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Smart Fire Detection System with Early Notifications Using Iot

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Abstarct

An extremely effective and cutting-edge technology that uses the Internet of Things to detect fires in real time and send out early alerts for prompt action is a smart fire detection system with early notifications. To detect flames, temperature changes, and smoke, the system combines a number of sensors, including a Flame Sensor and a DHT11 Temperature and Humidity Sensor, with an Arduino Uno microprocessor. The system's status, including if a fire or unusual temperature conditions are detected, is shown on the 16x2 LCD. While the Wi-Fi Module links the system to the internet and sends real-time notifications to users or authorities via a mobile or online interface, a buzzer offers instantaneous aural alarms. A 12V adapter provides the power, guaranteeing a steady supply. The Power Supply Board makes sure that different components receive the appropriate voltage and current. Because the system is housed in a plank, all of the components have both physical protection and a secure mounting base. Faster reactions to fire accidents are ensured by the combination of real-time detection and remote notifications via IoT, reducing damage and life-threatening risks.

Keywords: Arduino uno, IOT (Internet Of Things), Leakage Monitoring, Hardware Sensors

I. INTRODUCTION

Nowadays, a home security system is an essential concern. Indeed, this system is designed to ensure that properties and loved ones are always safe and protected. Over the past few years, having a robust security system for the home has become vital, which can provide protection in the most ideal and secure manner. Many countries are gradually implementing home security systems. A critical component of any home security system is the identification of individuals who enter and exit the house. In the past, people relied on traditional methods for their home security systems. The traditional security system depends on external factors such as keys, passwords, and ID cards for access. However, due to certain limitations, biometrics have emerged to offer a more promising security solution. Biometrics refers to a unique and measurable parameter used for individual identification. Biometric systems require specialized hardware such as fingerprint scanners, palm print scanners, DNA analyzers, etc. Furthermore, this specific equipment necessitates that the individual interacts with the hardware to capture data of unique human features. Biometric technology is regarded as one of the most secure verification systems available, providing a higher level of security than traditional methods. Face recognition is the most popular method within biometric technology after fingerprint recognition. This popularity is attributed to its greater stability, as faces have more distinguishing features. Additionally, it is considered highly secure because a face cannot be stolen, borrowed, or forged to gain entry into a

home. Face recognition is arguably the most intuitive method for conducting biometric verification among individuals. Face detection constitutes the initial phase of the face recognition system.

II.LITERATURESURVEY

In their work "IOT BASE FIRE EVACUATION SYSTEM 2022," Manaswini Parlikar, Shivkanya Angad Padole, Pratik Shahuttam Rao Sargar, Nikhil Vilas Jadhav, and Mayur Anil Shinde demonstrate how to obtain information and execute the appropriate action using a mobile application method. Here, data is stored in a database cloud. A number of sensors have been utilized to notify the user when a certain amount of fire, hazardous gas, or temperature rise occurs; an alarm will sound if necessary. Wireless access points or location tracking and rescue wi-fi techniques are employed for interior placement. In the event of a building fire, path navigation and mapping can be used to determine the best departure route. Additionally, this work uses the Ant colony optimization (ACO) algorithm to provide a safe departure route and the necessary instructions [1].

Hari Varshini S, Boomika S, Sherene Amalia G, and Leena R. (2022) developed an Internet of Things-based fire alarm security system. This study demonstrates the use of ad hoc networks in the development of microcontroller units, the internet of things, and fire alarms. The ESP 8266 Node MCU microcontroller chip is utilized here, along with an infrared flame sensor. This is capable of continuously detecting fire in the immediate vicinity. Following fire detection, the user receives an SMS message from the microcontroller unit containing the information. Alarms serve as alerts. Here, a buzzer is used for warning alerts, and heat, flame, and smoke sensors are employed as sensor devices. Here, programming is done in C, and email and SMS are sent via SMTP, or Simple Mail Transfer Protocol. LED lights and buzzers are utilized to detect notifications, and cloud apps are employed to store data online. The entire system can be turned on and off using the Blynk applications interface [2].

