FOREST MONITORING SYSTEM BASED ON GPRS AND POWERED BY IOT
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Keywords:
Forests are part of the important and indispensable resources for human survival and social development that protects the balance of the earth ecology. There is a need to design a smart and efficient Forest Monitoring System.

Introduction:
In recent years, the prevention and monitoring of Forest Fires has become a global concern in Forest Fire prevention organizations. At present, traditional forest fire monitoring measures include ground patrolling, watching tower, aerial patrolling, long-distance video monitoring and satellite monitoring and so forth. The Existing Conventional forest monitoring system has the basic issues of limited application unsatisfied monitoring results, financial, material and labor resources.

This project presents the prototype of a system for detection of any uncontrolled anthropogenic activities, smoke or fires in forests using sensors. The data from the sensors is processed in the microcontroller and is transmitted to the receiver unit through Zigbee network. The abnormalities alert the receiver unit and the pictures taken through camera are mailed.

This Forest Monitoring system prototype is designed and developed in an effort to improve the security level for valuable trees which have high demand in market like teak, Sandalwood, etc. This prototype is tested and demonstrated successfully for its functionality.

Objectives:
Most wildfires in forests and woodlands today are caused by people as a result of misuse of fire for conversion of forests to agricultural lands. The objective of the project is to prevent the smuggling, illegal logging and other anthropogenic activities in the forest. Such kind of system can be employed in any area of forest which is highly affected by smuggling and illegal cutting. There is no need for the guard to travel whole forest. We can see the visuals of all the happenings in the forest at the base station. Exact location of tree cutting can be found easily too. The microcontroller forms the heart of the system and all the sensor nodes are connected to the controller unit. The sensor data is processed in the microcontroller and is transmitted to the receiver unit. The receiver unit decides whether the environmental conditions leads to forest fire or not and is also alerted about the illegal activities if any.
Methodology:

Block Diagram (Method 1: Using Zigbee Module)

Transmitter:

- Power supply
- Fire sensor
- Smoke sensor
- Vibrator sensor
- Intruder Sensor (PIR)
- SST89E516RD2 Micro Controller
- Zigbee module (TX)

Receiver:

- LCD
- SST89E516RD2 Micro Controller
- ZigBee Module (RX)
- Phone number
- Location
- Photo
- Mail (Photos)
- Speaker
**Method 2 (Using GSM Module)**

**Hardware requirements:**
SST Microcontroller unit, Max 232, GSM/GPRS Modem, Zigbee module, PIR sensor, Vibration sensor, Fire sensor, Smoke sensor, Camera in IOT smart phone, GPS in IOT smart phone, GPRS in IOT smart phone.

**Software Requirements:**
Embedded C, Keil C Compiler, Flash magic, Eclipse, Android sdk, Java.

**Procedure:**
The Microcontroller forms the control unit of the whole project. The main hardware circuit basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Vibration, PIR, Smoke and Fire sensors are configured to monitor the corresponding data in the Forest. The data is processed in the Microcontroller and the processed data is transmitted to the receiver unit. If any abnormality is observed, the receiver unit asks the transmitter for the location and the photos taken at the transmitter side will be mailed to the receiver unit. The sensor values are processed and transmitted from the transmitting section through Zigbee Network in method 1 and is transmitted using GSM module in method 2.
Results:
1. The prototype of the system can be implemented in places where precious trees are planted, to prevent forest fires and other illegal activities.
2. The transmitter and receiver units are placed at proper places for performing experimental tests.
3. The LCD displays the message indicating the situation to the control station where the receiver unit is placed.
4. This message received at the receiver unit is used by the forest officer to take preventive action.
5. With improvements in hardware and firmware the system can be implemented in a large scale that will help forest officials.

Conclusion:
An advanced system for Forest Monitoring powered by IOT is developed which overcomes the demerits of the Existing technologies of Forest Monitoring and Fire Detection. This forest monitoring system is built based on ZigBee wireless network and GPS communication technology, from the perspective of construction cost, flexible networking, real-time monitoring. ZigBee network is used to monitor forest areas relative parameters such as vibrations, fire, Intruder(PIR) and smoke concentration. Finally monitoring center obtain the data from server and through Zigbee Wireless Network. The successful connection between ZigBee network and internet makes the functional complementarities of several networks and implements remote access to the data of forest monitoring region. Compared to traditional forest fire monitoring system, the program is good at flexible structure, low one-time cost, easy operation, wide expansion and better promotional value.

Future scope:
1. Fire detection in forest could also be possible if we used temperature sensors and humidity sensors along with the device which can also avoid wastage of valuable trees.
2. A sub server unit can be used in between the transmitter unit and main receiver unit to make the whole process take comparatively less time to alert the forest officer to take preventive action.
3. The system can also be upgraded with low-power elements, higher versions of Zigbee in order to make the system run for longer periods with increased efficiency.