

# Design of WSN Node For Protection of Forest Trees Against Poaching Using MSP430

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**Abstract-** *Wildlife prevention has become an crucial practice due to belongings of individual behavior such as cutting of trees on large scale and unregulated hunting which causes major threat to wildlife. So going to introduce the design on prevention of trees and wildlife in forest. This section includes the design of a system for detection to the prevention of cutting of trees using wireless sensor networks to avoid a forest that could direct to failure of a major figure of natural resources. Proposed work on a micro-controller based anti-poaching system provide work on Wireless Sensor Networks(WSNs) technology, which is accomplished of sensing theft by monitoring the signal formed by the cutting of trees using a 3 axis accelerometer. Simulations are approved by ns2.34. Ant colony algorithm is accomplished on ns2, and the architecture and network protocol development process of ns2 is analyzed in this. A low power MSP430 micro-controller is used along with RF modules. WSN is extensively cast-off technology in monitoring and controlling for the remote applications. The system architecture and the hardware designs are designated in detail.*

**Keywords-** WSNs, NS2, ant colony algorithm, network simulation, 3 axis accelerometer, MSP 430 Microcontroller, RF module CC2500.

## I. INTRODUCTION

Our topic is related to prevention of trees and wildlife. Today's life we have understood the value of trees. Our atmosphere is present because of trees. So going to introduce the project on, Design WSN Node For Protection Of Forest Trees Against Poaching Based MSP430. For that there will be two systems one is Master & other is Slave. Master is to transmit the current power of trees at present one power sensor Using between our trees because in forest all trees are very near even one tree get cut or any other force used on tree will effect on other side trees. Poaching of treasured tress which are mostly exaggerated include Sandalwood, Teak wood, Pine and Rosewood has been massively increased due to man's selfish wishes. Trees have been many creativities undertaken by different Organizations, and in particular Govt. of India, to allay this problem. This contain recruitment of anti-poaching watchers for deployment and training through

forests. Strict penalty for convicted offenders, and also giving special motivations for anti-poaching (Twelfth Five Year Plans 2012-2017) were directed at eradicating the risk.

The main components of project are 3 axis accelerometer. Consists of transmitter and receiver unit. A low power MSP430 micro-controller is used along with RF modules, GPS Module. Use of MSP430 Microcontroller as main controlling unit., has a very powerful and highly flexible structure. Based on that supplies and the characteristics of WSN, several research challenges of new protocols as well as hardware and software support are examined. This system does following work:

1. Interface RF module to create wireless sensor network.
2. Communicate with base station and discover the particular node where the tree is cut, the information and address of that node is immediately send to the nearest node and gives the acknowledgment to the base station also.
3. Interface GSM module and/or sending message to forest office.

The several features of wireless networks like routing protocols, power management, network structure and hierarchical networks are discussed [6]. This extract also emphasizes the IEEE standard 1451 for analog sensors and how sensors are selected for several applications and the generic procedure to desire system for them [4]. A system-architecture for locale monitoring is to design by considering design requirements like hardware of the nodes, sensor network and the abilities to access and manage remote data. It provides detailed about put on wireless sensor networks to real-world monitoring.

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/farm which will communicate with Control room server through RF network [1].

## II. COMPARATIVE STUDIES OF EXISTING SYSTEM

WSNs have been emerging as prime capable research areas in recent recognized for observing of events and environments over long dated of time. [1], [2]. The wide spread applications of WSNs are environment and locale monitoring, home/industrial monitoring and controlling like product quality, food processing and military application. Our necessary requirement to protect and maintain forest and environment application manually is very difficult.

In the entire study, it has been perceived that the old technologies could be taken over by the smarter use of WSN. But these technologies also had its demerits as mentioned below in detail.

