Forest Fire Detection with GPS using IoT

K. Arun[1*], *R. P.* Ram Kumar[1], *Abhiram* Kappaganthu[2], *Pruthvi* Samindla[2]

[1]Department of AIMLE, GRIET, Hyderabad, Telangana, India
[2]UG Student, Department of CSBS, GRIET, Hyderabad, Telangana, India

Abstract. Today's developing world makes environmental protection absolutely necessary. Numerous natural and man-made disasters were happening all around the planet. Forest fires are one such environmental catastrophe. Once it starts, the fire in the dense forest quickly engulfs the entire region, consuming everything in its path and igniting everything. On hot days, fire spreads more easily due to the dry conditions, decimating the grasses and trees in forested areas. To protect the ecosystems of the forest's flora and fauna, such forest fire calamities must be diminished. The objective of this endeavour is to create and put into use an Internet of Things (IoT)-based system that can anticipate and identify forest fires, alert the appropriate authorities to their specific location, and help firefighters put out the fire when it first starts. This would prevent the fire from engulfing a big area and allow for the implementation of preventative measures to put out any fires that might start in the near future.

1 Introduction

The term "Internet of Things" (IoT) refers to a broad category of electronic devices that are not standard computing equipment but are linked to the internet to send or receive data or both. 1.1 HISTORY OF IOT The Internet of Things has come a long way from one or two machines in the 1980s to billions in 2019. 1969 – ARPANET, the predecessor of the Internet, was developed. 1982 - Researchers at Carnegie Mellon University are connecting vending machines to the Internet to allow remote purchase of cold sodas. 1995 – The GPS satellite tv for pc network 1998 – IPv6 adds 2^128 new IP addresses, which even IOT devices struggle to eat. 1999 – The term IOT was first used by Kevin Ashton at MIT. 2000 – LG unveils its first smart refrigerator. Cool but too expensive to sell your work. 2008 – The first international IOT conference was held and there are now more devices online than there are today people of the earth. 2014 - The giant Consumer Electronics Show (CES) was all about IoT. 1.2 WORKING PRINCIPLE Smart, networked devices might permeate more of our daily lives in the near future. They will be present in our homes, places of employment, and cities where we live as well as accompany us wherever we go in the form of wearables, smart clothing, and other things we can't even imagine yet. This development goes by the name of the "Internet of Things" (IoT). Big Analog Data: A component of everything, including light, sound, temperature, voltage, radio warnings, moisture, etc., analogue recordings can be found everywhere. They stand in for the real and natural world. Although it is the oldest,

* Corresponding author: arun1700@grietcollege.com

fastest, and largest of all huge data, it represents an IT enterprise since its value exceeds that of digital statistics. 1 Figure1: Architecture (Courtesy: Source [1]) In figure 1, there are some various principles of the internet of things explained as: Big Analog Data: Analog records are everywhere or, in other words, a component of everything, including light, sound, temperature, voltage, radio alerts, wetness, etc. They represent the natural and physical universe. It is the oldest, fastest, and largest of all massive data, but because it is more valuable than digital statistics, it represents an IT enterprise. Real-Time: Real time has varied meanings for people who understand the Internet of Things (IoT) and others who don't. Since the information has already passed its expiration date when it reaches a network or computer system, real-time for the IoT does not begin at that point. The goal is to connect information technology (IT) with the operational period (OT), sensors, and records dimension. For the first time, the IoT significantly combines those two worlds, and the outcomes will be significant.

2 Existing methods

Video-camera, responsive to visible spectrum of smoke noticeable during the day and a fire recognizable at night. Infrared (IR), thermal imaging cameras based on the detection of heat flow of the fire. IR spectrometers to identify the spectral characteristics of smoke. The performance of the fire detection system depends on the performance of the fire pixel classifier which generates major areas on which the rest of the system operates. Thus, a precise fire pixel classifier is needed with high true detection rate and less false detection rate. The CCD camera system does not offer automatic detection of smoke but plans to introduce it sometime in the near future. Simply, it can provide images for fire agencies whenever the operator notices smoke and can use EYEfi software to use the GIS map and locate the smoke position on the ground.

3 Proposed system

Problem Statement of the Project Forest Fire Alerting System With Gps Coordinates Using IoT.

- Detect a fire in the forest and immediately send the coordinates of its location to the affected team.
- When a fire is detected, a buzzer will activate to warn you of the problem.
- In today’s world, protecting the environment is very important. Many man-made and natural disasters occur around the world. Wildfires are one such environmental disaster.
- When a fire breaks out in a deep forest, it burns and destroys everything and spreads throughout the forest.

