International Journal of
Advances in Scientific Research and Engineering (ijasre)

E-ISSN : 2454-8006

DOI: http://dx.doi.org/10.7324/IJASRE.2018.32697

Volume 4, Issue 4
April - 2018

Forest Monitoring System Using Wireless Sensor Network

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ABSTRACT

Biodiversity is a multifaceted concept that often eludes simple operational definitions. As a result, a variety of definitions have been proposed each with varying levels of complexity and scope. Traditional approaches to the tracking of wild animals provide useful, yet spatially constrained information. Remote sensing offers the prospect for large area characterizations of biodiversity in a systematic, repeatable, and spatially exhaustive manner. Information and monitoring systems for the forest sector are beneficial for effective policies and planning, valuation of forest resources and proficient investments. This project presents a system for monitoring forest and its vicinity based on IoT based wireless sensor network technology. The need to be able to accurately monitor forest cover and quality is crucial to understanding the costs of deforestation. The monitoring of forest and the surrounding area can, however, still is considered an open research problem due to its substantial vast area. Even though sufficient manpower has been deployed, it is inefficient as it could be life-threatening. This project is an attempt to prevent forest mishaps, the intrusion of animals in the surrounding forest areas, illegal activities in the forest by using wireless sensor technology and eliminating manual power to the highest possible extent.

KeyWords: *Internet of Things, deployment, wireless sensor networks, Alerting, fire detection, animal tracking.*

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1. INTRODUCTION

Researches regarding animal detection have been an important field to numerous applications. Many algorithms and methods have been developed by human being in order to have a better understanding on animal behaviour. Besides, these applications also can act as a warning system to human beings from intrusion of wild animals for early precaution measures. These applications can be narrowed down to three main sections, namely detection, tracking and identification of animal. With the technology of sensor, radio frequency identification (RFID), and global positioning system (GPS), one of the applications is the development of new zoological systems for animal tracing ability, identification, and anti-theft for the management and security and monitoring of animal health in forest. This system also alerts forest mishaps such as forest fires, illegal activities such as smuggling of valuable trees and poaching of endangered species.

1.1 Existing System

In existing system, the manual power had been used for fighting with the fire. So to avoid the human damage and to reduce the manual power we are currently using the ATV system. The ATV system is inefficient many a times as it could be life threatening. Manual power is not sufficient to control large group of wild animals. This system requires manual periodic monitoring throughout the forest area. Covering the vast forest area is a challenge. Detecting the location of forest fire with this existing system can be a difficult task.

1.2 Proposed System

The proposed work combines the embedded technology with the wireless communication technology. This project deals with a health monitoring and tracking system for animals and monitoring of forest accidents. This system tracks the animal's space and

also measures the animal's physiological signal by using IoTised transmission and GPS. This paper involves the use of PIR (Passive Infra-Red Sensor) which senses the presence of animal. It controls every component of the system. The LCD monitor displays if the animal has been detected. Buzzer is used for alerting. With the help of IoTised transmission the warning message is sent to concerned forest officials. The system is divided in three sections namely, the boundary section, the animal section and server room.

1.3 Current Status Of Development (Wireless Communication Based Smoke Detection System Design For Forest Fire Monitoring)

Based on wireless communication technology, this project designs a smoke detection system out of the need for forest scheme for the key fu debugging at the platform. Based on the hardware design, the overall scheme of software system is set up, which successfully gets through the experimental debugging. For communication, the data received from the sensor nodes is collected by a router to a coordinator, and subsequently sent to the GPRS module through a serial port. Finally, the information is shown on the PC/Mobile phones through the Internet. The overall system satisfies the particular need of forest environment monitoring, and presents a good prospect of application and promotion.

2. SENSOR DEPLOYMENT

A sensor is able to transform physical or chemical readings gathered from the environment into signals that can be measured by a system. In our case we have deployed a multisensor node that is able to sense several magnitudes in the system. The use of sensors to detect and monitor various parameters has enhanced the application of new technologies in the this field. Sensors are able to consider certain dynamic and static variables. Our Wireless Sensor system can me divided into 3 sections.

2.1 Boundary Section

This section monitors the boundary of the forest. The intrusion of the animals into the village areas near the forest will be detected and avoided in this section. The Infra- Red or Passive Infra-Red sensor is used to detect the motion of animals in the forest border. The Zigbee receiver will receive the signal from the Zigbee transmitter of the animal section whenever the animal is moving towards the forest boundary. When the presence of the animal is detected near the boundary area the controller sets the alarm. This will help to warn the localites near the forest boundary areas and also to scare the animal away from the boundary areas. All these information is updated in the cloud through the Wi-Fi module (ESP8266).The block diagram of this section is as shown in Fig 1.