TABLE I literature survey

Ref	Techniques	Advantages	Drawback
[1]	Nodes can be formed with a master node having additional resources and intelligence to communicate with base station.	Low Cost	Remained largely Ineffective, but still poachers was continue to thrive.
[2]	Used a cluster of sensor nodes to monitor the cutting of trees.	To Consume less power.	Selection of sensor
[3]	To monitor the trees by using MEMS Technology and vibration sensor for the forest department. Propose a microcontroller based anti-poaching system employing	Cost Reduction	Each individual node with a additional battery power to communicate with base station

[4]	Each individual node with a additional battery power to communicate with base station	Scalability, No need to store data	Very challenging to waiting time for connections
[5]	Embedded platform for a temperature sensor node having a network interface using the 802.15.4 Zig-Bee protocol.	Low-cost, low-power wireless networks.	The data is logged and stored.
[6]	LEACH routing protocol and its derivative Fixed-LEACH routing algorithm have been	Centroid of weighted position of the deployed nodes.	Centre of minimum enclosing circle for sensor nodes

## III. DEVELOPED SYSTEM

### A. Overview of Proposed System

The key idea in Figure 1, to design of wireless sensor node is the part of the WSNs. The wireless sensor node will be mounted on each tree which is able of identifying theft then automatically start and send alarm signals if any to the nearest node or to the Central Base Station or to the node.

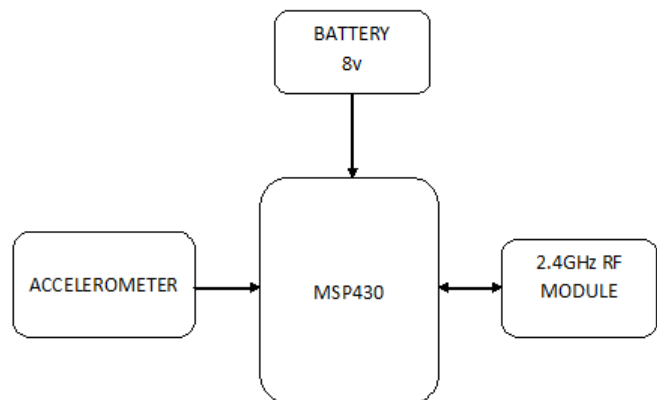


Fig. 1. Block diagram of node.

There is four basic components in the sensor node are as a sensing unit (3 axis accelerometer), a controlling-processing unit (MSP430G2553 micro-controller), a trans-

receiver unit (CC2500) and a power unit. Entire sensor and components were wisely chosen to have a low power consumption profile and have common input supply voltage range of 1.8-3.3V. Basic components are listed below:

1. Sensing module-The ADXL-335 is a 3-axis, low power, accelerometer. It has selectable measurement variety of  $\pm 3g$  minimum. The resolution of 4 mg/LSB will enable to measure the disposition change of less than  $1.0^\circ$ . This ADXL335 is interfaced to micro-controller through I2C/SPI. It has an ultra-low power consumption of - 350 $\mu$ A in active mode and 0.1 $\mu$ A in standby mode at 2.5 V (typical).[8]
2. Processing Unit-MSP430G2553 [10]- it is TI's MSP430™ family- ultra low-power micro controller. It is having different sets of peripherals for various applications. The architecture, design for extensive low power modes, so that it is optimized to get extended battery life for portable measurement applications. [10]
3. RF Module -. Communication module Zig-bee from Digi-Key is used, which is built on ZigBee/IEEE 802.15.4 standard. It operates at 2.4 GHz [9] (freely available ISM band in India), providing a maximum range of 30m. Its RF data rate is 250 Kbps, higher power consumption in range related to 900 MHz, In terms of much higher data rate and smaller compact antenna is the advantage. Low power, low cost and ease to use. The other advantages of RF module is interfaced with PC via UART [9].

### B. Proposed Architecture

Figure 2, shows the architecture of proposed system.

- Sensor nodes: Every Sensor Node will have sensor inputs as data of Accelerometer and microphone.
- Base Station: Receives the message from Sensor nodes. There can be one or many Base Stations for proper coverage of the required area.

MANET is a network that contains of wireless mobile nodes enlisted as PDAs, laptop computers, and smart phones. They have wireless communication ability that ever-changing form a temporary network without using any existing network infrastructure such as wireless access points connected to a wired network. Ant like-minded mobile agents demonstrate their usefulness for solving some combinational optimization problems such as the anti-poaching watchers. Ants communicate with each other through an askance method

called stigmergy. Each ant lays down a special chemical physical entity in its surroundings that is read by other ants to determine it as having been at a given location. This features has often been made in ant-like mobile agent algorithms.

