International Journal of Engineering & Technology, 7 (3.27) (2018) 186-188

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Wireless Sensor Based Monitoring System for Forest Tree Poaching and Fire Using Iot

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Abstract

Forest tree poaching is a serious threat to forest resource and has an impact on the environment hence preservation of trees is a must for mankind .This paper mainly aims at monitoring the trees using Micro –Electro mechanical system(MEMS) technology and employing vibration sensor , sound sensor, fire sensor. The vibration produced while cutting of trees using MEMS accelerometer is sent through Zigbee to the main server and the location is detected using GPS likewise if fire is detected the information is sent through IoT and it can be viewed by forest ranger hence alert message is sent to detect and avoid poaching of trees and fire in forest.

Keywords: *WSN, MEMS, microcontroller, IoT.*

1. Introduction

In wireless communication the information is sensed by the sensor such as sound, temperature and vibration for monitoring and collecting data to central server. It has transmitter and receiver unit they make use of microcontrollers, GPS and RF module. A wireless sensor node is mounted on trunk of a tree to detect anti-poaching. Each individual node has a set of sensors and the one with maximum power communicates with the base station and the base station receives the information and sends it to the central server. In certain cases clustering algorithm can be used if there are more number of nodes in a particular forest area.
The main drawback of WSN is its battery power for continuous monitoring and sending information to the central server

2. Existing System

The existing system uses Zigbee, microcontroller and GSM module and made use of various sensors to send information and the alert the concerned once the vibration sensor exceeds the threshold value through sms. The existing system made use of vibration and sound sensor to detect fall of tree and vibration produced due to accelerometer is sent through transmitter.

3. Proposed system

This system makes of Zigbee and IoT also they make use of fire sensors and GPS module for tracking the position and location of the forest.

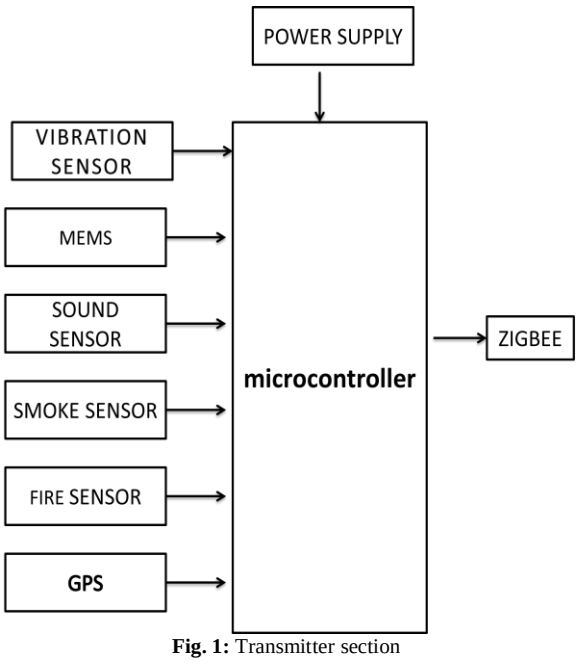

Fig. 1: Transmitter section

The Above Fig Shows the system diagram for our application which is tracking the cutting of trees illegally .five sensor and GPS unit is connected to the microcontroller through and ADC. The microprocessor analyses the information sent by the sensors in real time and if any illegal cutting of trees is predicted, the information about the GPS location of this place is sent to the corresponding officers in charge for prevention of cutting trees.

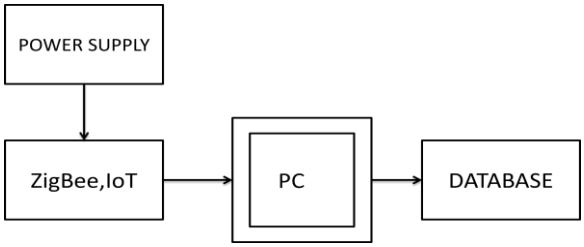

Fig. 2: Receiver section

The above Fig is the system of receiver diagram by giving the power supply to our pic board. The information of the data is located by using Zigbee and IoT Protocol. If IoT is used we can see through our mobile itself the location of the cutting trees and also if catches fire in the forest, and also the information passes to the range through our database.

Microcontroller

PIC microcontroller is used which makes use of flash memory as it can be used to write and erase several times. This makes use of the threshold limit of the sensed values and transmits the data to the receiver section and they make use of 40 pins. They are mainly used in remote control and house hold appliances.

GPS Module

It is satellite based navigation system used in military application. It is mainly used to detect and identify the location where the alert related to threshold level is reached taking into account its latitude and longitude for continuous monitoring and smart tracking of location to avoid poaching of trees or fire in forest application.