Review on Fire Detection Techniques by Jasa Marin K and Amal S Kannan, Department of Electronics and Communication Engineering, 2021. This paper introduced WSN (wireless sensor network) along with Flat network architecture Smart Fire Detection System Utilizing IoT Disaster and Development, Vol. 12, Issue 02, July to December 2023 95; through this network, the data is transmitted to the base station via specific routing protocols by various sensor nodes. Additionally, Hierarchical network architecture is presented where a combination of several sensor technologies is selected as robust sensors. Furthermore, the remaining sensor nodes here are typically referred to as cluster members, with the primary function of these devices being to relay the sensed data to the cluster head, which then sends this data back to the database station. This allows for a broader area to be covered. The paper also incorporates a Fire detection sub-system, which essentially involves each sensor detecting CO2 and temperature values through WSN technology and transmitting the data to the user at defined time intervals. An Early Fire Detection Method Based on the Image Processing method is utilized, which fundamentally relies on detecting fire through color features primarily represented by RGB Colour models. Moreover, using image processing techniques, that information is communicated to the user based on the specific color of the fire. Convolutional Neural Networks Based Fire Detection in Surveillance Videos is also implemented. For certain images, fire classes are categorized according to pixel size. By analyzing all these aspects, one can discern by observing the image whether it pertains to the fire class or non-fire class [3].

A research paper titled "A study on IoT Technologies for Fire Safety Systems 2020" by Brunda N, Chandan R, Lavanya N R, Prajwal G M, and Panchami S V discusses various aspects of fire safety

systems based on IoT. In this research focused on IoT, the authors have segmented the fire safety control system into distinct components: Sensors, Actuators, Gateway, and Servers. The sensor category includes Smoke sensors, LPG Sensors, Motion detectors (Sensors), Carbon dioxide detectors or sensors, and Tank Water Level Sensors. The primary function of the smoke sensor is to detect smoke produced by a fire or smoke emitted prior to a fire and relay pertinent information to the user or activate the warning alarm when necessary. With LPG Sensors, any occurrences of flammable gas detection and related fire incidents can be averted. A motion detector or sensor functions to recognize the movement of a person or object, sending detailed information directly to the user. The Carbon dioxide sensor or detector quantifies CO2 levels in the air, aiding in pinpointing the source of this combustible gas and facilitating ventilation. Tank Water Level Sensors monitor the volume of stored water for firefighting endeavors and notify via messages when the water supply requires replenishment. This research paper also highlights several relay nodes, pump control panels, and ventilation control panels as part of the Actuator section, which manage water pumps during fire suppression and exhaust toxic gases or smoke resulting from the fire via the ventilation control panel. For gateway networks, both wired and wireless gateways are employed as necessary. Concerning servers, cloud databases are predominantly utilized for the storage and transmission of data. Furthermore, the paper presents the use of certain mobile applications within the server, allowing for information sharing from the fire's origin to the user through email or SMS, as well as providing the capability to control the fire based on analyzed data to facilitate extinguishment. This research paper indicates that the authors primarily emphasize the swift detection of fire through various sensors and the rapid collection of data to enable quick extinguishing of the fire [4].

Udaya Dampage, Lumini Bandaranayake, Ridma Wanasinghe, Kishanga Kottahachchi, and Bathiya Jayasanka from the Department of Electrical, Electronic, and Telecommunication Engineering developed a forest fire detection system that uses wireless sensor networks and machine learning. In this report, they primarily use machine learning and wireless sensor networks to study forest fires. Here, the article first issues a forest fire warning and then goes on to describe the causes and consequences of forest fires. Here, a wireless sensor network is utilized for fire detection, with a greater focus on early fire detection. To improve this fire detection procedure, a machine learning regression model is suggested. In this case, environmental conditions are monitored via wireless sensor networks, which also transfer the data they collect from one place to another. where it is possible to track and examine these facts. Additionally, a microcontroller transfer model unit is employed here, and power for additional microcontroller devices and sensor nodes is provided by batteries and solar panels. The sensor nodes in this study are initially placed in a garden, and data is subsequently gathered from the garden using a wireless sensor network and sensor device. Additionally, the data can be obtained in the form of graphs here by employing the machine learning method. Graphs can be used to display temperature ratios, human ratios, light intensity ratios, or carbon levels. One can determine whether a fire scenario has happened by merely examining this graphical output or other parameters [5].

