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Protection of Valuable Trees from Smuggling & Forest Fire and Preventing Wild Animal Roaming in Residential Areas

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ABSTRACT: Nowadays there are many incidents about smuggling of trees like Sandal, Sagwan, etc..., These trees are very costly but meagre. They are used in medical science, cosmetics. To restrict their smuggling and to save forests around the globe some preventive measures need to be deployed. We have developed a system which can be used to restrict smuggling as well as prevent the animal roaming in residential areas. The system consist of Arduino UNO interfaced with tilt sensor, flame sensor, vibration sensor and PIR sensor. In case of problem the device sends an alert message to the forest officers using GSM module along with the exact geographical location using GPS. And also real time data is being updated from the device to the monitoring section using IoT.

KEYWORDS: Arduino UNO ATmega328, Tilt Sensor, Vibration Sensor, Flame Sensor, PIR Sensor, Node MCU, SIM808

I.INTRODUCTION

In world, forest and agriculture are the main producers for producing food, fibre and many other desired products, by the cultivation of certain plants and raising of domesticated animals. But, the trees and plants on that places are in dangerous situation due to three main reasons.,

Forest Fire: The report, "Strengthening forest fire management in India", jointly prepared by the ministry of environment, Forest and climate change (MOEFCC) and the World Bank says Forest Fire are leading cause of forest degradation in India.

Smuggling of valuable trees: In International market, there is a big demand for such trees. Indian sandalwood costs 12,000 to 13,000 INR per Kg whereas in international market red sanders command high price of INR 10 cores per ton. Cutting of such trees leads to forest degradation.

Wild Animal Roaming: Many wild animals are entering into the field for food and shelter. It results in destruction of agricultural lands. Hence, the main object of our project is to develop a system, which can be used to restrict smuggling, Forest Fire and prevent wild animal roaming in residential areas.

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II. EXISTING SYSTEMS

- 1) Fencing the forest area. This is one of the oldest method used but the cost required to build it increases proportionally to the area of forest.
- 2) Manual monitoring of forest by enforcing the security personals in specific forest region is one of the methods to control the cutting of trees. But it is hard to monitor the entire area by humans and providing continuous over day and night is impossible.
- 3) Tagging of trees using RFID just like tagging the animals is employed. However this does not provide real time information when the problem occurs. It leaves a message only when the tree is moved from its original position.
- 4) CCTV camera installation in the forest is again very costly and hard to implement.

III. PROPOSED SYSTEM

Thus on noticing all the exciting problem, a new system is developed to prevent smuggling of trees, forest fire and animals roaming in residential areas using IOT. This system will be cheap, effective and will provide a real time monitoring of forest area. Every unit will be installed with a small unit which consists of Arduino UNO that is interfaced with flame sensor, passive infrared sensor (PIR), tilt sensor, vibration sensor. We make use of GSM and IOT module. If there is a problem the system will send an alert message to the forest officers using GSM module along with the exact geographical location provided by GPS. And also real time data is updated from the system to the monitoring system using IOT. This data will be used by the forest officer to take a necessary action.

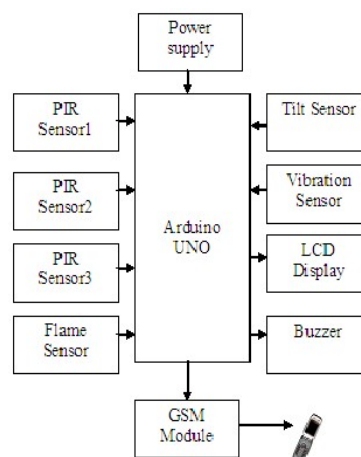


Figure.1. Block Diagram of the Proposed System

Sensing Unit:

Flame sensor: A flame detector is a sensor which is designed to detect and respond to the presence of flame or fire. Flame detectors comprise an electronic circuit with an electromagnetic radiation receiver. They are activated when they receive electromagnetic radiation from one or more defined wave lengths according to their design in the UV or infrared spectrum. Advanced flame detector models offer fields of view of about 90° to 120°

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Vibration sensor: Vibration sensor is used for testing the impact force. It has a high sensitivity towards vibration. It consists of piezoelectric element. It is suitable for measuring the flexibility, vibration impact and touch. When the vibration is sensed, certain voltage will be generated and released to the Arduino UNO. We can adjust the sensitivity by adjusting the on board potentiometer with the screw.

Tilt sensor: Tilt sensors are essential components in security alarm systems today. Tilt sensor is used to measure angle within a limited range of motion. Tilt sensor is called as inclinometers because the sensor just produce a signal but inclinometer produce both readout and a signal. These devices produce an electrical signal that varies with an angular movement. Tilt sensors can be implemented using mercury and roller ball technology, and can be mounted using mechanical threading, magnets, or adhesives, depending on what type of surface they are being mounted to.

PIR sensor: A PIR-based motion detector is used to sense the movement of people, animals or other objects. A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. Here we use PIR sensor to detect the human movement in the restricted forest. The module has an on-board pyroelectric sensor, conditioning circuitry and a dome shaped Fresnel lens.