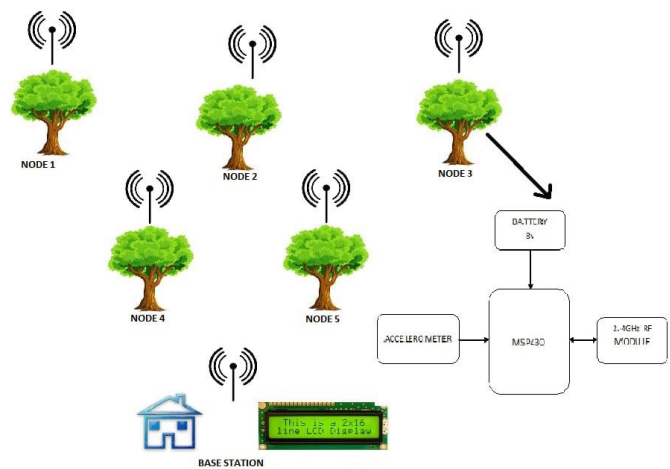


Fig. 2. Proposed Architecture

For example, Every time the ants transfer food from the source to the nest, they deposit some pheromone so that the newcomer ants can follow. When the ants deposit pheromone faster than it evaporates, the pheromone starts to collect. The additional the ants follow a given path, the more the pheromone path is conversion. The ants may gross the longer path as well as the shorter path. However, over time the shortest route will accumulate greater pheromone density and it will appeal more fellow ants. Such helpful response mechanism. Therefore, even though the ants find the shortest path later than largest one shortest path easily dominates[11].

### C. Work-Flow

The work-flow design of projected system is shown in the Figure 3. First initialize IO pins of controller like ADC and UART serial port. Here the MSP430G2553 model is used as a controller because advanced features is available like Low Supply-Voltage, Universal Serial Interface and ultra-Low Power Consumption. On the further side continuously displays the current status of cutting trees from all nodes on LCD screen. If discover the particular node where the tree is cut, the information and address of that node is immediately send to the nearest node and gives the acknowledgment to the source node also. If the acknowledgment is effectively acknowledged from that node then the address packet is send to the base station. Based on this packet information base station is easily discover the shortest path by using ANT-AODV algorithm and store the data.

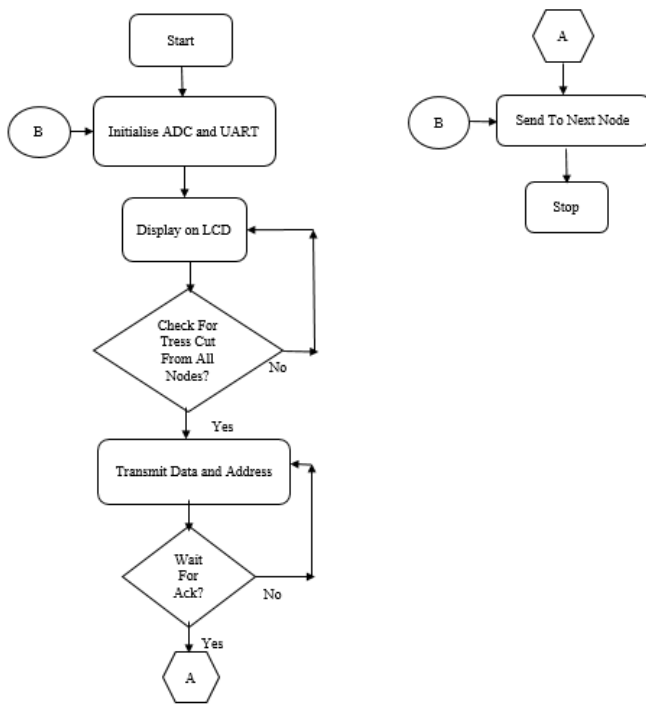
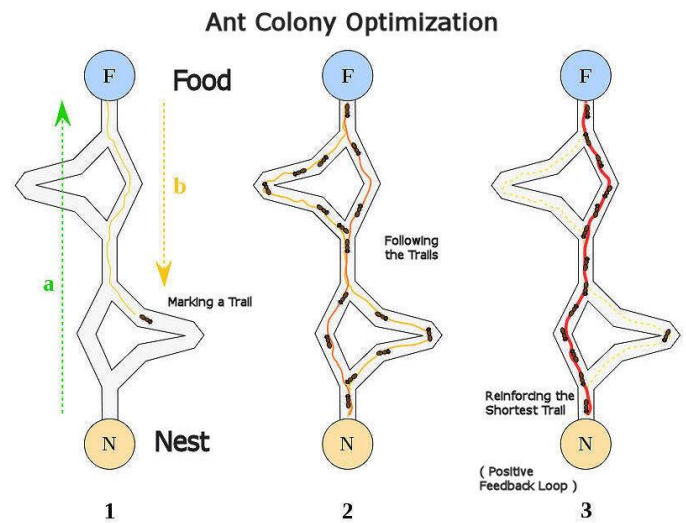


