

# Gsm Based Anti-Theft Alarm System For Trees In Forest Using Wireless Sensor Network

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**Abstract**— In the present arena, wildlife and forest departments are facing the problem of movement of animals from forest area to residential area. The number of trees has reduced drastically from the forest that creates an unhealthy environment for animals to survive in the forest. The trees in the forest like sandalwood and other trees which are restricted to cut by the government.

This project proposes a system for tracking and alarming for the protection of trees. The main concept of this project is to monitor and prevent smuggling activities in the forest. PIC 16F877A is the main controller used in our project. This system uses IR sensor, flame sensor, RFID reader and tag. PIR sensor and MEMS which are placed in the trees. The purpose of ZIGBEE in the system is for wireless transmission of data to the server and the GPS is used to track the place and position.

If any abnormal condition occurs, automatically a SMS will be send to the concerned department. Human

detection is easily identified and also fire accidents can be prevented.

**Keywords**- PIC controller16F877A, IR sensor, PIR sensor, Flame sensor , GSM , MEMS, GPS, RFID tag and reader , ZIGBEE,LCD display.

## I. INTRODUCTION

Trees are very important for our survival in many ways. They clean the soil by filtering sewage and chemicals used in farms. They also prevent soil erosion. It is seen that the presence of trees in an area can increase property values by at least 15%. For all these reasons it is very important for us to save trees and increase the green cover of the earth. The trees and plants grew in some years and benefited people in several ways. In the Himalayan region people close to the mountains daringly fell trees, chop them for wood for cooking. This thoughtless felling of trees by the tribal people living in the hills and mountains and the people close by is quite harmful to nature. Cutting and smuggling the sandal-trees has been occurring in many forests without the knowledge of the wildlife wardens. Logs of the sandal-trees

if sold in the market fetch a very good sum. There are regular smugglers of the sandal-trees. Thus it is important for us to save trees and protect the ecosystem.

## II. AVAILABLE TECHNOLOGY

### *A. ANTISMUGGLING SYSTEM FOR TREES IN FOREST WITH SOLAR POWER GENERATION.*

As concerned citizens our ideology is to prevent such smuggling activities by using latest technologies. Hence a SMART SOLAR based Module has been devised which operates in a particular area and maintains database of the identified trees. Trees are made Smart with sensors embedded in them, forming a Sensor Network that communicates using GPRS with the Server, based on Internet of Things (IoT) concept. The Server uses the most latest technology of Amazon Cloud Web Services.

### *B. IOT BASED ANTI-POACHING ALARM SYSTEM FOR TREES IN FOREST USING WIRELESS SENSOR NETWORKS*

The design system uses three sensors tilt sensor (to detect the inclination of tree when its being cut), temperature sensor (to detect forest fires), sound sensor (for effective detection of illegal logging i.e. even the sounds generated while axing the tree are also sensed). Data generated from these sensors is continuously monitored with the aid of Blynk App. With respect to the sensors, their output devices are activated through relay switch. For tilt sensor and sound sensor a buzzer is activated and for temperature sensor a water pump is activated. Generated data is stored in Blynk Server over the Wi-Fi module. Forest officials are notified when any event occurs so that appropriate action can be taken.

### *C. ANTI SMUGGLING SYSTEM FOR TREES IN FOREST USING FLEX SENSOR AND ZIGBEE*

Every tree will be equipped with one small electronics unit which consists of Micro Controller, Flex Sensor and Zigbee module. Tree cutting will be detected by flex sensors. At server unit cutting trees will be shown in VB front end. Communication between the trees and server will be done by Zigbee modules.

### *D. DESIGN AND DEVELOPMENT OF WIRELESS SENSOR NODE FOR ANTI-POACHING OF VALUABLE TREES*

The main idea presented in this paper is to design a wireless sensor node which is a part of wireless sensor network. It will be mounted on trunk of each tree, capable of detecting theft as well as automatically initiate and send alarm signals if any to remote terminal through wireless media. In a network, a cluster of 15-20 tree nodes can be formed with a master

node having additional resources and intelligence to communicate with base station. The base station will be located at the entrance of the jungle or farm.

## III. PROPOSED TECHNOLOGY

This project is to monitor and prevent smuggling activities in the forest. PIC 16F877A is the main controller used in our project. This system uses IR sensor, flame sensor, RFID reader and tag. PIR sensor and MEMS which are placed in the trees. RFID readers and tags placed in the trees will be having a unique code, if any abnormal condition occurs, through this code we can able to identify the exact tree in a bunch. The zigbee in the system is for wireless transmission of data to the server and the gps is used to track the place and position. If any abnormal condition occurs, automatically a sms will be send to the concerned department, then the forest officer can reach the location and prevent the illegal activities, thus the natural environment is prevented from external factors.

