FIRE AVOIDANCE IN SMART CITIES USING CLOUD BASED SERVICE

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ABSTRACT

These days, fire alarm systems are widely used and installed in a variety of locations, including homes, offices, and banks. When they spot the fire, they sound a loud alarm to let everyone know. But what if no one is home or is awake to hear the alarm, which can be the case at night or when nobody is home. As a result, we are developing an IoT-based fire alarm system that will alert concerned parties via email in addition to sounding an alarm in the event of a fire. This technique can also be used to automatically alert the fire service in the event of a fire. Here, we'll use an infrared flame sensor to find the fire, an ESP8266 Node MCU to sound the alarm, and a cloud-based service to send notifications to the concerned person and process the prevention method. An infrared flame sensor is used in this Internet of Things project to locate adjacent flames, and a Node MCU triggers the relay to immediately put out the fire. Additionally, it notifies the authority using the Blynk App. You can readily comprehend the idea of a fire detector and alarm system with the aid of this project.

PROBLEM STATEMENT

Fire, as one of the world's biggest calamities, needs to be discovered as soon as possible to prevent it from seriously harming the environment and living things. So, our goal is to device a Fire Alarm system which not only trigger an alarm but also sends an email/notification alert to concern persons and also take preventative measures on its own.

INTRODUCTION

Communication for the development of intelligent systems, where everything is designed to be intelligent. Smart home automation pays close attention to these factors to make the system more dependable, adaptable, secure, and economical. Although there are many home automation systems on the market, we want to focus more on the fire risks brought on by electrical faults. Here, we need to have advance knowledge to prevent damage to expensive electrical equipment and short circuits in order to make the system more secure and save the lives of both electrical equipment and people [1]. In this regard, a variety of sensors, circuit interrupters, microcontrollers, and IOT all play crucial roles in preventing electrical disasters, minimising malfunctions, and providing owners with advance notice so they can take safety steps.

The Internet's definition has recently altered due to the development of the Internet of Things (IoT), which enables customers and providers to connect at any time and from any location. These variables have produced enormous amounts of data, which is how the idea of "Big Data" came up. The information acquired by sophisticated technological gadgets needs sufficient processing and storage capacity on a constant basis. Other recent advancements, such image processing and remote sensing, have shown important benefits in monitoring the state of fire catastrophes across wide areas. As a consequence of a change in perspective regarding the way the IoT works, investigations into IoT contributions have been done in an insight type of discipline. In order to save the ecosystem and forest life, it is crucial to identify and intervene in any potential forest fire situations as soon as feasible. One of the most volatile occurrences that affects timberlands is resolved by using forest fires. Due to wildfires burning for longer every season and growing in quantity, scale, and time, local governments invest in IoT technology that helps anticipate, identify, and manage situations connected to fire in forests by detecting their temperature, CO2 levels, moisture, wind direction, and speed.

LITERATURE SURVEY

Avita Katal, et al. [1] created a simple, low-cost fire detection gadget that instantly delivers information to the owner's smartphone. The recommended solution immediately alerts the closest fire station when there is a higher fire danger and sends a push notification to the fire brigade operator instructing them to go as fast as possible to the location. In order to warn individuals close when there are flames, an IR sensor, LED, and buzzer are used. Olfa Dallel and others [2] presented a novel XACML-based Access Control and Delegation (XACML-based ACD) mechanism that combines access control with delegation operation control. The Delegation Decision Point (DDP), which implements delegation control based on delegation control criteria, is a new decision point that the proposed technique adds to the XACML architecture. They have a world-class algorithm for controlling policy that also works with IoT systems. Our XACML-based ACD system alerts local users via a sensor, an LED, and a buzzer, and they want to eventually add a dynamic delegation.

