



AUTOMATIC FIRE DETECTION, MONITORING AND CONTROLLING IN INDUSTRIES USING IOT

Dr. G C Manjunatha , Manjunatha K H , Usha. G

Assoc. Prof , Asst. Professor, Asst. Professor

gc.manjunatha@gmail.com , manjukh09@gmail.com , ushagonal645@gmail.com

Department of ECE, Proudhavevaraya Institute of Technology, Abheraj Baldota Rd, Indiranagar, Hosapete, Karnataka-583225

ABSTRACT

In our daily lives, security and automation take front stage. Nowadays, there is a standardised method to designing security systems and automating industrial processes. We have created low-cost industrial automated security systems and attempted to raise these standards in this project by integrating new design methodologies. Everyone aspires to feel as safe as they can. This wireless industrial safety security system with fire sensors is designed to be user-friendly for any user. The NodeMCU Single Board Computer, which is based on Arduino, controls the system in its entirety. In the event that the NodeMCU detects fire, it will notify the on-board WIFI module, turn on the DC water pump to sprinkle water, and sound an alarm to notify the staff. The NodeMCU will keep a constant eye on all of the sensors.

INTRODUCTION

This project is an Internet of Things (IoT) based fire detection, monitoring and controlling system that best suited for industrial applications. This work focused on using the low cost ESP8266 Wi-Fi module that triggers the alarm and send the email with the help of SMTP server. Fire is the major cause of accidents claiming valuable lives and property.

The chemical reaction between carbon-based materials in presence of oxygen generates flammable vapor causing a steady rise in temperature and results in a fire. The major characteristic of fire is that it extends exponentially with time. Hence, timely detection of fire is critical for avoiding a major accident. In this report, fire detection system is integrated with IoT platform.

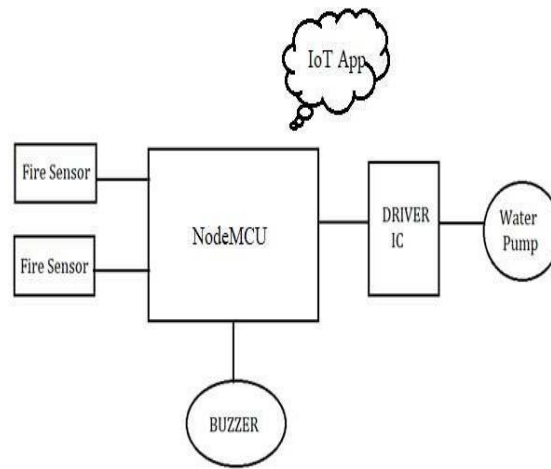


Figure1 Block diagram

LITERATURE SURVEY

Introduction to IoT and Fire Safety in Industries:

Explore papers and articles that provide an overview of IoT and its applications in industrial settings. Look for literature that discusses the importance of fire detection, monitoring, and control in industrial environments and the challenges associated with traditional systems.

IoT-Based Fire Detection Systems:

Investigate research that focuses on the development of IoT-based fire detection systems.

Identify different sensor technologies (e.g., smoke detectors, temperature sensors, gas sensors) and communication protocols used in these systems.

Evaluate the effectiveness and reliability of IoT-based fire detection compared to traditional methods.

Real-Time Monitoring and Data Analytics:

Review studies that emphasize real-time monitoring of environmental parameters relevant to fire risk (e.g., temperature, humidity, gas concentration) using IoT devices.

Look for literature discussing the integration of data analytics techniques (e.g., machine learning, predictive modeling) for early detection of fire hazards based on sensor data.

Remote Monitoring and Control:

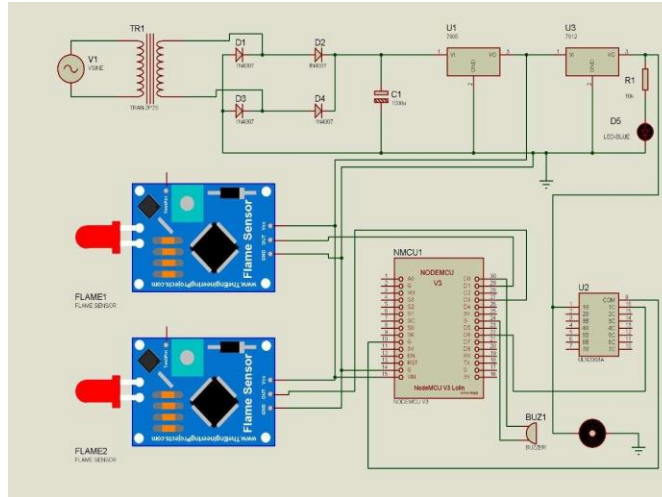
Explore how IoT enables remote monitoring of industrial facilities for fire detection and prevention.

