FIRE DETECTION AND PROTECTION SYSTEM

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Abstract:
This paper presents a prototype model version developed for fire discovery as well as security systems with a key purpose of properly reducing fires to make certain the security of lives and also building. Such systems play a critical function in discovering fires without delay notifying passengers, as well as immediately managing or snuffing out the fire prior to it spreads out thoroughly. By using sophisticated logical methods these systems evaluate the nature of the fire allowing aggressive procedures to be taken. Very early discovery enables rapid action decreasing possible damages plus making sure the safety and security of people within the facilities. Additionally, the combination of contemporary modern technologies improves the system's performance as well as dependability even more improving its capacity to avoid disastrous occurrences. Via the application of this model the paper intends to add to the innovation of fire security steps, promoting a much safer setting for both domestic plus business setups. Eventually the growth and also implementation of efficient fire discovery.
Keywords: Fire detection, Fire protection, Prototype model

INTRODUCTION

Fire accident survey shows that 80% losses caused thanks to fire would are kept faraway from if the heart was identified promptly. ESP 32 based IOT empowered fire indicator and observing framework is that the account this issue [4]. The key components and functions of a system designed to detect, suppress, and prevent fires in buildings[6]. It typically includes information on the types of detection devices, suppression systems, and emergency response [1],[5] procedures used to ensure the safety of occupants and minimize property damage in the event of a fire [7],[8].

During the task, we've assembled fire finder utilizing ESP32 which is interfaced with a temperature sensor, a smoke sensor, a humidity sensor and signal. Based on the nature of the fire the sensors will activate [2]. The temperature sensor detects the heat produced due to monitoring or fire buzzer related to a ESP32 gives us an alert sign [3]. For a fire detection and protection system is that it is essential for ensuring the safety of a building and its occupants in the event of a fire.

Fire detection and protection system typically includes information about the purpose and importance of such systems in preventing and controlling fires in buildings and other structures [6]-[7]. It may also include details about the various components and technologies used in fire detection and protection systems, as well as any relevant regulations or standards that govern their design and installation.

For a fire detection and protection system may delve into the different types of fire detection and suppression methods available, such as smoke detectors, sprinkler systems, and fire extinguishers [5]. Based on the nature of the fire the suppression systems will activate like temperature sensors, humidity sensors etc. It could also touch on the importance of regular maintenance and testing of these systems to ensure they are functioning properly in case of an emergency[3]. Understanding the

background and context of fire protection systems is crucial for ensuring the safety and well-being of occupants in any building or structure.

The problem statement for a fire protection system is to effectively prevent and suppress fires in order to protect lives and property. Fire detection and protection systems are designed to detect fires early, alert occupants, and control or extinguish the fire before it spreads and causes extensive damage. Objectives for a fire detection and protection system refer to the specific goals and aims that are set in place to ensure the safety and protection of individuals and property in the event of a fire. This may include detecting fires early, controlling or extinguishing fires effectively, and minimizing damage and loss [4]. These objectives are crucial in designing and implementing an effective fire protection system. Fire detection and protection systems are critical components of building safety, designed to detect, control, and mitigate the impact of fires. Here is some relevant background information about fire protection systems:

OVERVIEW OF FIRE DETECTION AND PROTECTION SYSTEM

In fire detection and protection system esp32 module is linked with different sensors one side and with relay module and buzzer to other side. The above prototype system is the fire detection and protection system. It is basically runs on ESP32 module and is connected with LCD display for visualizing the process, 5V buzzer, flame sensor, temperature sensor, gas sensor and 2-channel relay module. These relay modules are connected with water and CO2 pumps. This system's work can be noticed from any location by the usage of Blynk software and we can monitor the surroundings through this software[5].

A. ESP32 MODULE : The ESP32 is a popular low-cost, low-power system-on-chip microcontroller module that is capable of both Wi-Fi and Bluetooth functions.

B. FLAME SENSOR : It is used to detect the flame and humidity levels around the surroundings. These are sensitive to the light waves emitted by fires. In case of fire, dryness of air increases hence humidity decreases. This device detects fire or wavelength within range of 760-1100nm.

C. Temperature Sensor : It used to detect the temperature around the surroundings. Advantage provided with respect to its ° Kelvin counterpart is that no subtraction is required from its output. We use DHT11 sensor in this prototype. it provides value in percentage (20 to 90% RH) and temperature values in degree Celsius (0 to 50 °C). It has pins VCC, GND, DATA, and a not in use pin NC.

D. **Gas Sensor :** It used to determine the various concentration of gases around the surroundings. The sensor traps limited concentration of certain gas and subsequent identification of the gas is done by measuring characterized breakdown voltages. It can detect LPG, Smoke, Alcohol, Propane, Hydrogen, Methane and Carbon Monoxide concentrations ranging from 200 to 10000 ppm. This MQ2 Gas sensor, it operates on 5V DC and approx consumes 800mW.

E. Buzzer: This is device used for alarming purpose. It is a mechanical or piezoelectric audio signaling device, which is used on alarm circuits and timers. It is basically a 5V buzzer. This 5V Buzzer, it operates at 5V DC and current rating approx 30mA.

F. Relay Module: It is ideal for micro projects which require a small amount of AC or DC power.

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Fig. 1. Block Diagram of fire detection and protection system

Fig. 2. ESP32 Module

Fig. 3. Infrared flame sensor

Fig. 4. DHT11 Sensor

Fig. 5. MQ2 Gas Sensor

Fig. 6. Buzzer

Fig. 7. Relay Module

G. Pumps and Nozzles: A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages. These are electronic pumps which can be triggered with the help of relay module and different suppressing agents are given out from it.