Accelerometer

Accelerometer is used to measure the force applied to a device. It provides digital output and makes use of electro mechanical principle. When accelerometer experiences force the values for initial condition is displayed with respect to time when the force applied exceeds the threshold limit the information is conveyed to the receiver and also displayed in web page so that the concerned officer can take necessary action.

Vibration sensor

They are electro mechanical system used for measuring acceleration normal vibration do exist in forest environment whereas abnormal vibration need to be detected early and sent to the receiver through Zigbee and effective steps need to be taken to avoid tree poaching.

Sound sensors

These are used to detect intensity of sound in forest environment in decibels. In forest there are noises due to trees and wildlife hence noise levels are fixed such that if there are tree falling the noise level is abnormal which is sent to the forest officer and there is a difference between tree falling due to natural calamities and trees falling due to illegal means.

Zigbee

It is based on IEEE 802.15.4 specification. These are high data communication standards and require low power hence used in forest where there are scarcity of resources and power backing are major issues[13]
The data's are sent in packets having maximum size of 128 bytes and supports 64 bit addressing high priority messages are sent across the network. Generally they make use of mesh network and they operate in ISM band and their data rate varies from 20 Kbits/sec to 250kbits/sec

IoT

It is a concept of identifying the object connected to internet .It allows objects to be sensed in remote places for integration of internet with the network. In the proposed work once abnormal values in vibration and other sensor devices are detected it is sent from transmitter to receiver through web page using IoT and the forest ranger can view the page in his system and initiates action. This provides faster and reliable information.

4. Hardware Implementation

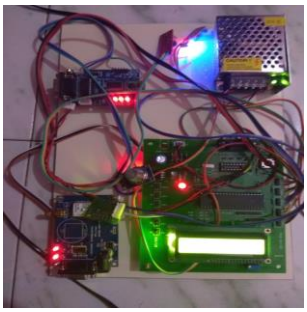

Fig. 3: Image of transmitter hardware implemented

In the transmitter circuits we are using,

- GPS module.
- Zigbee module.
- Power supply.
- Pic board.

In this pic board we are using microcontroller for controlling five sensors they are

- Vibration sensor.
- MEMS sensor.
- Sound sensor.
- Smoke sensor.
- Fire sensor.

Using power supply in the circuit. While we detect our sensors normal value changes into abnormal value once a threshold value is detected and sent to the receiver section along with its latitude and longitude direction by using GPS module.
By using latitude and longitude direction, it is use to detect in forest Ranger PC (Browser). So Ranger can easily find the location of cutting trees and if any fire is detected it is also conveyed to the authorities.

Fig. 4: Image of receiver hardware implemented

In the receiver circuits we are using,

- Power supply.
- IoT module.
- ZigBee module.
- Pic board.

For receiving we are using both ZigBee and Internet of Things (IoT) module for our output, we are creating our IoT clouds to

locate our direction of latitude and longitude with the date and the time of the cutting trees and if any fire issues it can be also detected by fire sensor if we use ZigBee we can see in browser by PC or In IoT means in through our mobile and PC.[12]

5. Output And Results

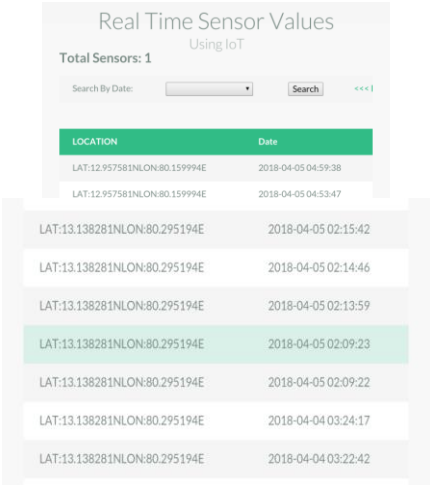

Fig. 5: Image of result in webpage

This shows all our output by detecting our sensors. It gives in value of longitude and latitude direction by using GPS module. So Ranger can locate the places by using the directions.

6. Conclusion

The proposed method makes use of low power cost effective device which tracks the information continuously and abnormal situation is sensed and sent through reliable secured communication techniques. Hence the forest ranger is been related to poaching and detection of fire in the forest. IoT webpage is created and the sensed information is received at regular intervals for monitoring purpose.
The paper is presented by using ZigBee and IoT module based WSN node to detect theft by cutting trees and smuggling contributing to the protection of trees and experimental results have been detected and compared to validate the proposed design

7. Future Enhancement

The proposed paper mainly aims at detecting the poaching of forest trees and fire this can be enhanced in future by making use of energy harvesting methods for wide range of coverage .Since power constraint is an issue for continuous monitoring such harvesting methods enhances better life time.

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