Look for examples of IoT-enabled control systems that can automatically trigger fire suppression mechanisms (e.g., sprinkler systems, foam suppression) or initiate evacuation procedures in case of a fire.

PROPOSED SYSTEM

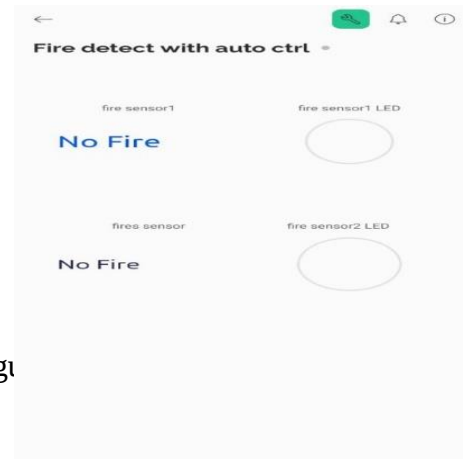
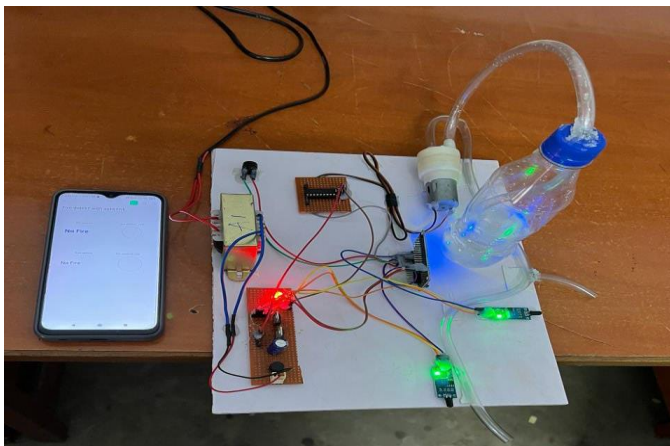
The circuit diagram depicts the hardware prototype that has been developed to realize the proposed methodology. It is composed of flame sensors, NodeMCU and alarm appliances (buzzers or devices that produce loud noises), fire control units (sprinkler systems or fire extinguisher systems), driver IC, power supplies and wirings and an IOT based Blynk interface.

Figure2 Schematic diagram



Whenever the Flame sensor detects the fire, it sends signal to the NodeMCU and then NodeMCU board will be connected to the blynk. cloud through the internet and the information will be updated in the IOT web server using in-built Wi-Fi module. We can turn ON and OFF this system using the blynk.app interface. The smartphone receives a push notification as soon as buzzer is activated in the event of a fire.

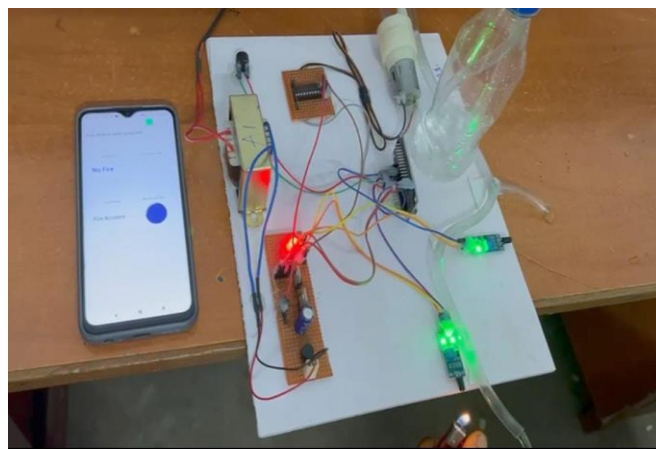
RESULTS



Fig



Figure.5 Photocopy of No fire at initial stage



IoT-based systems using IoT can detect fires at an early stage, allowing quick and effective response, minimizing damage and potential loss of life.

Remote monitoring: IoT-based systems allow remote monitoring of the environment and detecting any anomalies, even in hard-to-reach areas, providing real-time data and alerts for timely response.

Precision monitoring: IoT sensors can be used to monitor and control different aspects of the industrial environment, such as temperature, humidity, and air quality, making it possible to detect and prevent fire hazards before they occur.