H. BLYNK SOFTWARE: Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and Node MCU via the Internet. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

RELIABILITY ANALYSIS AND DISCUSSION

The Integrity Evaluation as well as Conversation reviews the efficiency of the suggested fire discovery along with alarm system making use of Raspberry Pi as well as computer system vision innovation. Metrics such as discovery precision, incorrect alarm system price together with reaction time are used to examine system dependability. Speculative screening under numerous problems supplies understandings right into its performance in spotting fires while lessening incorrect alarm systems. Relative evaluation with existing systems determines possible benefits together with restrictions. Tips for improvements focus on formula improvement along with system strength. In General, the area highlights the importance of dependable fire discovery systems in safeguarding lives as well as residential or commercial property, supplying understandings for future research study plus functional applications. When temperature is increased above normal then the buzzer starts alarming [8]. If fire occurred then humidity will be decreased and then buzzer starts alarming and the relay module gets the signal and water nozzle will be triggered. If fire is occurred along with smoke, then the buzzer starts alarming and the relay module gets the signal and CO2 nozzle will be triggered [1],[3]. The Labelled Diagram, it depicts the overall connection of the kit and pins of each component.

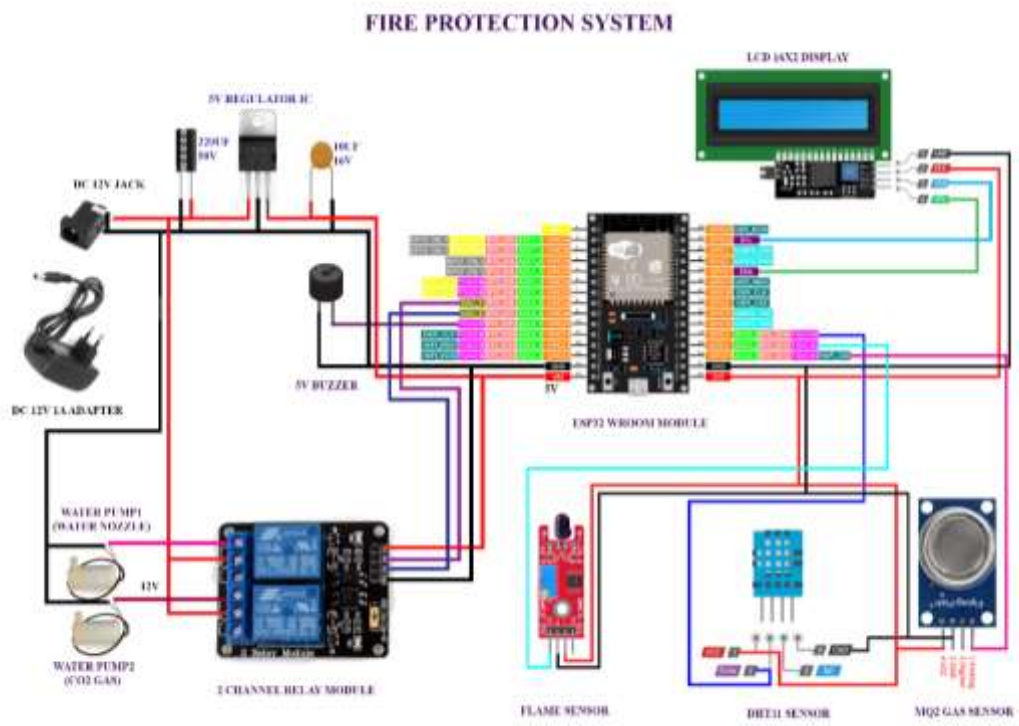

Fig. 8. Fire Protection System

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Fig.9. Top view of prototype

This prototype is very simple and is capable to provide warnings based on sensors. Each and every step is shown on the LCD display and this can be monitored through online in blynk software. Fire protection systems are crucial for preventing and mitigating the damage caused by fires. From detailed analysis several key components added to the IoT device [6],[7]. When fire is occurred depending upon the nature of fire used by nozzles. The types of fire protection systems including the fire detectors, Gas sensors, Fire alarming systems, Automatic sprinklers and fire suppressing agents and there are different types of fires.

Case 1: Wood Fire: In case of wood fire, the temperature rises and flame occurs, so the relay operates and water can be used for this type of fire so water nozzle will be triggered.

Fig. 10. System detecting wood fire

The fire is sensed and smoke percentage is calculated and water nozzle opened.

Case 2: Electrical Fire: In case of electrical fire, the temperature rises and flame will not occur instantly in addition with detection of smoke, so the relay operates and we can't use water for this type of fire so CO2 nozzle will be triggered.

Fig. 11. System detecting electrical fire

The System detecting electrical fire, it sensed the smoke and humidity, temperature.

Case 3: Combustible Metal Fire: In case of metal fire, the temperature rises and flame occur instantly in addition with detection of smoke, so the relay operates and dry chemical nozzle will be triggered.

CONCLUSION

The relevance of durable fire security systems cannot be overstated as they play a vital duty in protecting both people along with frameworks from the ravaging effect of fires. This research study checks out different sorts of systems, such as lawn sprinklers together with fire extinguishers, clarifying their capability in fire reductions. Highlighting the value of routine upkeep to make certain functional preparedness the study highlights the need of recurring checks as well as fixings. In addition, it highlights the value of enlightening the general public concerning fire security to proactively avoid fire cases. The job set, originated from these searchings for shows vital for firemens, constructing assessors plus fire security specialists, providing thorough assistance on system choice, installment, as well as upkeep. By advertising fire security recognition the set adds to a society of avoidance. Looking ahead improvements in fire discovery innovation, renovations in security laws together with ingenious methods to fire as well as fire remain to be vital focal points for future progression in fire security efforts.

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