## IV. COMPONENTS USED

### *A. PIC Controller*

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have many application in digital electronics circuits.

### *B. Flame sensor*

This module can detect flame or wavelength in 760nm to 1100nm range of light source. Small plate output interface and single-chip can be directly connected to the microcomputer IO port. The sensor and flame should keep a certain distance to avoid high temperature damage to the sensor. The shortest test distance is 80cm, if the flame is bigger test it with far distance. The detection angle is 60 degrees so the flame spectrum is especially sensitive.

### *C. Infrared Sensor*

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. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually, this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.

**D. Zigbee Transceiver Module**

ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need a wireless connection. Hence, ZigBee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.

**E. MEMS**

MEMS are separate and distinct from the hypothetical vision of molecular nanotechnology or molecular electronics. MEMS are made up of components between 1 to 100 micrometres in size (i.e. 0.001 to 0.1 mm) and MEMS devices generally range in size from 20 micrometres (20 millionths of a metre) to a millimetre.

**F. GPS module**

It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth. GPS is made up of three parts: between 24 and 32 satellites orbiting the Earth, four control and monitoring stations on Earth, and the GPS receivers owned by users. GPS satellites broadcast signals from space that are used by GPS receivers to provide three-dimensional location (latitude, longitude, and altitude) plus the time.

**G. GSM**

GSM (Global System for Mobile communication) is a digital mobile network that is widely used by mobile phone users in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies: TDMA, GSM and code-division multiple access (CDMA).

**H. RFID tag and reader**

An RFID reader is a device that is used to interrogate an RFID tag. The reader has an antenna that emits radio waves; the tag responds by sending back its data. An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification. The tag's antenna picks up signals from an RFID reader or scanner and then returns the signal, usually with some additional data.

**V. WORKING PRINCIPLE**

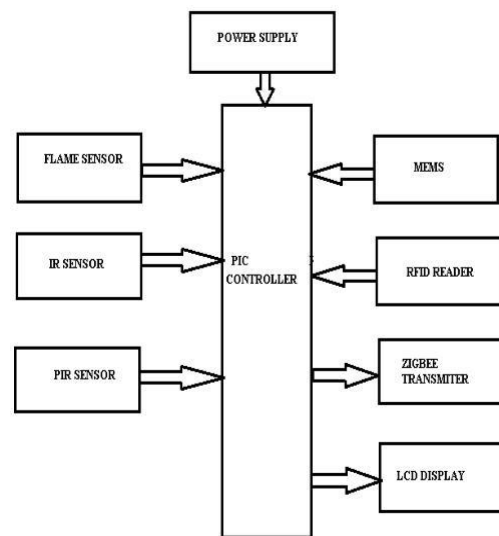
The main concept of this project is to monitor and prevent smuggling activities in the forest. PIC 16F877A is the main controller used in our project. This system uses IR sensor, flame sensor, RFID reader and tag. PIR sensor and MEMS

which are placed in the trees. IR sensor helps detects the fallen trees and the flame sensor is used to detect the flame in and around the surroundings, The PIR sensor detects the motion of nearby surroundings and MEMS is used to identify the exact position of the trees (i.e it can detect whether the tree is in straight or tilted position).

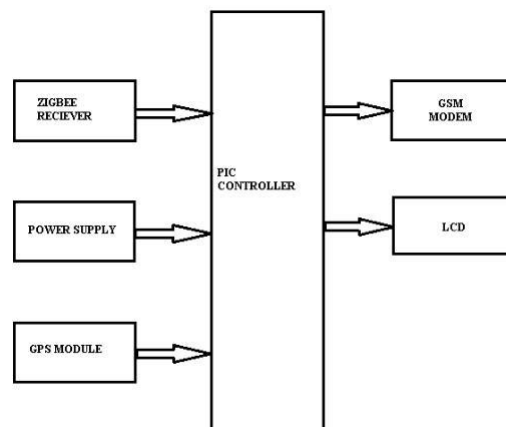
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**VI. BLOCK DIAGRAM**