Fig.3: Work-Flow

Initialize all of the ants with a uniform pheromone level. Randomly place ants on the grid. Progress forward tracing a path by probability selecting the next node based on the relative pheromone level of surrounding node. Eliminate loops in the path traced. Retrace steps. Globally update the trail by evaporation a portion of the pheromone according to the parameter. Apply the amount of pheromone to retrace ants. Loop or exit.

Ant Colony Based Routing Algorithm (ANT-AGENTS WITH AODV) which reduces overhead, because routing tables are not interchanged among nodes. It involve of three stages namely Route Discovery phase, Route Maintenance and Route Failure Handling. The Route Discovery stage be made up of of two mobile agents that is Forward Ant (FANT) for route request and other agent is Backward Ant (BANT) for route reply to build original routes. FANT packets have exclusive order number and source address is announced by the sender and will be transitory on by the neighbors of the sender. Node getting the FANT for the first time generates a record with accesses of destination address (Source address of FANT), following hop (address of previous node), and pheromone value (number of hops the FANT needed to reach this node). The destination node cuttings evidence of FANT, extinguishes it and makes BANT which establish pheromone track to destination node. In Route Maintenance phase, DUPLICATE ERROR flag is set for duplicate packets to prevent from looping problems. It also allows for the evaporation of pheromone by decrementing factor in route table. In Route Failure Handling phase, node

deactivates the path by reducing pheromone value to 0 in corresponding route table entry and go to the Route Discovery phase for selecting path and sending packets to the destination over that path.



[http://en.wikipedia.org/wiki/Ant\\_colony\\_optimization](http://en.wikipedia.org/wiki/Ant_colony_optimization)

Fig.4: Work-Flow of ACO

**IV. RESULTS**

*A. Software Design Aspect*

Figure 5 shows Data Rate of Adxl 335 is kept at 100Hz, selecting range of + 3g. The sensor sensed by each of axis is stored of 16 bit Register for each axis. The data output of X Axis, Y Axis and Z Axis is 10 bit. The threshold value of the accelerometer for 0.1 sec. This is done to avoid any false detections by the accelerometer. If the accelerometer senses more acceleration than that, then it starts recording acceleration details on all the three axes.

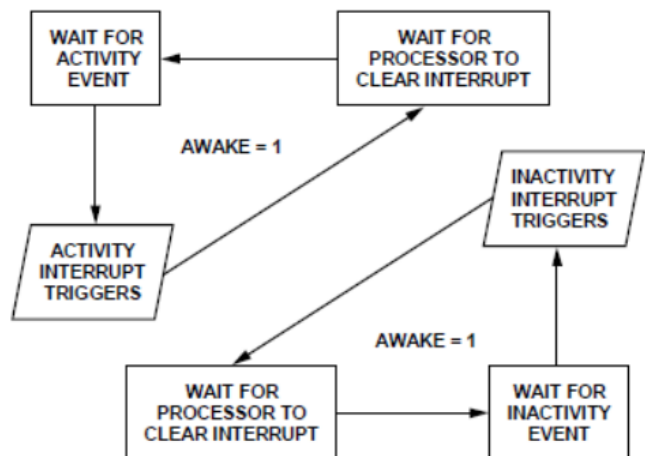


Fig.5: Flowchart Illustrating Activity and Inactivity Operation of ADXL

As soon as it observe activity, it sends data captured to a node according to a protocol it is programmed with. Hence the node detects inactivity and the node goes in sleep mode. Activity and Inactivity is kept in linked mode for proper functioning of Activity-Inactivity detection shown in figure 6 and it displayed on serial monitor.