Such forest fires should be avoided to protect forest habitats. The goal of this work is to design and implement a self-sufficient IoT-based system that predicts and detects forest fires and transmits their precise location to officials. Natural disasters. Fires also destroy forests and endanger human lives. The human oxygen supply is depleted. The risk of burns is increasing due to global warming. First appeared in the 1980s. Wildfires are a constant threat to the natural processes, resources, and environmental aspects of communities. Therefore, it is important to detect forest fires as early as possible. This paper highlights the importance of wireless sensor networks as a potential solution to the problem of early detection of forest fires. Objective of the Project • Protecting our environment is essential for today's developing countries. Many natural and man-made disasters occur around the world. One such environmental tragedy is forest fires.

- Starting deep in the forest, the fire spreads throughout the area, burning and destroying everything in its path.
- Drought makes it easier for fires to spread on hot days, killing grass and trees in forested areas. Such forest fire disasters need to be reduced in order to protect the habitats of forest animals and plants.
- This will prevent the fire from spreading to a wider area and allow you to take precautions to prevent fires that may break out in the near future.
- Such forest fires disasters should be curbed in order to protect fauna and flora habitats in the forest.

The aim of this work is to design an IoT-based system that is self-sufficient, predicts and detects wildfires, and transmits precise locations to authorities to help firefighters extinguish slow-burning fires and to implement. This information is transmitted to a nearby central unit, where it is processed and, if necessary, published on Internet websites that work with civil defence units. This website is accessible by certain authorities so that they can act quickly in the event of an alert. It is important to note that this device is effective, environmentally friendly and emphasizes the importance of its existence. Research shows that man-made and natural disasters are increasing rapidly as human technology advances. Protecting our environment and natural resources is very important. In today's world, technology must be used to make ecosystems more livable by preventing catastrophic losses. A land fire is an example of a natural phenomenon. The goal of this project is to develop an autonomous Internet of Things system that can quickly detect forest fires and respond to them before they disappear and spread. The main purpose of this system is to track fires and protect the entire system from fire hazards. Furthermore, the proposed model is designed to include autonomous capabilities such as self-monitoring and self-healing, so that a ubiquitous environment created for a specific goal can incorporate and deliver analytics as a service. The result is a robust and fault-tolerant system. Intelligence at the network edge. According to this report, forests, as we all know, are one of the most valuable and important tools, and wildfire reduction and identification has been extensively researched in the global wildfire prevention sector. Conventional wildfire detection had problems with real-time performance and monitoring accuracy. Maintain the forest. Fire detection patterns were discovered, enabling relevant government agencies to make accurate and timely extinguishing or prevention decisions. According to the report, wildfires are becoming one of the biggest causes of environmental destruction. Current forest fire monitoring systems cannot continuously track all locations in an area in real time and provide early warning of fire danger. A wireless sensor network, on the other hand, continuously collects sensor data values such as temperature and humidity from two locations in the area, day and night, providing the fire brigade control center with up-to-date and accurate data. They considered a comprehensive method for identifying and tracking wildfires using wireless sensor networks in their proposed system. Our designs include wireless sensor network architectures, sensor distribution strategies, clustering, and communication protocols. The purpose of this framework is to detect fire threats as early as possible given the energy demands of sensor nodes and environmental elements that may impact the required network operational level. We built a simulator to test and evaluate the proposed technique. Through large-scale model studies, we have shown that our system can quickly respond to forest fires while using energy efficiently.

It represents the architecture of the project. The outline of project. The first step of module 1 is to connect our required sensors to the ESP32.the ESP32 is integrated with the BMP280, Fire Sensor, MQ6 which detects the temperature, fire and glasses respectively. This module deals with collections of the data from connected sensors to ESP32 ARDUINO. The information sensed and collected by the temperature and gas sensors is received by an IC ATMega 328-p (microcontroller) inserted into the Arduino level display of the transmitter

circuit. Sensed information and signals collected from temperature and gas sensors are received by an ATMega 328-p IC (microcontroller) inserted into the Arduino level display of the transmitter circuit. As soon as the sensors detect the values they are displayed in the mobile telnet app. A buzzer is activated in parallel to this indicating fire in the forest. The application indicates the information related to temperature, fire and the gas along with the coordinates of the sensor. As soon as the fire is detected the buzzer is activated indicating the fire in the forest. As the Wifi module is used to send the coordinates to the mobile. The GPS module is used to known the place.

