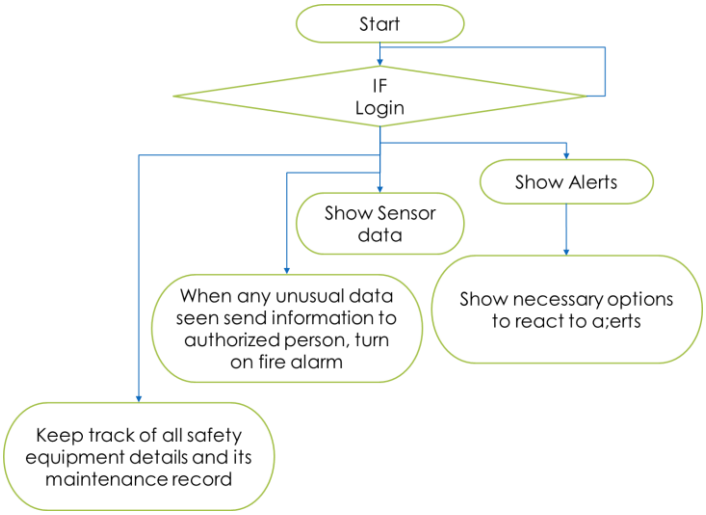

Figure 2.3: Web Application

8. RESULTS

Figure 3.1 shows the overall faults, notifications, requests present in the system / to that user.

Figure 3.2: Overall System's health, important information about the pump, engine, water level, diesel level and battery status.

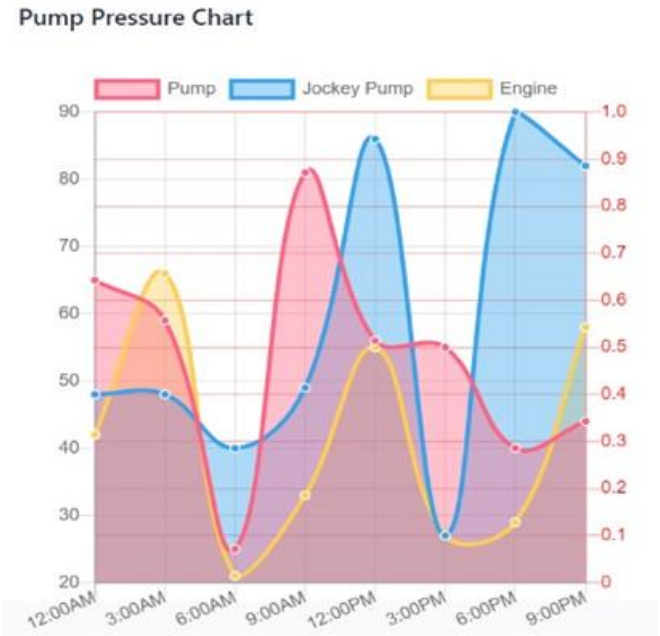

Figure 3.3 shows pressure of different pumps present over time.

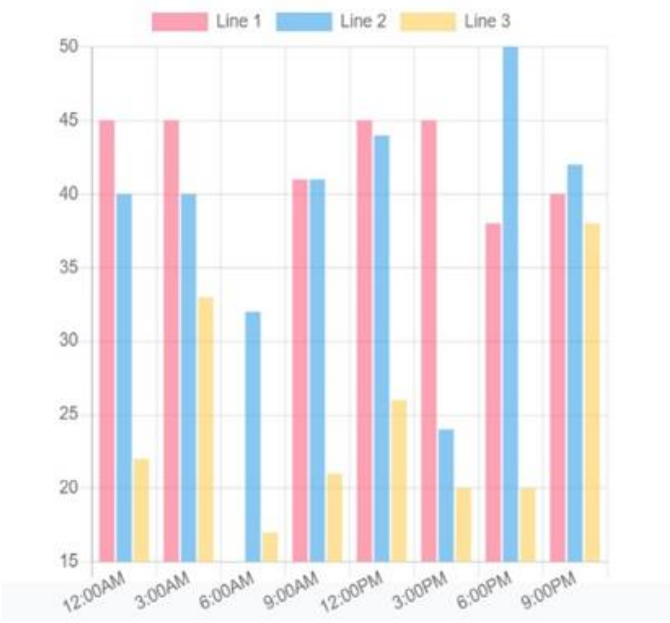

Figure 3.4: Show pressure at different pipe lines.

9. CONCLUSION AND FUTURE SCOPE

This advanced IoT system with web application provides information about the diesel and other liquid flow which might cause huge fire accidents if it is leaked or if any pipes that carry these fluids are damaged. So, this system provides 24*7 monitoring of this system and also provides necessary alerts if anything is wrong in the system, thus minimizing the damage or fire accident which might have occurred. Web application provides provision for monitoring multiple industries at a time, thus reducing the number of workers need to manage and maintain the system.

This system checks corresponding intended information from different sensors to help oversee about the all the pumps status, water level, diesel level. The proposed research enhances the Fire safety management system and automates the process. Web application provides a clear picture whole system and safety equipment's that are installed.

This proposed work is a better way of maintaining and managing fire safety system in industries. The modules deployed in this design are low-cost, versatile, and durable. A list of future works which can be performed on this system is listed as follows:

- To measure pump / motor speed and control it automatically to maintain fluid flow rate.
- With furthermore sensors interface, can even control pump / motor working so that it can be turned on and off according to the requirements
- Develop this module to integrate with all safety system which will be implemented while building new industry or factory and control all the safety system with less effort and man power
- Update the fluid controlling values to automatically close and open, so that in case of any emergency the valves can be close automatically.

REFERENCES

[1] Md Iftekharul Mobin , Md Abid-Ar-Rafi , Md Neamul Islam , and Md Rifat Hasan," An Intelligent Fire Detection and Mitigation System Safe from Fire," International Journal of Computer Applications, Volume 133 - No.6, January 2016.

[2] Jia Jiang, Zhe Gao, Huanhuan Shen, Changsheng Wang," Research on The Fire Warning Program of Cotton Warehousing Based on IoT Technology" International Journal of Engineering Business Management, vol.18, no.2, pp.121-124,2017.

[3] Yi Li, Jianjun Yi2, Xiaoming Zhu, Zhuoran Wang and Fangwen Xu, "Developing a Fire Monitoring and Control System Based on IoT", Advances in Intelligent Systems Research, volume 133.

[4] Shi Yongkui, zhou xin, Zhang Songmei,|| The Design of Safety Early Warning System for Chlor-Alkali Chemical Industry||, International Conference on System Science, Engineering Design and Manufacturing Informatization,2017.

[5] H. Thimm, "A Continuous Risk Estimation Approach for Corporate Environmental Compliance Management," Proc. IEEE 15th Int. Conference on Environmental and Electrical Engineering, Rom, Italy, pp. 83-88, 2015.

[6] IEC, IEC CD 62832: Industrial-Process Measurement, Control and Automation - Reference Model for Representation of Production Facilities (Digital Factory), 2014.