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Deforestation control and forest monitoring system using Lora technology

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ABSTRACT

Deforestation causes a critical threat to natural world, leading to loss of biological diversity, habitat destruction, and also adverse effects in the climate. To fight against this challenge, our project presents a deforestation control and system monitoring that utilizes LoRa (Long Range) technology and a range of sensors, including fire, smoke, DHT11(humidity and temperature), sound and tilt sensors, integrated with Arduino. This innovative system offers an effective solution for early detection, monitoring, and control of forest fires, thereby to come up with the mitigation of environmental damage and conservation of forests. The project operates on principles of real time acquisition, transmission, and remote monitoring.

Keywords—*Deforestation, LoRa Technology, MEMS, DHT11, Tilt, Fire, Smoke, Humidity, Soil Moisture sensors.*

I. INTRODUCTION

Forest is a conditional feasible resource that can revitalize but it requires a certain duration of time to maintain its operation and it plays an important role in our daily lives because we depend upon it for our survival. The forest resources in India was found to be exhausted which is much high. Rapid over-exploitation, industrialization and also urbanization have been resulted in loss of forest cover to alarming rate permanently. Deforestation was only the main cause for the climate change. We really face a lot of problems because of deforestation. There is a need for high protection and continuous monitoring of the forest. So there is a need for global forest surveillance device used to detect deforestation, fire and any other illegal activities. Different measures were taken in consideration for controlling such effects. At first human power was used to monitor forest area. But due to this the human life will be kept in risk and also cant monitor and control the whole forest easily.

LoRa Technology is used for very long distance communication without any Wi-Fi module. It is based on the spread spectrum modulation approaches which are derived from chirp spread spectrum (CSS) technology. It is a less power, long range wireless platform which become de facto wireless platform of internet of things (IOT).

This paper mainly describes on forest monitoring system like deforestation, fire, smoke, humidity and temperature with different and large number of sensors and also it will let us know the illegal sounds in the forest using sound sensor.

II. LITERATURE SURVEY

The study [1] is focused on evolving of forests. It is completely concentrated on struggle between safeguarding the forest and also diversion towards their use for the justifiable resources. Roughly around 1.52 million hectares of all the forest places were redirected for non-forestry usage from the year 1980.

The paper [2] mainly describes about the forest monitoring and various issues in the forest. It also helps us to understand the forest present status with respect to the demand supply of wood, fuel, timber and also any kind of non-wood products in the forest. It also describes about the contrasting policies and management initiatives in the forests.

The study [3] tells about various responsibilities and powers of employees and officers of forest department which includes development team, field director, forest resource management, chief conservator of forest ,foresters and many like this. They are having many duties and responsibilities on forest deforestation and forest fires.

The paper [5] describes the new ideas of forest monitoring system using a different technology calles as LoRa technology. And also using different sensors for sound, humidity, fire and smoke we monitor the issues in the forest and give a message to the forest management team.This innovative system offers an effective solution for early detection, monitoring, and control of forest fires, thereby contributing to the conservation of forests and the mitigation of nature damage. The project operates on the principles of real-time data acquisition, transmission, and remote monitoring.

III. EXISTING MODEL

An IOT(Internet of Things) based forest monitoring system was created earlier by taking the help of forest owners by considering various illegal issues in forests to control deforestation in forest areas, climatic changes like humidity& temperature, fire detection, soil moisture. But the disadvantage is that it require Wi-Fi module. Without Wi-Fi module the system does not work. [10]

IV. PROPOSED MODEL

The proposed model describes the use of different modules to measure various parameters in forest areas without any human interaction and to send the data without any Wi-Fi module to the forest department.[9] It is an low cost system to monitor forest illigal activities, measure the humidity in the soil using humidity sensor, fire detection using flame sensor and with many other advantages.
The system comprises the following key components:

1. **LoRa Technology:** LoRa is employed for long-range communication, enabling the remote data transmission from the field to the near central monitoring station. It certifies a reliable and extended wireless range, making it acceptable or remote forested areas.[8][13]

2. **Arduino NANO:** Arduino is a tool for doing computers that can sense and control more of the physical world than your desktop computer. It's an open-source computing platform which is based on a simple micro controller board, and a developed environment for writing software for the board. Arduino NANO is used in this project for both the transmission and also receiving the data.

3. **Fire and Smoke Sensors:** Fire and smoke sensors are placed in the forest areas. They are designed to detect the fire and smoke, triggering alarms in real time when anomalies are detected.

