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IOT BASED INTRUSION DETECTION AND FIRE DETECTION SYSTEM USING LORA

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Abstract:

A significant resource for human life is the forest. A forest consists of thousands, maybe even millions of different species of animals and plants that coexist in a sophisticated "ecological mix".The greatest threat to forests in densely populated emerging nations like India is the use of illegal and unauthorised methods for cutting down the trees and forest fires caused due to environmental changes. As a result, many devices are developed in recent years based on Internet of Things(IOT) for a real time intrusion detection and fire detection system. In this paper,We use laser detector to protect forest from illegal entries such as human beings, wild animals etc. Flame sensor along with the other thermal sensors are used to detect Fire in and around the periphery of the forest.The LoRa(Long Range) module is also incorporated in the system to wirelessly transfer the sensor data to the nearest forest officials.Compared to different wireless transmission technologies LoRa transmits data to a longer range.

Key Words: Intrusion detection, PIR sensor, LoRa and fire detection.

1. Introduction

Forest is a huge area and protecting it would be even difficult due to lack of manpower and resources. Its protection is crucial for the survival of natural resources, environmental conditions, and the health of the ecosystem. Extreme circumstances caused on by catastrophic events cause significant loss of physical and personal assets globally. Because of inadequate resource planning, the consequences of such threats may be amplified. Security flaws or bad management, emergency planning, and warning systems might all be contributing factors. In this paper, we discuss about laser security system to protect forest from illegal entries such as cutting down of trees, killing or capturing of wild animals and poaching etc.

Modern alarm systems are electronic devices that are used to identify, track down, and stop criminal activity. It has the ability to detect intruders, fire, and other changes in its surrounding environment. It generally looks for potential attacks and alerts the appropriate authorities to any incidents.

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Here, we have discussed about the outline and realization of an IOT based electronic system to alarm the illegal intrusion by using Laser sensor and the other thermal sensors to detect fire in and around the periphery of the forest. The LoRa technology incorporated in the system will automatically send the notification about the illegal entry from the periphery of the forest. This information will be sent from the spot to the central server system as well as the nearest forest officials through SMS so that an immediate action can be taken.

2. Related Work

This method, which uses LoRa technology based on the LoRaWAN protocol to connect low power devices dispersed over wide distances, is suggested for application in detecting fire in forest areas[1]. The process includes transmitting at low transmission power and low data rates over long distances.

The conventional approaches to detecting and preventing forest fires rely on surveillance using satellite photos, guards' survey, aerial observation, or high ranges video detection [2].

Emerging methods for early detection of forest fires using unmanned aerial vehicles and LoRaWAN sensor networks [3]. The writers of this paper offer two unlike methods for locating forest fires. Aerial aircraft without pilots (UAVs) outfitted with specialized cameras make up the first solution. In this research, various drone usage scenarios for detecting forest fires are given and examined, including a system that combines rotary-winged UAVs and fixed-wind. The basic setup of the system described in this paper suggests employing a set of connections of cameras that are installed on the soil to continuously monitor the forest. The cameras in use feature two lenses, providing both conventional and infrared (IR) images [3].

The authors of the article [4] suggested employing contemporary technology to create a forest fire detection system in the forest region. The system was designed to alert the forest officer to a forest fire that had begun as well as to detect fires. A microcontroller directs the system's operations, while the employed sensors are responsible for locating and recognizing the fire. This technology is based upon the Internet of Things, which allows for continuous monitoring of activity as well as the storage and sharing of data on the internet. The freshly saved information is periodically reviewed by the forest ranger and is always verifiable [4]. The surveillance system is typically located close to a fire station or the forest office.

Wireless sensor network for forest fire detection [5]. In this paper, the authors suggest a forest fire detection system that makes use of a sensor nodes in order to prevent the destruction of thousands of forest hectares. A microprocessor, a receiver, a transmitter, , and three sensors are included in each node. The methods of measurement include the measurement of temperature, the detection of methane, hydrocarbons, and CO2 levels.