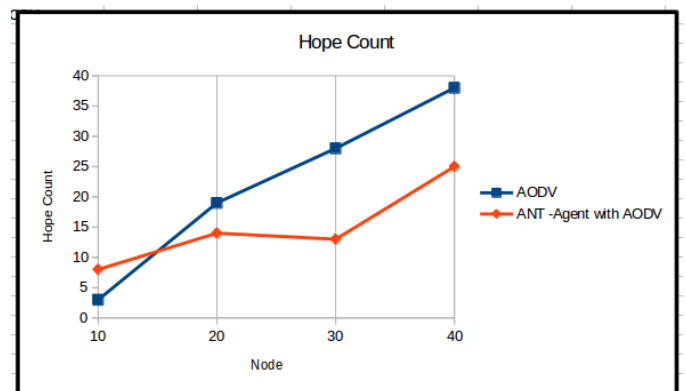
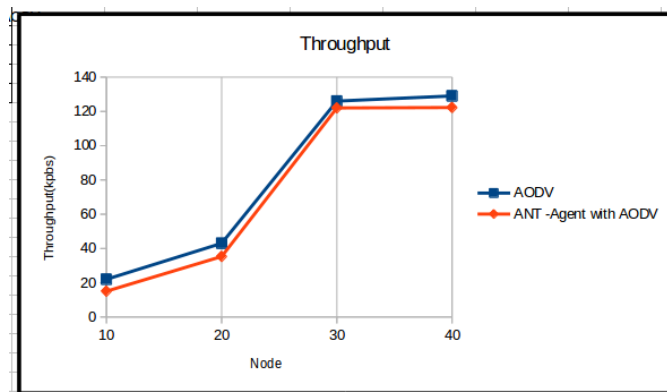
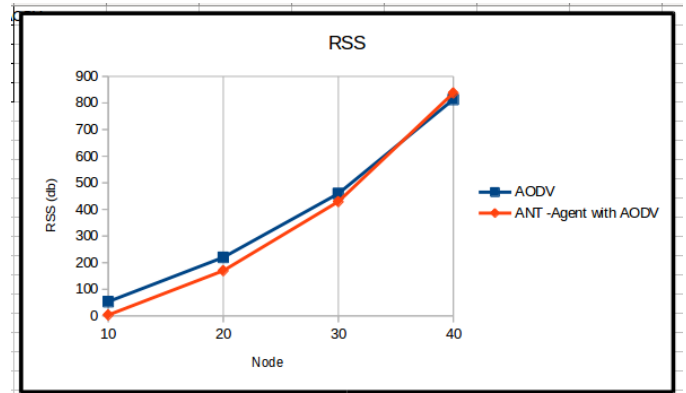
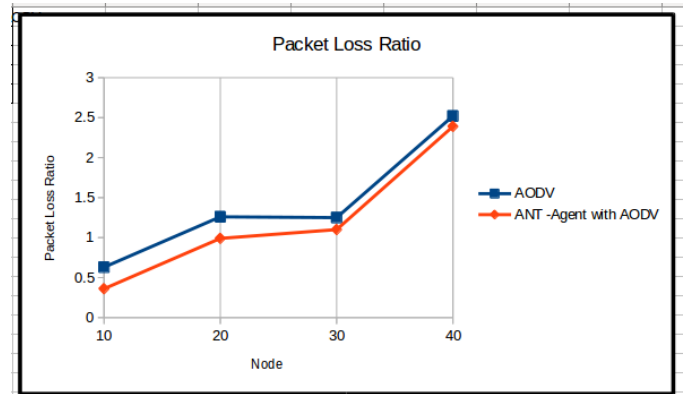
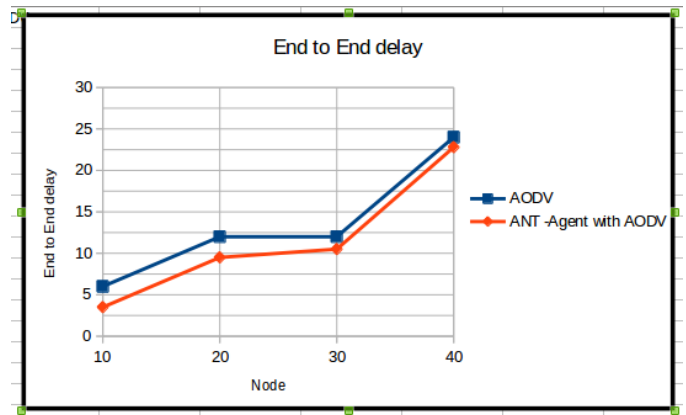
*B. Network Performance Analysis with Varying Node*

Network simulations are carried out in ns2.34 based on the specifications given in Table II. In this set of simulations. In this set of simulations, the sensor node density is varied as 10, 20, 30 and 40 nodes within a fixed terrain of size 800m x 800m, representing a forest.