Many researchers have created firefighting or monitoring systems using the cloud service. A system that automatically monitors industrial applications was developed as part of research. Employing the cloud based idea, it produces alerts/alarms or make intelligent decisions [3]. Other studies created a miniature industrial setting where sensors could only be controlled and monitored based on information from industrial site sensors. This data is processed and appropriate control action is placed [4]. Other studies created a system that can track sensor data, upload it online, and be used by industries to make critical decisions and produce alerts and alarms utilising the Internet of Things [5]. Others created an Internet of Things (IoT) based fire alarm and monitoring system that is ideally suited for commercial and residential applications. An IoT platform is integrated into the system. It may detect smoke, an increase in temperature, flame, etc. and transmit that information via GSM to a remote monitoring station to produce the necessary instructions for the actuators [6].

Despite adopting the same IoT concept, the majority of past experiments are extremely different; one of them used GSM, while another used WI-FI. By taking into account early fire monitoring and management via a different communication protocol, this study varies from earlier studies [7]. To identify fire using CNNs-based image classification, the authors H. Xiang, L. Chen, and W. Xu of this research [8] presented Deep Residual based fire network (DRFNet), a simple fire detection method. Max and average pooling layers, along with a number of 2D convolutional layers, make up the model. Additionally, the network makes advantage of four skip connections to increase accuracy. A low-cost wifi-based automation system for a prototype smart house has been developed by Ravi Kishore Kodali and Subbachary Waheb A.et. al [9] using an android smartphone and an Arduino. It enables the simple and efficient control of any electrical device in the home, including the light bulb and fan.

The created system will then be made capable of being managed remotely via a web server so that the user may do so even when they are not at home. Similar to that, this paper [10] presented an architecture for recognising fires based on residual blocks and depth-wise convolutional layers. When deploying a model on a low-end device, the authors take the complexity of the model into account. In order to reduce the number of floating-point operations, they designed a portable architecture (FLOPS). The fire detection system discussed in the paper [11] offers a variety of data processing choices, so it does not exclusively rely on cloud computing. As a result, it offers speedy reaction times to the local government at a reasonable cost. Our ongoing research will expand our object detection model to recognise other situations and nefarious threats.

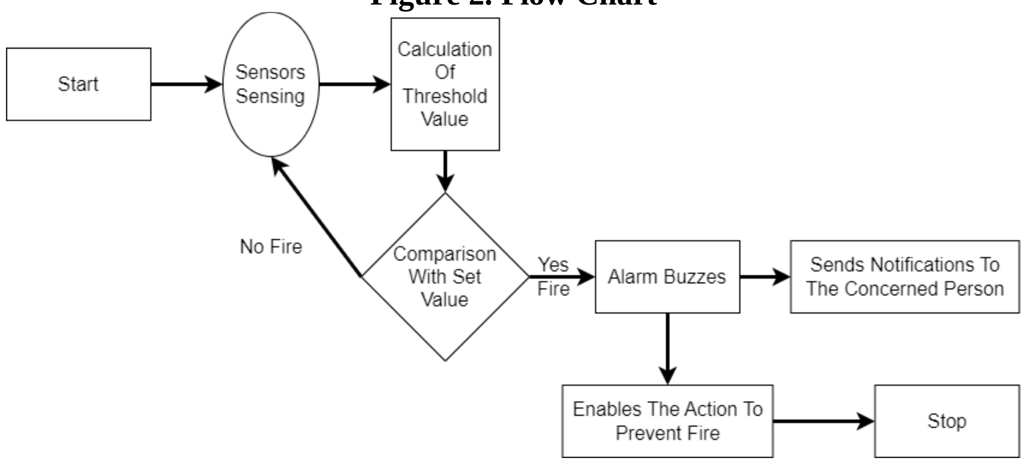
Yerroju [12] suggested system can identify smoke, other flammable gases, and fire. Through this method, the coordinates for the location of risks may be sent to the nearby fire department. According to this paper, the Internet of Things is a rapidly evolving technology that helps provide smart solutions for the development of smart cities. For the delivery of high-quality public safety and security services and to offer information to the public safety management, it is essential to adopt data-driven emergency response systems with urban IoT design standards. For the identification of forest fires, a wireless sensor network including a temperature sensor and a Global Positioning System (GPS) component was also recommended in [13]. The main connection, a satellite, was used to transmit the temperature data to the headquarters. The design of an excessive number of arrangements and components proved to be a significant roadblock for the plan put out by [14].