III. EXISTING SYSTEM

One of the most destructive and potentially fatal situations that can happen in both residential and commercial settings is fire. To reduce the risk to lives and property, fire must be detected early. Manual intervention or simple smoke detectors are frequently used in traditional fire detection systems, which may not always be quick enough or thorough enough to identify fire threats. Furthermore, these systems typically are not able to deliver alarms or notifications in real time, which can cause serious

damage and delayed reactions. An intelligent, automated, and real-time fire detection system that can precisely track environmental factors including temperature, humidity, and flame presence is required in the current situation. This system should also be able to notify users or authorities in advance so that prompt action can be taken to contain the fire and stop damage. Modern technologies like the Internet of Things (IoT), which could improve fire safety by offering real-time notifications and remote monitoring, are not integrated into traditional systems, which are frequently expensive.

IV. PROPOSEDSYSTEM

The suggested system, a Smart Fire Detection System with Early Notifications utilizing IoT, is intended to give users or authorities immediate notifications and real-time fire monitoring. To identify the presence of fire, unusual temperature changes, and humidity variations, the system is outfitted with essential sensors such a Flame Sensor and a DHT11 Temperature and Humidity Sensor. An Arduino Uno processes the data from these sensors and sets off an alarm system. The device shows pertinent data, including temperature and humidity readings, on a 16x2 LCD screen and sounds a buzzer to alert those in the vicinity of a fire or other dangerous situation. In order to facilitate remote monitoring and guarantee that users or authorities are promptly alerted to the fire hazard, the system is furthermore outfitted with a Wi-Fi Module (such as the ESP8266) that may transmit real-time notifications to a mobile or web application. The system is powered by a 12V adapter, which is controlled by a power supply board that makes sure every part gets the voltage it needs. Because the system is enclosed in a plank, the components are protected and stable. By enabling a speedier reaction to fire events, this IoT-based technology greatly improves fire safety and lowers possible damage by ensuring prompt detection and notification.

SYSTEM ARCHITECTURE

The description of the overall traits of the software is linked to the definition of the requirements and the established order of a high degree of the gadget. During architectural design, numerous web pages and their relationships are described and designed. Key software components are defined and decomposed into processing modules and conceptual records systems, and relationships between modules are described. The proposed system defines the following modules

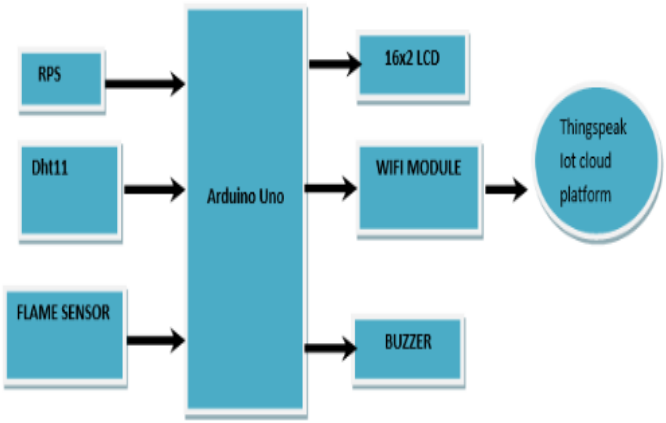

Fig 1. Block Diagram

VI.Hardware Required:

- Arduino uno
- Flame sensor
- Buzzer
- LCD Display
- Regulator

Arduino UNO

The Arduino UNO is a standard board that was developed by Arduino.cc and is based on an ATmega328P microcontroller. It is easy to use compared to other boards, like the Arduino Mega board, etc. It is made up of digital and analog input/output pins (I/O), shields, and other circuits. The name UNO means "one" in Italian. It was also the first Arduino USB board that was released by Arduino.

Fig 2. Arduino uno

IOT (Internet of Things)

IoT stands for Internet of Things, which means that getting access to and the use of the devices and home home equipment you use every day on line.

Our IoT guide covers all IoT topics consisting of get entry to, functions, pros and cons, surroundings, framework of desire, architecture and domains, biometrics, CCTV cameras and security systems. Opening doors, gadget.

