

# ANTI-THEFT ALARM SYSTEM FOR FOREST TREES USING WSN

**Abstract** - Our life is dependent upon trees. There is a long association of man and trees. Since the hoary past man and trees have been the two major creations of nature. In his prehistoric days man turned to trees and plants to collect the things vitally necessary for his existence. Since that time man and trees have been interdependent. From past few years, it is seen that smuggling of environmentally and economically important species of trees such as Teakwood, Sandalwood, Pine and Rosewood has been dramatically increased. They are useful in medical sciences and cosmetics. Since they are costly, smugglers allegedly cut down many of these trees and transport them to their factories for commercial purposes. The most effective measure is “the implementation of a real time, wireless sensor network (WSN) and data logging system” using GSM module and three type of sensors, which will be an advanced and a cheap modern technology to make monitoring more robust, effective and feasible.

Keywords– WSN [Wireless Sensor Networks], Sandalwood trees, Zigbee, Arduino.

## 1. INTRODUCTION

From many days we are reading in the newspapers about the smuggling of precious trees like sandalwood, teakwood, rosewood etc. These trees are very costly. These are mostly useful in the medical sciences and cosmetics. Because of huge amount of money involved in selling of such tree woods illegal activity like smuggling is taking place. There have been several initiatives undertaken by different stakeholders and in particular by the Government of India, to mitigate these problems. These include the recruitment, training and deployment of anti-poaching watchers and private or government security guards across forests. Strict punishments for convicted offenders, as well as giving special incentives for anti-poaching activities were aimed for eradicating the menace. However, the punitive measures have remained largely ineffective. This problem isn't related to India only. China, Australia and African countries are also struggling with same issues. Putting cost in mind, Indian sandalwood costs 12000 to 13000 INR per kg whereas in international market Red Sandals command a high price of INR 10 core per ton. The Indian sandalwood tree has become endangered in recent years, and in an attempt to curb its possible extinction the Indian government is trying to limit the exportation of sandalwood. For an individual, maximum permissible purchase limit is not to exceed 3.8kg as per Government.

In order to avoid the smuggling, a system which consists of Micro Controller, accelerometer sensor, flame sensor, vibration sensor, GPS and GSM module is designed. Communication between the trees and server will be done by GSM modules and GPS is used to get the location parameters. At main server, there will be one authorized person who will receive the messages and can take actions accordingly to provide security. Tree cutting will be detected by accelerometer sensor. Putting this problem in mind, a system is designed which help us to achieve our goal.

## 2. LITERATURE SURVEY

This paper [1] proposes a microcontroller based anti-poaching system employing WSN technology, and MEMS accelerometer. WSN is widely used technology in remote monitoring applications. The micro-controller that is used over here is PIC16F877A. MEMS accelerometer senses the tilt of the tree. Sound sensor combines a microphone and some processing circuitry. It detects sound from silence and outputs digital trigger signal. Fire sensor is used to detect the rise in temperature. Smoke sensor detects the lubricant gases in the surrounding environment. GPS gives the latitude, longitude and altitude values. For the purpose of serial communication UART is used. Internet of Things is used to transfer data without requiring human to human or computer interaction and objects, animals or people are provided with unique identifiers.

The main objective here [2] is to build a protection system using Bluetooth 4.0 and GSM to alert the concerned authorities in case of sandalwood robbery. IEEE standard for Bluetooth is 802.15.1. Technology called frequency-hopping spread spectrum is used in Bluetooth, where it makes use of 79 channels to transfer the packets. Version 4.0 of Bluetooth is called smart Bluetooth because it includes basic Bluetooth, low energy and high speed protocols. The protection mechanism proposed in this paper can be implemented using either cluster or distributed architecture. Cluster architecture is a master slave architecture in which each tree is treated as slave node. Whereas distributed architecture is collection of clusters in which for a particular master node, other master node acts as slave. This protection model consists of two parts; protection circuit which serves the function of slave node and mobile application which is installed in every master node and monitors all the slave nodes.

In this paper [3], a low power MSP430 microcontroller along with RF modules is being used. WSN is widely cast-off technology in monitoring and controlling the remote applications. The design that is discussed over here has a portable wireless sensor node which is the part of a Wireless Sensor Networks. It will be attached on trunk of each tree, and is used to identify robbery and also sends signals to Central Base Station. The system is designed to consume low power, and it works better with rechargeable batteries which can charge using natural solar system. A solar panel taken in the system is used for recharging node's batteries. The cluster of a node is around 5-10 trees. This can be formed into a cluster with a master node having extra properties and to communicate with central base station. The location of central base station is at the entrance of the forest which will communicate with node through RF network. The designed network will follow Star topology.

This paper [4] discusses the application of machine learning to prevent smuggling of trees. Inception-V3 model is the pretrained convolutional neural network used in the proposed system for training the system. System applies previous learning experiences to perform present or future classifications. The Application uses Infrared cameras to capture images of objects near the tree, captured images are processed to obtain high resolution images from low resolution images. The processed images are next sent to pretrained inception model for classification of objects in the image. On the basis of resemblance of classified images with bottlenecks probability of finding an intruder is calculated. Hence on detecting any abnormal value of probability, an intimation in the form of message is sent to the concerned authority.

The suggested system over here [5] consists of tree unit and main server unit. Each tree has a micro controller, Flex sensor, Accelerometer, temperature sensor, Zigbee and GSM module. The cutting down of tree is sensed by flex sensor and accelerometer. Tree unit gives the information about cutting down of trees when it catches fire and consists of three sensors accelerometer sensor, flex sensor and temperature sensor. There are several tree units and tree unit 1 is responsible to host the information from the multiple tree units. Each tree unit consists of ZigBee module and controller is accountable for data transmission from primary stage to final stage. Main server unit is responsible for user interface and displaying the data that was transmitted from stage 1. Once the base station is modified, the authorized person takes action accordingly.