Automated response: IoT-based fire control systems can be programmed to respond automatically to specific situations, such as activating fire suppression systems or opening smoke vents.

Reduced downtime: By reducing the risk of fires, automatic detection and control systems can minimize downtime, improve productivity, and reduce costs associated with equipment replacement, repairs, and lost production.

APPLICATIONS

Manufacturing industries: In manufacturing industries, fire accidents can cause severe damage to equipment and materials. IoT-based fire detection systems can monitor the temperature, smoke, and

gas levels in real-time and alert the relevant personnel in case of any abnormal readings. The system can also automatically control the temperature and humidity levels to prevent any fire accidents.

Power plants: Power plants involve high voltage equipment and flammable materials. IoT-based fire detection systems can monitor the equipment and detect any abnormal temperature or pressure changes. The system can also automatically control the equipment to prevent any fire accidents.

Warehouses: Warehouses are usually stocked with flammable materials, and a fire can quickly spread and cause damage to the entire facility. IoT-based fire detection systems can monitor the temperature, smoke, and gas levels in real-time and notify the relevant personnel immediately. The system can also automatically control the temperature and humidity levels to prevent any fire accidents.

Hospitals: Hospitals have to deal with various kinds of medical equipment that are prone to fire accidents. IoT-based fire detection systems can monitor the equipment and detect any abnormal temperature or pressure changes. The system can also automatically control the equipment to prevent any fire accident

CONCLUSION

Making ensuring your building is fireproof is an important first step. In order to keep the building safe, alert the appropriate parties in the event of a fire, and allow them to put out the blaze, a high-quality fire detection system must be installed. To protect building inhabitants from harm and to avoid loss of life, a fire alarm system is primarily installed to receive warnings when a fire is detected. Preventing property damage is the secondary objective of fire safety. Work operations may be ensured by reducing damage and averting fires. Because of the adaptability and accessibility of IoT-based fire detection and controlling systems, they can be remotely accessed from any location via the system or mobile devices, and they may receive messages from the alarm, including an alarm occurrence.

FUTURESCOPE

We can implement the project by adding GSM module which uses SMS to send an alarm to the user's mobile phone. So, by using GSM module a SMS can be sent even in absence of internet and we can use Global positioning System (GPS) which provide information in the form of coordinates of the location of the point of fire through GSM SIM900 Module Short Message Service (SMS) to the user. Through the use of thermistors and the software/firmware of the detector and the system, Response Time Index (RTI) of a heat detector can be reduced so that the detection of a thermal event could be more quickly detected. Smoke alarms with voice and location alerts will identify whether it is a fire or a carbon monoxide emergency, and in which area of the building the fire has detected.

REFERENCES

1. Fire Incidents from 2001-2014, National Crime Records Bureau (NCRB), Accessed from:

<https://ncrb.gov.in/>.

2. S.J. Liu, G.Q. Zhu, The Application of GIS And IOT Technology on Building Fire Evacuation, *Procedia engineering*, 71(2014) 577-582.
3. S.E. Morris, T.A. Moses, Forest Fire and The Natural Soil Erosion Regime In The Colorado Front Range, *Annals of the association of American geographers*, 77 (1987) 245-254.
4. A. Alonso-Betanzos, O. Fontenla-Romero, B. Guijarro-Berdiñas, E. Hernández- Pereira, M.I.P. Andrade, E. Jiménez, T. Carballas, An intelligent system for forest fire risk prediction and fire fighting management in Galicia, *Expert systems with applications*, 25 (2003) 545-554.
5. B.U. Töreyn, Y. Dedeoğlu, U. Güdükbay, A.E. Cetin, Computer Vision Based Method for Real-Time Fire and Flame Detection, *Pattern Recognition Letters*, 27 (2006) 49-58.
6. M.S.A. Azmil, N. Ya'Acob, K.N. Tahar, S.S. Sarnin, (2015) Wireless Fire Detection Monitoring System for Fire and Rescue Application, In 2015 IEEE 11th International Colloquium on Signal Processing & Its Applications (CSPA), IEEE, 84-89.
7. R.A.Sowah, A.R.Ofoli, S.N.Krakani, S.Y.Fiawoo, Hardware Design and Web- Based Communication Modules of a Real-Time Multisensor Fire Detection and Notification System Using Fuzzy Logic, *IEEE Transactions on Industry Applications*, 53 (2016) 559-566.