**A. TREES SECTION**

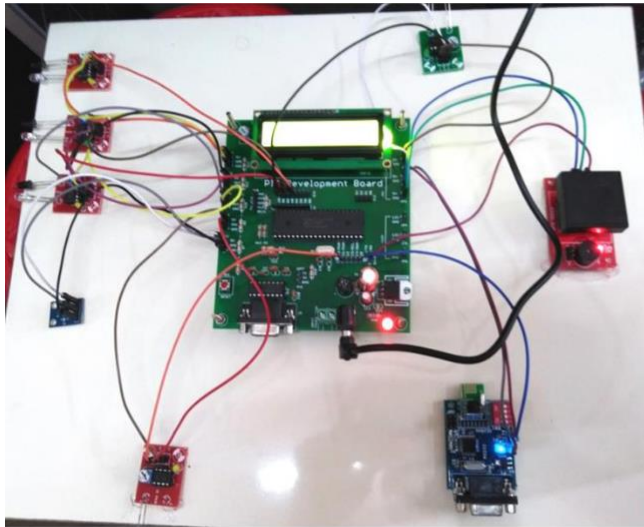


**B. RECEIVER SECTION**

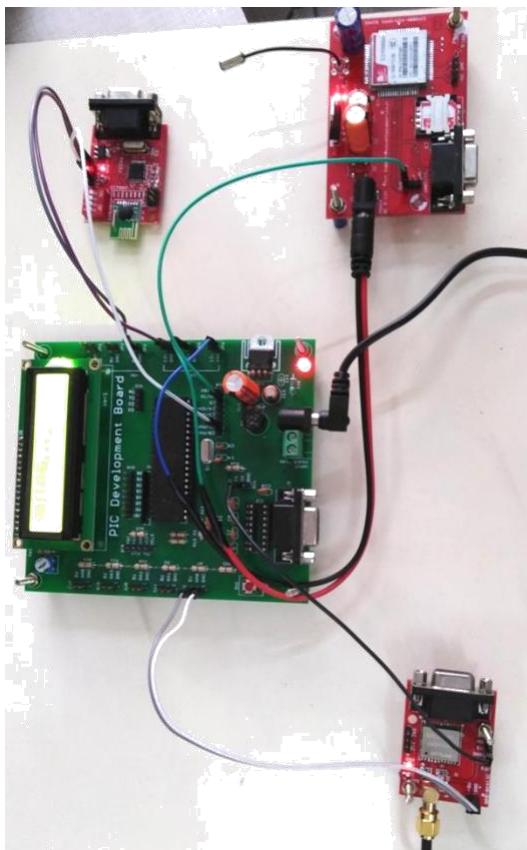


VII. RESULT

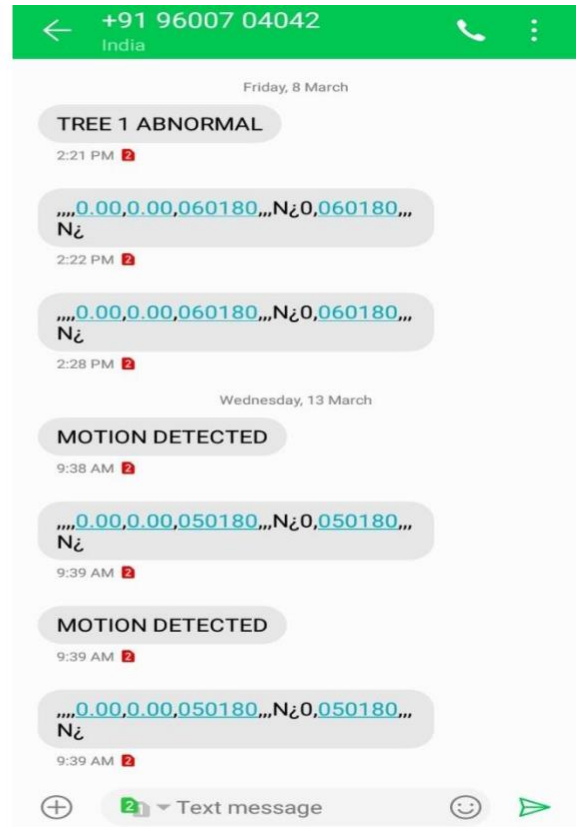
A. Prototype Of Tree section:



B. RECEIVER SECTION



C. SMS alert



VIII. ADVANTAGES

The economically important trees are protected. Thus illegal activities like smuggling of trees are prevented and which maintains the natural balance of ecosystem. Forest officer need not to roam through the forest everytime which helps to reduce time consumption and also reduces the workload and manpower.

IX. PROJECT IMPLEMENTATION SUMMARY

The project is implemented in three steps. First all the data from the different types of sensors are stored in the PIC controller and secondly all the data are transmitted to the receiver using Zigbee protocol. And lastly if any abnormal condition occurs sms sends to the phone number coded in the PIC controller using embedded C.

X. CONCLUSION

Thus, this effective and reliable system helps in controlling and stopping the smuggling activities. Apart from the main objective, the system also helps in reducing the global warming to a great extent. The natural habitat of the animals is preserved indirectly. The trees can also be protected from forest fire by using this system. This in turn helps in reducing deforestation. Thereby, the ecological balance is maintained. Economical valuable trees are preserved and

any illegal activities are prevented. Thus the natural ecosystem is maintained.

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