This paper studies detecting a forest fire using a network of wireless sensors. We know that there are different methods for detecting methods for forest fires in which. Some are monitoring from watch towers and using satellite images. Unfortunately, these are inefficient due to some reasons like sophisticated equipment they have to needs a large number of trained personnel, and they are making it difficult for real-time monitoring because when it is seen that its speed is not controlled, levels of damage [6].

3. Proposed Methodology

The security to the forest has to be provided in order to protect forest from deforestation and any kind of illegal intrusion. In this paper we proposed a system to protect forest from fire and illegal entries by using laser beam sensors along with the other sensors and send the notification to the nearest forest officials by using LoRa SX1276. Here, a laser detector identifies objects that passes through the vision line between the pair of laser detectors. The passive infrared sensor and the other thermal sensors are also combined with the laser detector to improve its efficiency in poor conditions and on various environments. When the motion is detected the system immediately transmits the notification through LoRa communication.

Fig.1: Flow chart of the proposed system

4. Hardware Requirements

Figure 2:Block diagram of the system

A.PIR Sensor

An IR sensor that detects infrared radiation which is generated by objects and identifies whether they are stationary or moving is a PIR sensor, also referred to as a passive infrared motion sensor. Unlike Active Infrared sensors, which emit infrared radiation, this type of motion sensor just receives it. The HC-SR501 PIR sensor is made up of a pyroelectric component as well as important electrical components like circuits, resistors, and capacitors.

B. DHT11 Sensor

A reasonably priced digital temperature and humidity sensor is the DHT11. To measure humidity and temperature in real time, this sensor may easily be linked to any micro controller, such as an Arduino, Raspberry Pi, or another model. The DHT11 sensor is made up of a thermistor for temperature sensing and a capacitive humidity detection element. With a 2-degree precision, the DHT11 offers a temperature range of 0 to 50 degrees Celsius. The humidity range of this sensor is 20 to 80 percent, with an accuracy of 5%. This sensor has a 1Hz sampling rate.

C. Flame Sensor

A flame-sensor is a type of detector that is used to detect and respond to fires and flames. The radiation emitted by flames or glowing ignition sources is optically detected using a flame detector. Flame detectors are primarily intended to protect areas where anticipated fires will develop quickly, with little or no incipient or where ignition is almost instantaneous. A flame detector can often respond faster and more accurately than a smoke or heat detectors. The flame sensor is used to identify flames and other light sources with wavelengths between 760 and 1100 nm.

D. LoRa SX1276

Semtech's RF transceiver chip SX1276 from Lora1276 features LoRa TM Spread Spectrum modulation frequency hopping technology. This module performs better than FSK and GFSK modules because to its long-range and high sensitivity (-139 dBm) qualities. Powerful anti performance ensures that multi-signal won't be dealing with one another even in a population frequency setting. The AMR and remote industrial control fields frequently use this 100mW, extremely small module. The data is transmitted by the module using AES128 encryption, which improves security, to gateways, where it is decrypted and retransmitted to an objective node.

E. Laser Detector

The laser beam detector that is employed in each sensor node can detect intruder motion up to 100 metres away. With high power lasers, this distance can be increased much further at an additional expense.an infrared photoelectric beam sensor with digital frequency conversion, Install the transmitter and receiver, then design an invisible barrier that no one can see. The detector will provide an alarming signal, i.e. motion is detected, when something blocks the infrared or when the beam is passed by someone. Once installed, anyone who crosses the detection lines it will activate the alarm panel and sends the notification by a call or text message.