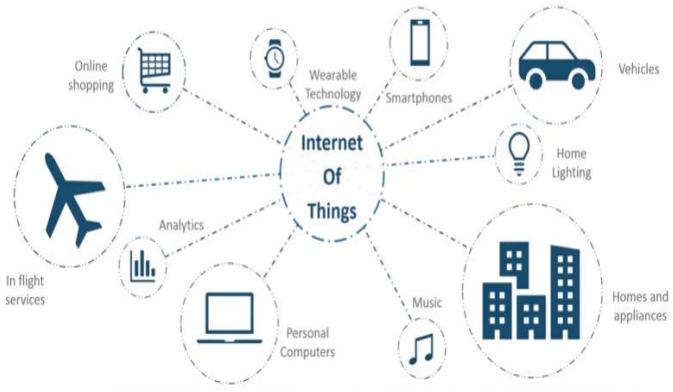

Fig 3. IOT Internet of Things

Flame sensor:

One essential part that determines whether there is fire or flame nearby is the flame sensor. It detects the infrared light that fires emit. When the sensor detects a flame, it sends an output signal to the Arduino Uno, which can activate additional parts or set off an alarm (like the Buzzer). For the system to detect fires in real time, this sensor is essential.

Fig 5. Flame Sensor.

LCD Display

A liquid crystal show (LCD) panel is designed to challenge information on a microcomputer display screen onto a big display the usage of a popular overhead projector in order that a extensive target audience can view the statistics at the display without crowding around the tv screen. . In LCD screens, two layers of glass are separated by way of a thin liquid crystal ("LC" in LCD). This liquid crystal layer, in conjunction with different optical additives, is liable for producing the photo with the aid of encoding the image within the orientation of the liquid crystal material.

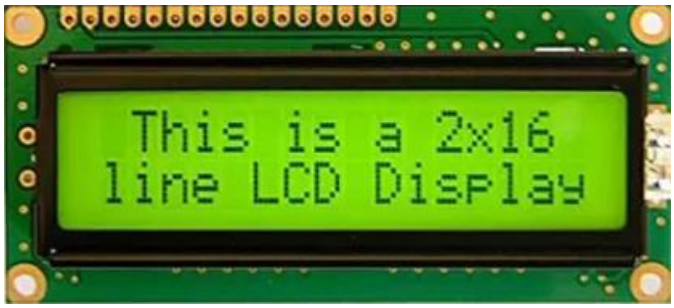

Fig 6. Lcd display

Gas Sensor

The sensor is product of a ceramic detail lined with SnO2 and when this detail comes in touch with a certain gasoline, the conductivity of the sensor modifications. This exchange in conductivity is then transformed into an electrical sign that may be measured and interpreted. Ammonia (NH3), Sulfur (S), Benzene (C6H6), CO2 and different dangerous gases and fumes. Like different MQ collection gasoline sensors, this sensor has a virtual and analog output pin. If the quantity of these gases inside the air exceeds a threshold, the virtual pin will become greater seen.

Fig 7. Gas Sensor.

Buzzer

There are many procedures to the connection between someone and art work. A preferred manner to degree volume is to apply a buzzer. Therefore, in layout method, some clever technologies are frequently related to configurations. So this text appears on the pinnacle view of a big sound device with photos of a defender or goalscorer and their percent. An audible alarm device may be electromechanical, piezoelectric, or mechanical, along with a watchdog or buzzer.

The main objective of this provider is to transform the audio signal into sound. It works well with direct modern-day and is used in timers, alarm devices, printers, alarm clocks, computers, and many others. Depending on the configuration, it can generate a ramification of sounds, consisting of alarms, song, bells and sirens.

Fig 8. Buzzer

VII. Conclusion

In conclusion, by fusing real-time monitoring, quick detection, and instant notifications, the Smart Fire Detection System with Early Notifications using IoT provides a notable improvement in fire safety. The system can precisely identify fire dangers, temperature variations, and unusual humidity levels by using a Flame Sensor, DHT11 Temperature and Humidity Sensor, and an Arduino Uno. Both visible and auditory alerts are guaranteed by the combination of an LCD display and buzzer, and users or authorities can get vital information in real time thanks to the Wi-Fi module, which guarantees prompt action. By offering remote monitoring capabilities, IoT technology improves the system's overall efficacy. By facilitating a quicker reaction to possible fire threats, this technology not only improves home and business site safety but also reduces damage. The suggested method improves fire detection and prevention in a variety of settings in a dependable, economical, and scalable manner.

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