Additionally, a constant and ongoing power source was required for the parts that make up the connecting cables as well as the temperature sensor setup. However, modifications to the environment or to any of the standards may affect the framework simultaneously. IR (InfraRed) Thermal Imaging cameras because of the innovation of warmth change from the fire, IR Spectrometer which recognises ridiculous credits or smoke gases, and Light Detection & Ranging (LDR) are among the cameras that are sensitive in the delicate range between light and foggy smoke, in the mild at affirmation or smoke in the middle of sunshine and hearth blasts around evening time [15]. The design's drawback is that weather factors like haze and shadows might result in a significant number of false alarms.

PROPOSED FRAMEWORK

To put out the forest area fire as quickly as possible by calculating the degree of temperature and carbon dioxide level. The flowchart of the proposed system to solve the previous shortcomings are shown figure 2. The proposed architecture depicts a complete illustration of an IoT-enabled fire monitoring and detection system.
Sensors are needed to warn the critical temperature of the ignition and the extent of the Carbon Dioxide (CO2) gas at the proper time with a clear vision scenario, sensors—which act as data acquisition hubs and monitor temperature and smoke—should be placed at a reasonable distance to allow a glance over the entire woodland section. The matching microcontroller receives the data that the sensors have collected. In the case of an emergency or crisis, these sensors can respond effectively in all situations by detecting and transmitting all forms of variations collected regarding changes in the ambient scenario. Following the microcontroller's receipt of the data records, a transmitter sends the data across a realistic distance to the beneficiary station. The microcontroller, or TC in this case, is a crucial part of a physical circuit that organises, coordinates, and makes it possible for the complete circuit to work. The information is then transferred to the cloud and then the notification is sent to the concerned authority.

Figure 2. Flow Chart

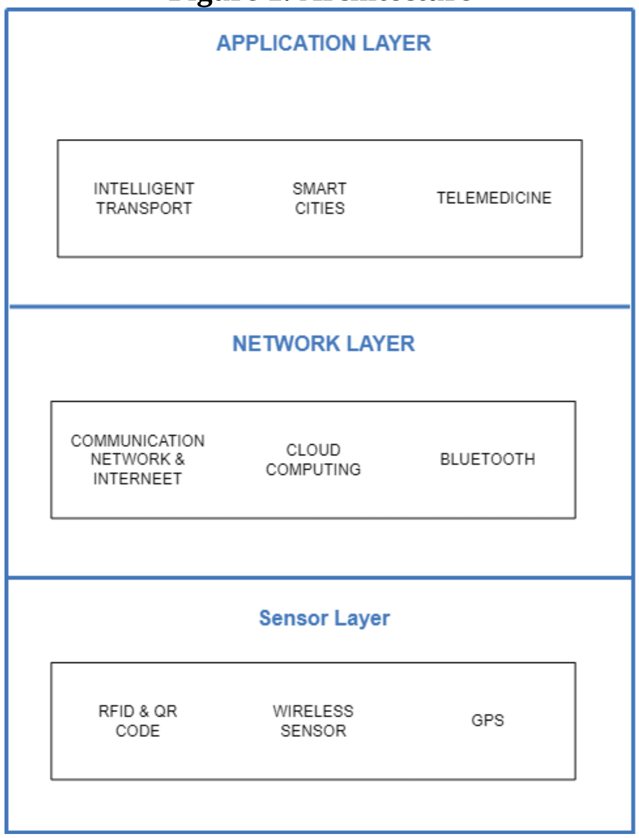


ARCHITECTURE:

The perspective of the internet has changed in recent years with the introduction of IoT and other cutting-edge advancements. Things and customers may be constantly linked at all times and locations by using the Internet of Things (IoT). The vast volume of data gathered as a result of the IoT discipline is referred to as "Big Data" in this context. An effective repository and continual information management are crucial for smart device data. IoT refers to the process of connecting commonplace items, such as mobile phones, houses, and installed apps, to the internet in order to enhance connection and functional capabilities.