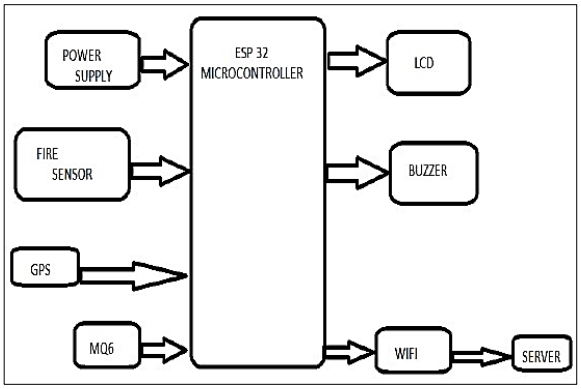

Fig. 1. Connectivity diagram.

For the implementation of the project, there are four modules that should be worked on. They are:

1. Fetching details from sensors
2. Analysing the information
3. Coordinates to mobile telnet
4. Altering the buzzer

3.1 Fetching details from sensors

The first step of module 1 is to connect our required sensors to the ESP32. The ESP32 is integrated with the BMP280, Fire Sensor, MQ6 which detects the temperature, fire and gasses respectively. This module deals with collections of the data from the connected sensors to the ESP32 AURDINO. Message notification code is integrated into Arduino using Twilio cloud community, which sends messages directly to the user's mobile in case of mobile not connected with the internet through mobile telnet. The values were sent to the Microcontroller Processor Unit (MCU) and analysed.

3.2 Analysing the information

The information sensed and collected by the temperature sensor and gas sensor is received by IC ATMega 328-p (microcomputer) inserted in the Arduino level display part of the transmission circuit. The controller then runs the coordinated activity on it and passes it to the sender. A sender sends information to a receiving station. Once the transmitter receives the information from the controller, it will transmit it to the designated area and preferred stations will be extended for use. The microcontroller is the heart of the device circuitry. It coordinates and activates the behaviour of the entire circuit, in this case the transmitter circuit.

3.3 Coordinates to mobile telnet

Telnet is an application protocol that provides two-way, interactive, text-oriented communication over the Internet or local area networks over a virtual terminal connection. An 8-bit, byte-oriented data connection using the Transmission Control Protocol, where user data is interleaved in-band with Telnet control information. As soon as the sensor collects the value, it will be displayed in the mobile telnet app. At the same time, a buzzer will be activated to inform you of forest fires. The application displays temperature, fire and gas information along with sensor coordinates.

3.4 Altering the buzzer

A buzzer or buzzer is a mechanical, electromechanical, or piezoelectric audible signalling device. A buzzer is an integrated structure of electronic converters, DC power supplies, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronics, telephones, timers and other sound electronic products. As soon as the fire is detected the buzzer is activated indicating the fire in the forest.

4 Results and discussion

The main goal of this project is to immediately improve fire detection in specific areas by incorporating certain notable features that can overcome the shortcomings of previous models. The suggested model's created hardware kit, which includes sensors such as Fire Sensors, MQ6, BMP280, GPS, Buzzer and a Wifi module coupled to ESP32 ARDUINO Board, is depicted in the Figure 2.

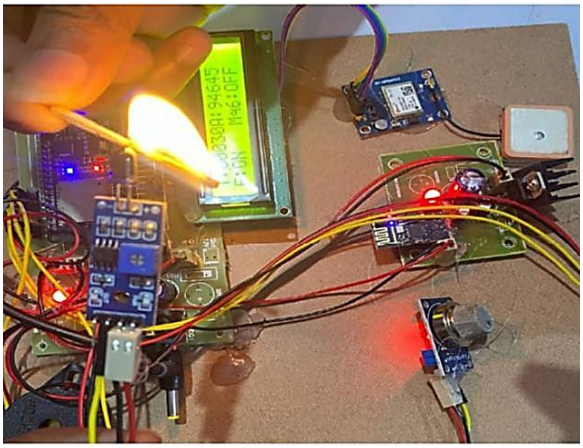

Fig. 2. Hardware setup of the project.

The criteria include things like detecting fire, gas and temperature. These factors aid in determining whether the forest is secure or not. These characteristics are collected using a fire sensor, BMP280 and MQ6. The MQ6 detects the type of gas emitted in the surroundings. The Bmp280 will detect the temperature in the forest and Fire sensor will detect the fire that is emitted in the forest. Above figure shows the code that is implemented in the Arduino IDE which is used to detect the fire. Figure 3 shows the display of LCD where the values noted by the sensors are displayed on the LCD. The LCD displays the temperature, fire, Gas and

atmospheric pressure. The location of the sensor can be known using the mobile telnet application in mobile that can be shown in the above figure.