### **3. PROPOSED SYSTEM AND METHODOLOGY:**



The system consists of two units:

A. Tree Unit and B. Control Room Unit

**A. TREE UNIT:**

Tree unit has necessary sensors to know its condition status. This unit consists of three sensors to give the information of activities such as Cut Down of trees, fire detection etc. This unit is powered with solar energy and rechargeable batteries.

Tree unit basically consists of three sensors which are Vibration Sensor, MEMS Accelerometer Sensor and Fire Sensor. The controller is also equipped with GSM, GPS and ZigBee Transmitter. When the smuggler starts to cut the tree, the vibration created by it is sensed by the vibration sensor and the tilted position of the tree is sensed by MEMS Accelerometer.

GPS is used to get the location details such as Latitude, Longitude which are sent to an authorized mobile number with Google Map Link using GSM when the sensors threshold values are crossed. ZigBee Transmitter notifies the base station about the illegal activity.

**B. CONTROL UNIT:**

The control room unit basically consists of ZigBee receiver and TTL to USB converter which displays data on PC Software. ZigBee Receiver receives the message sent by ZigBee Transmitter and displays on PC.

#### **4. BLOCK DIAGRAM:**

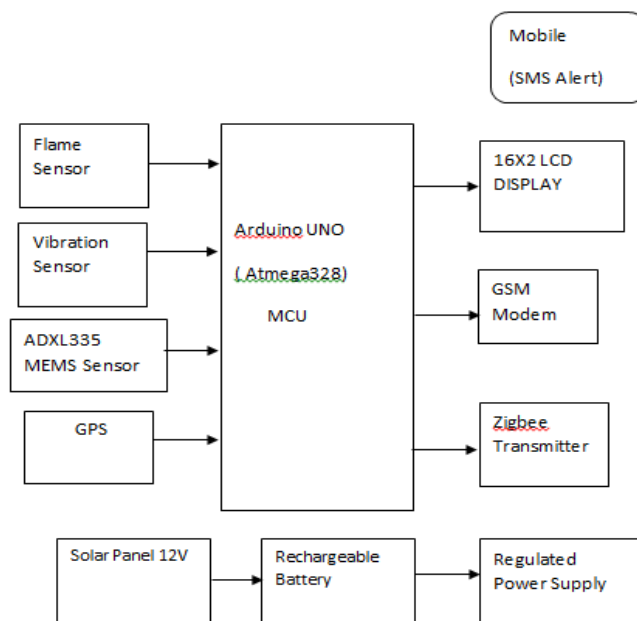


Fig. 1 Transmitter Block Diagram



Fig. 2 Receiver Block Diagram

### 5. RESULTS:

The output on the serial monitor when an abnormal condition of MEMS accelerometer is detected is as shown:

```
Latitude:12.921279  
Longitude:77.570747  
www.google.com/maps/place/12.921279,77.570747  
MEMS ABNORMAL POSITION
```

Fig. 3 Output when MEMS is abnormal

The output on the serial monitor when fire is detected by flame sensor is as shown:

Latitude:12.921105  
Longitude:77.570724  
www.google.com/maps/place/12.921105,77.570724  
Fire Detected

Fig. 4 Output when fire is detected

The output when vibration is sensed by Vibration sensor is as shown:

Latitude:12.921105  
Longitude:77.570724  
www.google.com/maps/place/12.921105,77.570724  
Vibration Detected

Fig. 5 Output when vibration is detected

Message sent to the authorized phone number when an abnormal condition at the location is noticed:

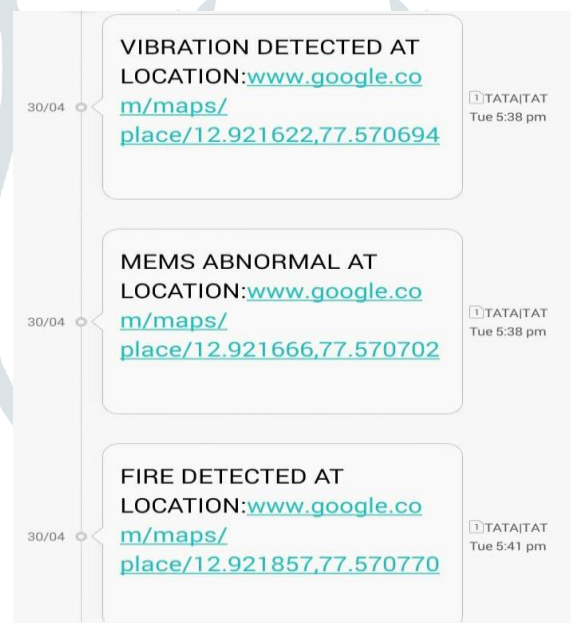


Fig. 6 Message sent to the authorized phone number

## 6. CONCLUSION AND FUTURE SCOPE:

The main purpose of this project is to protect the valuable trees such as sandalwood, teakwood, rosewood etc.... Using this system, we can easily track the poaching activity which reduces deforestation and helps in maintaining the ecological balance and also protects the wildlife. It uses various sensors such as vibration sensor and accelerometer to detect the vibration and the angle of tree while it is being cut. Flame detector is also used. When an abnormal condition is noticed, GSM immediately sends a message to the base station so

that the authorised person can take necessary action.

We can use image processing for live video streaming, image capturing using camera based on advance hardware processing devices like Raspberry Pi.

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