Processing Unit:

Arduino UNO: Arduino UNO is a microcontroller based on ATmega328p. It has 14 digital input/output pin, 6 analog USB connection and power jack. Its operation voltage is 0 to 5v. The sensors are interfaced with the Arduino UNO with their analog and digital pins. It can be powered with USB connection or with the external power supply. The ATmega328 has 32KB memory and it has 2KB of SRAM and 1KB of EPROM.

Output Unit:

GSM module: GSM (global system for mobile communication) it is a wireless modem that works with GSM wireless network. It sends and receives the data through radio waves. GSM module requires a SIM card to operate from a wireless carrier. The data are processed by the processing unit and if the problem is detected then the message alert is sent to the forest officer using GSM and also it is monitored on the cloud server webpage using IOT.

IV. METHODOLOGY

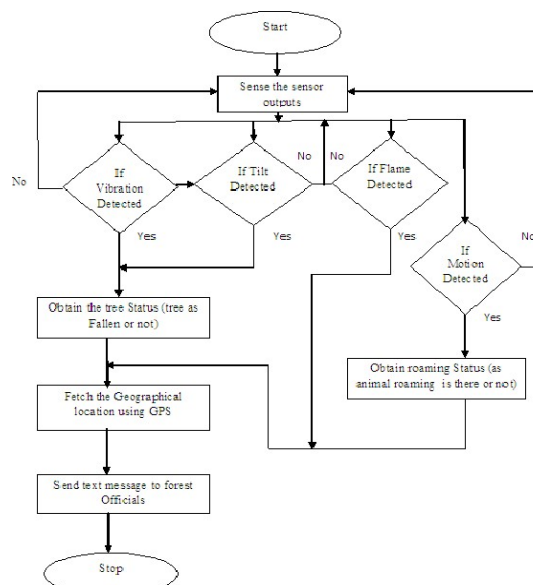


Figure.2. Flow Chart of Working Procedure

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The proposed system is used to protect the valuable trees from smuggling, forest fire and prevent the wild-animal roaming in the residential areas. Here the Arduino UNO ATmega328 and the four Sensors are used for continuous monitoring. Tilt sensor is used to measure angle within a limited range of motion. Tilt sensor is called as inclinometers because the sensor just produce a signal but inclinometer produce both readout and a signal.,Vibration sensor is used for testing the impact force. It has a high sensitivity towards vibration,A PIR-based motion detector is used to sense the movement of people, animals or other objects,A flame detector is a sensor which is designed to detect and respond to the presence of flame or fire.

Those sensing elements used to protect the trees from smuggling, forest fire and prevent animal roaming. While, SIM808 module is used for location tracking. The current status of the system is updated on Blynk application via Node MCU. The device is fixed on tree and forest ends. If the person trying to cut the tree, then vibration sensor sense the vibration and its value goes high. If the vibration value is above the threshold value, then it sends the alert message to the concern authorities. If tree fallen occurs, then the tilt sensor value goes high, which sense and monitors the angle of the tree. If orientation of the tree get changes, then it send the alert message. While, GPS tracker is used to track the location of the tree and if there is any change in the location, then it send the updated location to the authorized person. When there is any forest fire happens, then the flame Sensor detect the Flame and send the message and location about fire accident .To prevent the animal roaming in the residential area, We are using passive Infrared Sensor which, detect the motion the human or animal.

For animal detection, We are using three PIR Sensor and it is placed at different height based on the animal and man height. The first one fixed at 2.5feet it detect the animals like tiger, lion, bear and second PIR Sensor is fixed at 6feet and it is used to detect the animal and as well as human. The Third Sensor is placed at 6.5feet and it is used to detect the animals like elephant, Giraffe. When the first sensor alone sensed, it send the message as “TIGER CROSSING” to the authorized person. When the first and second sensor is sensed, it doesn't send the message, because, it is placed in human height. When all the three sensors sensed, it send the message as “ELEPHANT CROSSING” to the authorized person. Hence, all the sensor details are continuous monitored using wifi module with Blynk app.

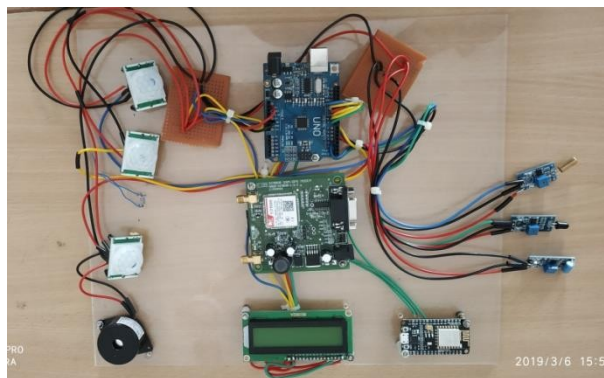


Figure.3. Hardware Design

V.CONCLUSION

This paper consists of a low cost and low power IOT based system to detect the smuggling of trees, where the human beings are not able to provide security. The forest is monitored under IOT system. Here the multiple sensors are placed in different places in forest. If there is any undesirable things occurred in any location of the forest. The sensor detects and updates that information to the Arduino microcontroller and these sensor values are continuously updated in the IOT system. The information which is updated also stored in the cloud server and it is also monitored by the



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authorized person through website. By this the forest officer can take necessary steps against those kinds of undesirable activities.

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