Fig. 3. Display on LCD.

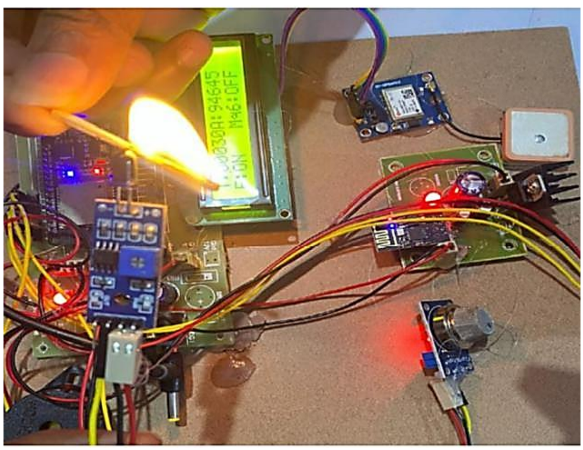

Fig. 4. Testing the prototype.

```
Connecting to 192.168.4.1 port 23, please wait...
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
Fire-ON-17.5204,78.3675
T:00030 AP:94646Fire-OFF Mq6-OFF
```

Fig. 5. Output of the proposed method.

5 Conclusion

The idea provided in this paper discusses a novel information system that has been established using innovative technologies, IOT devices, and the utilization of sensors to aid enhance emergency management. Specifically, Arduino-based gadgets were employed. Several hurdles were overcome throughout the creation of this solution, including the usage of data transfer protocols (4G), interface with hardware devices, sensor integration, and the translation of recorded data into relevant information for user presentation. Furthermore, diverse technologies (mobile devices, online services, and IOT devices) have been integrated, as has the synchronization of all system data across platforms (new alerts, measurements, and so on). This would be beneficial in a variety of situations, including forest fires, factories, and buildings, because it sends a message as soon as a fire is detected and emits a warning via buzzer. Furthermore, the LCD indicates the fire level, which may be watched by a concerned individual. This allows for the identification of fires at an early stage. This technology allows for improved control of forest monitoring and illegal tree harvesting, as well as early identification of forest fires before significant damage occurs. In the future, this project can be used in industry to detect different types of gasses. It can be used in various locations to detect fire. After the prototype is developed, it can also be used to detect emergency incidents in coal mines. To achieve such things, we need to develop other sensors. This project can be used to detect fires in all public places.

References

1. A. Ramelan, M. H. Ibrahim, H. Brillianto, F. Adriyanto, R. Subeno, A. Latifah, *A Preliminary Prototype of LoRa-Based Wireless Sensor Network for Forest Fire Monitoring*, in the Proceedings of the International Conference on ICT for Smart Society (ICISS), pp.1-5, (2021)
2. Ishitha, S. Nagaraju, H. A. Mohan, M. Harshitha, R. Gowda, N. Jeevan, *IoT based Anti-poaching and Fire Alarm System for Forest*, in the Proceedings of the IEEE Mysore Sub Section International Conference (MysuruCon), (2021)
3. A. Tehseen, N. A. Zafar, T. Ali, *Algorithm-based Dynamic Formal Model for Forest Fire Detection & Extinguishment System*, in the Proceedings of the International Conference on Frontiers of Information Technology (FIT), (2021)
4. B. S. N. Prasad, R. Manjunatha, *Internet of Things Based Monitoring System for Oil Tanks*, in the Proceedings of the IEEE International Conference on Mobile Networks and Wireless Communications (ICMNWC), (2021)
5. H. F. Abdulsada, M. G. Al-Hamiri, Abdul Rahaim, Abdul-Jaleel, *Fire spread monitoring system of a forest based on interpolation and cloud computing*, in the Proceedings of the 5th International Conference on Engineering Technology and its Applications (IICETA), (2022)
6. Ashok Kumar, R. Santhana Krishnan, P. Manimegalai, G. Gayathry, N. Mahanathiya, G. Abinaya, *Solar operated IoT based smart system to monitor illegal logging*, in the Proceedings of the 7th International Conference on Communication and Electronics Systems (ICCES), (2022)
7. Miriyala, Trinath, Karthik, Ragipati, Mahitha, V. Reddy, Int. J. of Eng. & Tech. **7**, 124, (2018)