TABLE II Scenario Specifications.

Parameter	value
Channel type	Wireless Channel
Network interface type	Wireless Phy
Routing protocol	AODV
Number of nodes	10,20,30,40
Traffic type	CBR
MAC type	802.11MAC Layer
Mobility Model	Random Way Point
Topological dimension	800 X 800
Rad50 IO Model	Two Ray Ground
Packet Size	50

It can be concluded from the obtained results that, number of nodes present in a given area have a major impact on network performance. As the node density is increased from 10 to 40, PDR drops approximately by 53% percent for all the node densities, while throughput drops by around 7.5kbps for all the node densities.



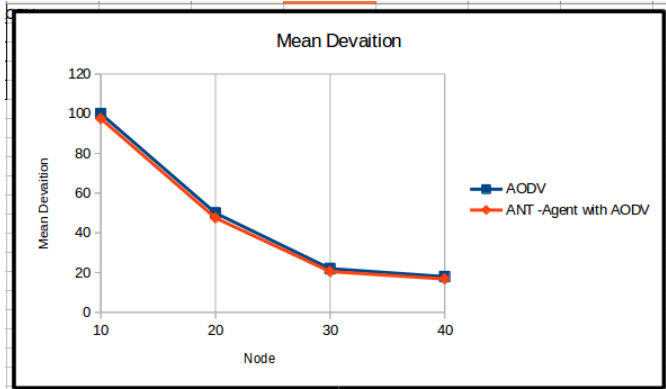
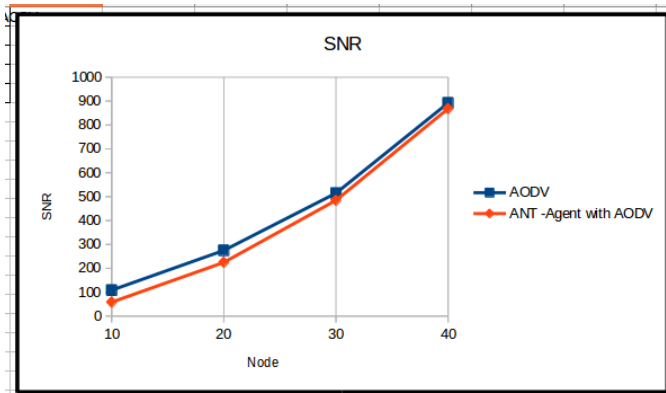


Fig. 6: Network Performance Analysis with Varying Node

C. Hardware Description

In this section experimental result and simulated results are explained. Accelerometer sensor is attached on test bench tightly; data is acquired by MSP controller & transmitted via RF module with battery supply of 5V.



Fig.7: MSP development board interfacing with ADXL & RF Module



Fig.8: MSP development board interfacing with RF Module and GSM Module

V. CONCLUSION

The author extend a least cost and RF based WSN node to identify theft/smuggling contributing to the safety of important & costly species of tree. So other sensor implementation and work on various critical aspects of system has to be done in future. This article has described the strategy and execution of a WSN for preventing trees and wildlife. Forest fires have multidimensional harmful effects in social, financial and environmental matters.

This paper presents the performance of RF based sensor network for forest monitoring, through simulations carried out using ns2.34 simulator tool. Simulations are carried out to study the effect of variation in node density and communication duration on network performance, and to study the effect of data transmission rate and node density on network performance. Network performance is measured in terms of PDR, End to End delay, Throughput (kpbs), Hop Count, SNR, RSS (db) and Mean Deviation

The future scope of work is implementation of Multi-node network and incorporation of microphone, motion detector sensor & temperature sensor to make systems more effective to acquire data such human or animal interference, fire detection etc. So author concluded that WSN is very influential and appropriate tool to be practical in this application.

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