4. **DHT11 Sensor:** The DHT11 sensor measures different environmental parameters such as temperature, humidity. These data points are crucial for assessing forest conditions, as they influence fire risk. It is a low cost for measuring the temperature and humidity.[6][7][11][12]

5. **Soil moisture sensor:** This sensor is used for testing the moisture of soil, when the soil is having water shortage, the output will be at high level, else the output will be at low level. By using this sensor we can automatically water the flower plant, or any other plants requiring automatic watering technique.

6. **Sound Sensor:** Sound sensor is used to detect unusual noises, which can be indicative of unusual activities or disturbances in the forest.so due to this a person can easily find the disturbance coming from the forest and can take action.[4]

7. **Tilt Sensor:** Tilt sensors are placed on trees to detect any sudden changes in tree angle. This can be a sign of illegal activities or tree falls.

8. **DC stepdown bug converter:** LM2596 is the AC to DC step down regulator, which is adjustable +1.23 to 35v dc output, 2A. Ideal for projects requiring a regulated power supply which are battery operated. The LM2596 regulators are monolithic ICs which provide all the required functions for a step-down (buck) switching regulator, and it is capable of driving a 3-A load with a very excellent load and line regulation. These devices are available in output voltages of 3.3 V, 5 V, 12 V which are fixed and an output version which is adjustable. It requires a minimum number of external components, these regulators are very simple to use and also includes internal frequency compensation, and a fixed frequency oscillator.

9. **SIM 900 GSM module:** SIM 900 GSM module is used for passing the message to the forest monitoring team so that if any issue arises they can get a better solution andso the issue.

The system operates as follows:

1. Sensors continuously monitor their respective environmental parameters.
2. When a sensor detects an anomaly, it sends a signal to the Arduino controller.
3. The Arduino processes the data and transmits it via LoRa to a central monitoring station.
4. At the monitoring station, the data is received, analyzed, and displayed on a user-friendly interface.
5. In the event of fire detection, alerts are immediately sent to relevant authorities for rapid response.

By employing this Deforestation Control and Monitoring System, the project aims to address deforestation challenges by providing a real-time data on environmental and climatic conditions, ensuring early detection of fires and illegal activities, and enabling prompt intervention to protect forests and biodiversity. The use of LoRa technology ensures that even remote forested areas can be effectively monitored and protected. This project aligns with the global efforts to combat deforestation and preserve the natural environment.
The implementation of this system demonstrates a proactive approach to environmental conservation and can be a valuable tool for authorities, environmentalists, and organizations committed to protecting our forests.