5. Implementation:

Initially, we have designed the prototype consisting of two poles. Each pole constitutes a sensor node, power system and laser detector. A 40 watts solar panel is used for charging and maintenance of 12V battery and a solar charge controller is used to keep the battery from overcharging by regulating the current and voltage which is coming from the solar panel to the battery. Laser Detectors are used for motion detection within a range of up to 100 meters. A pair of laser beams (Tx and Rx) will detect the motion in between two poles separated by some

physical distance. The two adjacent poles are aligned in such a way that the buzzer will give us an alarm when any person/obstacle appears in between the two aligned poles.

PIR sensors are used to detect the motion in the range of 1-3 meters within a close proximity which can notify the arrival of any humans with an intention to break the pole itself. The flame sensor module is also integrated in the system can detect flames in the wavelength range of 760 – 1100 nanometer. LoRaSX1276 transmits the data to the gateway which will send the sensor data to the cloud. These data can be retrieved remotely from the cloud at the control room so that necessary instructions is given to the nearby forest officials.

All the above sensors are integrated and interfaced with Arduino Uno board for both transmitting and receiving the sensor data.

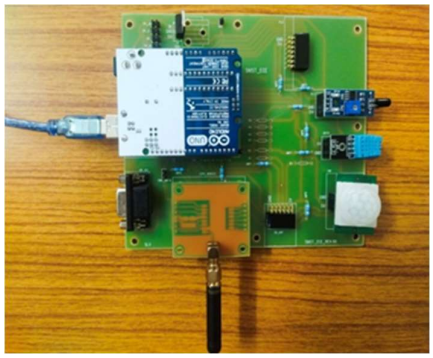

Fig.3: Fabricated PCB board

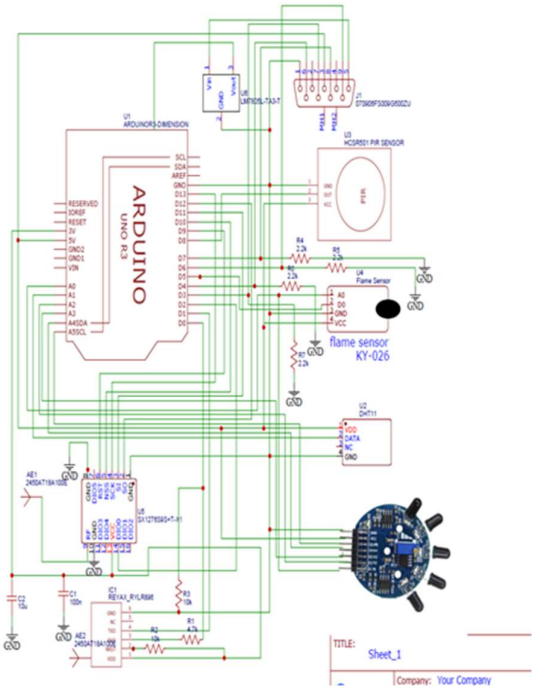

Fig:4 Circuit Diagram

6. Result and Analysis

The two adjacent poles are aligned in such a way that the buzzer will give us an alarm when any person/obstacle appears in between the two aligned poles. The sensors which are integrated with arduino sends the notification to the nearest forest officials through LoRa.

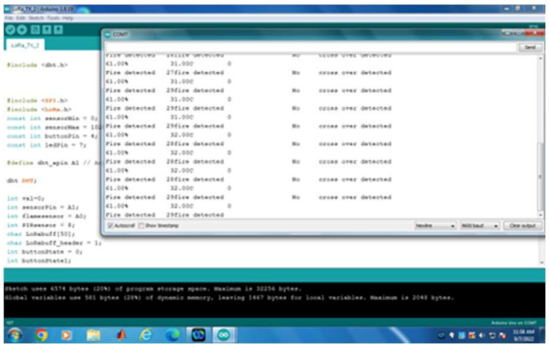

Fig: 5 Result

Conclusion

In this project, the integration of inexpensive electronic components allowed the system to detect fire and illegal entries and the addition of a solar panel made the system self-powered.We have tried to give a cheap solution and identified all of the project's components and technological requirements. They are obtained and put through testing in both the lab and the field.

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