As a result, it is a clever collection of frameworks that employs data analysis to draw out some crucial information from the linked devices. The communication of this loop is made easy via layered architecture. Layered engineering also suggests that a team would work on several system components concurrently. This implies that different system components can be transferred without restriction. The foundational architecture (layered) of the Internet of Things includes three essential functional levels as well as key elements including services, interfaces, and sensors. These layers interact with one another to bring about the intended results as depicted above.

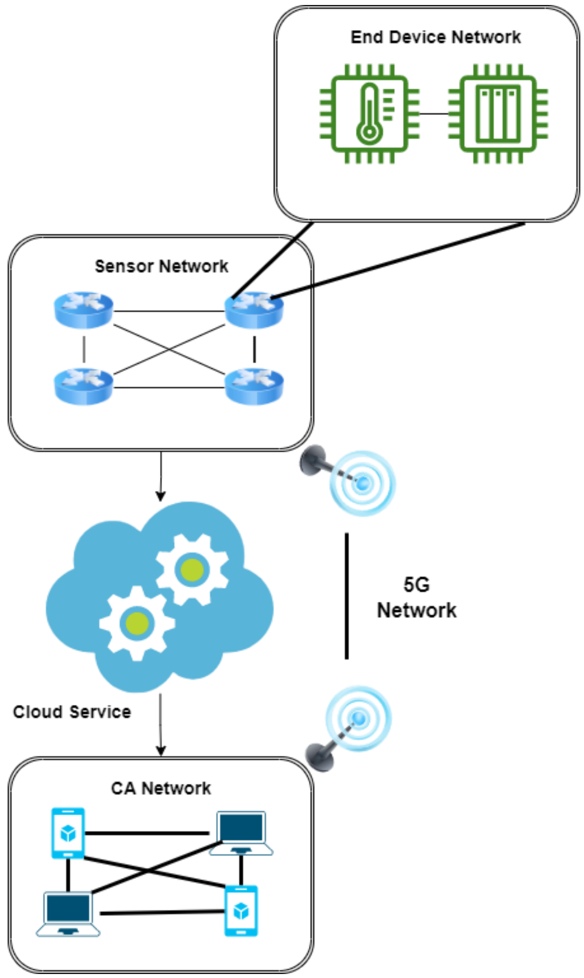
Figure 1. Architecture



BLOCK DIAGRAM:

End device network is the base level network where all the sensing and data collection takes place. Sensor network is the network of multiple end device circuits which are placed throughout the city. In this layer all the ESP8266 collect the data from the sensors and then send the data to the cloud network. The cloud services we use are to store the new data and compare it with the set threshold value for the sensors which acts upon the data received. CA network is also known as concerned authority network which can be the fire department or the owner of the establishment.

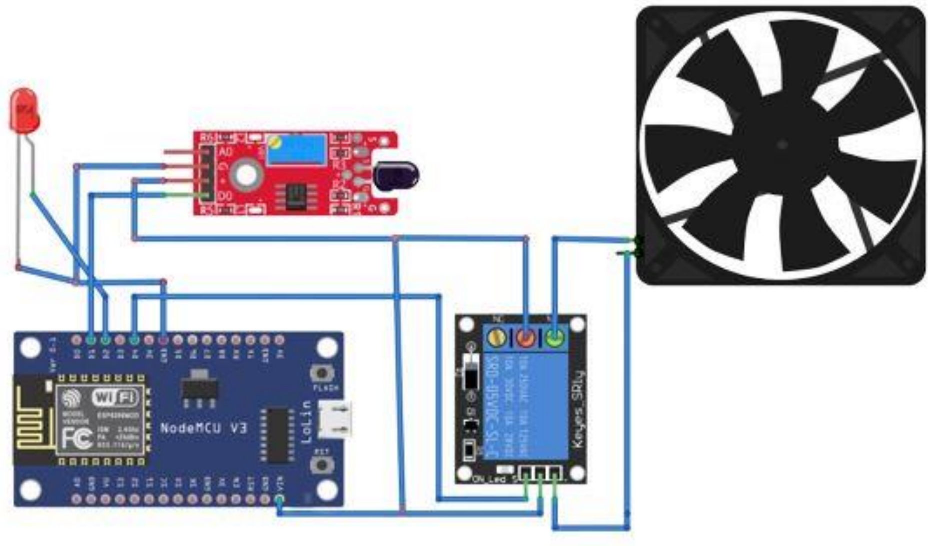
Figure 3. Block Diagram



CIRCUIT DIAGRAM:

- First, connect the Vin pin to the positive rail on the breadboard.
- Then connect GND Pin to the negative rail of the breadboard.
- To interfere with the flame sensor, Connect Vcc and GND to Vcc and GND on the breadboard.
- Now Connect the D0 pin (signal pin of the flame sensor) to the D1 pin of NodeMCU (ESP8266).
- Now let's connect the Negative terminal of LED to the GND Pin of NodeMCU and the Positive Terminal to the D2 pin.
- Similarly, interface single channel relay GND and Vcc pin to GND and Vcc. Then, Input the Pin to NodeMCU D4 Pin.
- Now, connect the 12v DC fan positive terminal to the normally open (NO) Pin, and connect the positive terminal 12V adaptor to the common pin of the relay.
- Finally, the Negative Terminal of the DC fan to the 12v adaptor Negative Terminal.

Figure 4. Circuit Diagram



ALGORITHM:

1. Initialize the ESP32 board and connect it to the Wi-Fi network using the credentials.
2. Initialize the Blynk library with the authentication token.
3. Connect the smoke sensor to a GPIO pin on the ESP32 board.
4. Connect the buzzer to another GPIO pin on the ESP32 board.
5. Set up a Blynk Virtual Pin to receive the smoke sensor data.
6. In the setup function, set the smoke sensor pin as an input pin and the buzzer pin as an output pin.
7. In the loop function, read the smoke sensor data and check if it exceeds a certain threshold value.
8. If the smoke sensor data exceeds the threshold value, turn on the buzzer to sound the alarm and send a notification to the Blynk app.
9. If the smoke sensor data is below the threshold value, turn off the buzzer.
10. Handle the Blynk app notifications as required.
11. Repeat steps 7-10 continuously.

PSEUDOCODE:

```
// Initialize the ESP32 board and connect to the Wi-Fi network
initializeESP32();
connectToWiFi(ssid, password);
// Initialize the Blynk library with the authentication token
initializeBlynk(auth);
// Connect the smoke sensor to a GPIO pin on the ESP32 board
int smokeSensorPin = 4;
```

```
// Connect the buzzer to another GPIO pin on the ESP32 board
int buzzerPin = 5;
// Set up a Blynk Virtual Pin to receive the smoke sensor data
int smokeSensorVPin = V0;
setupVirtualPin(smokeSensorVPin);
// Set the smoke sensor pin as an input pin and the buzzer pin as an
output pin
pinMode(smokeSensorPin, INPUT);
pinMode(buzzerPin, OUTPUT);
while (true) {
  // Read the smoke sensor data
  int smokeSensorData = analogRead(smokeSensorPin);
  // Check if the smoke sensor data exceeds the threshold value
  if (smokeSensorData > thresholdValue) {
    // Turn on the buzzer to sound the alarm
    digitalWrite(buzzerPin, HIGH);
    // Send a notification to the Blynk app
    sendNotification("Fire detected!");
  } else {
    // Turn off the buzzer
    digitalWrite(buzzerPin, LOW);
  }
  // Handle the Blynk app notifications
  handleNotifications();
  // Wait for some time before repeating the loop
  delay(1000);
}
```

CONCLUSION & FUTURE WORK:

In this study, we used an IOT device to build a fire indication that is wired to an alarm, an IR flame sensor, and a buzzer. In the case of a fire, the exhaust sensor will detect smoke while the heat sensor will detect rising temperatures. A Microcontroller based bell or alarm will sound a warning signal. Before a fire that has been ignited will attach to a nearby object and start to emit smoke and cause damage the fire will be put off by our system. The aim of this article in the future would be to put the above-mentioned model into action using the proposed arrangements in order to obtain preliminary results.

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