V. BLOCK DIAGRAMS

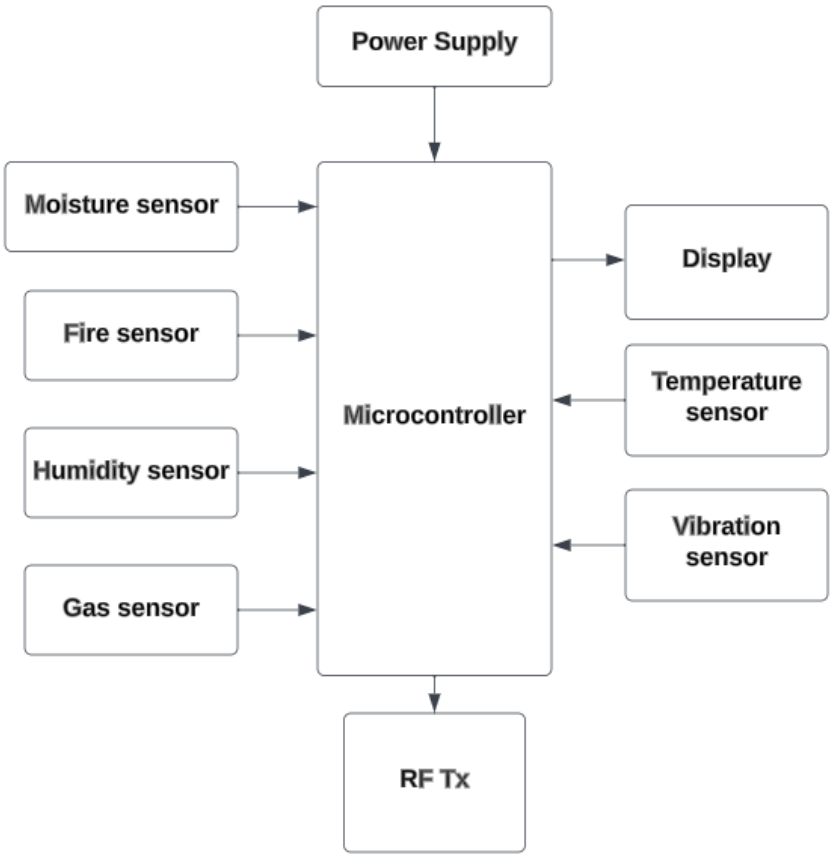

Fig 1- Transmitter

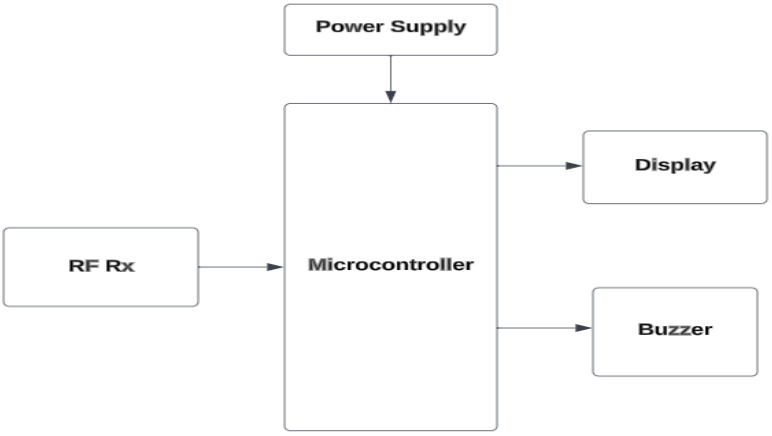

Fig 2- Receiver

VI. ADVANTAGES

1. Deforestation Control
2. Fire Detection
3. Soil Moisture Testing
4. Disturbance Monitoring
5. No Use of Wi-Fi Module
6. Efficient Change Detection

VII. CONCLUSION

Our project Designed to present a Deforestation Control and Monitoring System that utilizes NRF24L01 as a Lora (Long Range) technology and a range of sensors, including Flame Sensor to detect fire, Mq2 Sensor to detect Gas and Smoke, DHT11 (humidity and temperature) Sensor to detect Temperature and Humidity Levels, Moisture Sensor to detect Moisture Content of The Trees, and tilt Sensor to detect Tree Fall in the forest, All this sensors are integrated with Arduino Nano. And also We use Sim900 GSM Module to Send the processed Data Through Sms Alert.

This innovative system offers an effective solution for early detection, monitoring, and control of forest fires, thereby contributing to the conservation of forests and the mitigation of environmental damage. The project operates on the principles of real-time data acquisition, transmission, and remote monitoring.

VIII. RESULTS

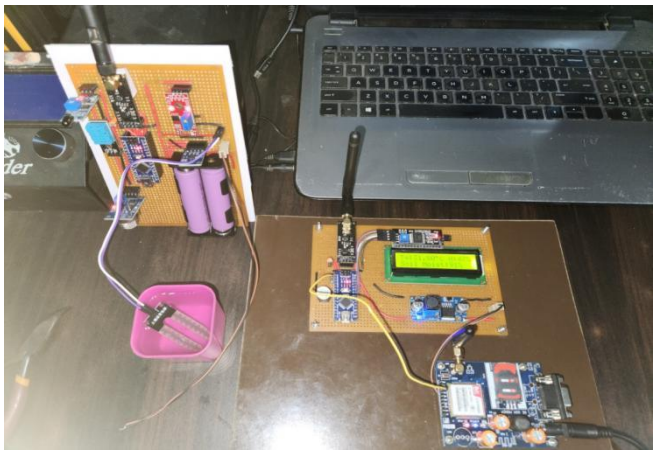

Fig 3: Moisture sensor Detection

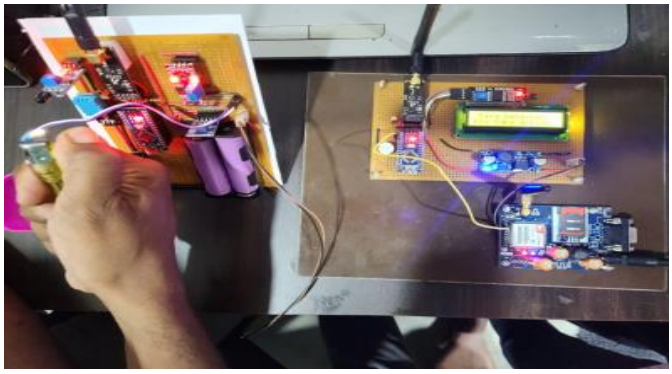

Fig 4: Fire Detection

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