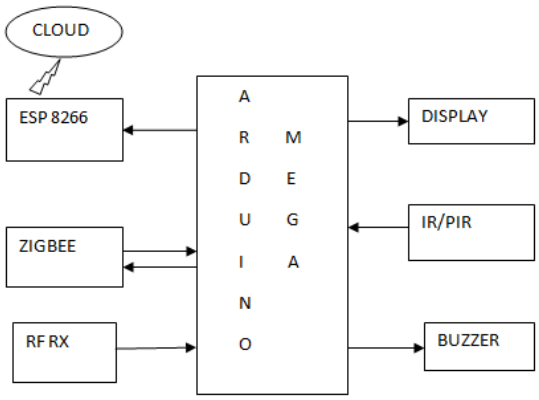

Fig 1. Block Diagram of Boundary Section

2.2 Animal Section

This section is used for detection, tracking and to monitor the health of wild animals. The temperature sensor monitors the health condition of the animal. The Zigbee transmitter transmits signal to the receiver at the boundary section if the animal is moving towards the boundary area. The GPS modem tracks the location of the animal and the location is updated to the cloud through the Wi-Fi module and this information is sent to the android device of the concerned authority. The GPS module will receive string from satellites and send to the Microcontroller. The microcontroller will extract latitude and longitude information from string and send it to the Wi-Fi module. And this will be sent to the android device in NMEA data format**.** Fig 2 explains the working of the animal section.

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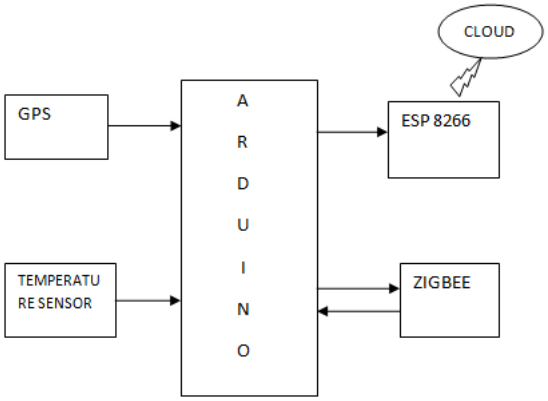

Fig 2. Block Diagram of Animal Section

2.3 Tree Section

In this section forest mishaps like forest fire and illegal smuggling of the valuable trees is monitored. The smoke sensor and the fire sensor detect the forest fire. The RF transmitter prevents smuggling of valuable trees by sending radio signals to the RF receiver at the boundary section. Thus the smuggling of trees can be monitored at the boundary section and also concerned forest authority can be informed through IoT. Fig 3 explains the functioning of tree section.

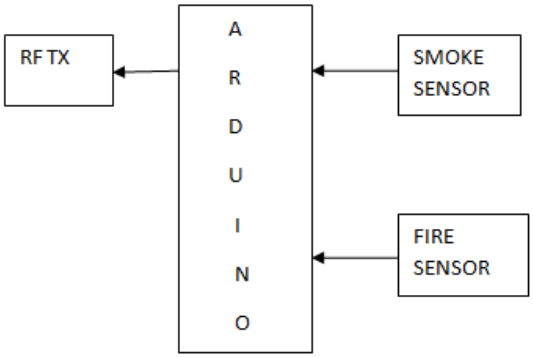

Fig 3. Block Diagram of Tree Section

3. METHODOLOGY

Our IoT system is dependent on the wireless sensor networks deployed throughout the entire forest area. The wireless communication happens over the sensor network, Wi-Fi module and a smart phone or a computer that notifies the concerned forest authority of the parameters that are tracked. This data will be updated on the cloud for future analytics such as tracking animal migration moments, the health of the animals, also their count. The working is as follows.

1. The sensor network deployed in each section will keep updating the parameter readings in the cloud through a Wi-Fi communication module.
2. Any changes with the data that can trigger to set the alarm will also be recorded and notified at the server room.
3. The concerned authorities or the local can access the data and the warning notifications of the same.
4. The data stored in the cloud can be used for analytics.

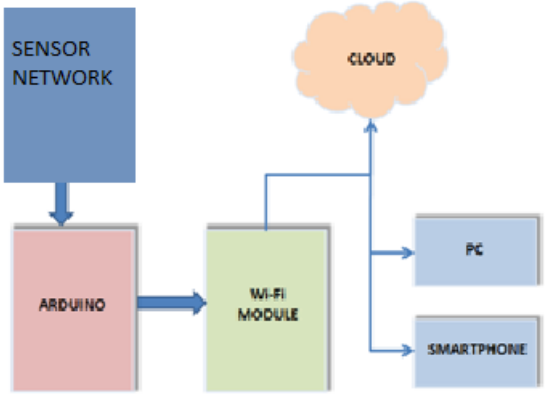

Fig 4. System Architecture

Fig 4. depicts the system architecture. Here when we talk about data it includes the live locations and well-being of animals, the fire accidents, and the count of the trees. The data used for analytics can be used for monitoring the migration moments of the animals. Fig.5. demonstrates the tracking of animal location. Accordingly the local can be warned when there are such moments. The analytics will also keep the count of endangered animals and valuable trees. Any intrusion of animals into the civilian resident area or the illegal entering of smugglers and poachers can be avoided.

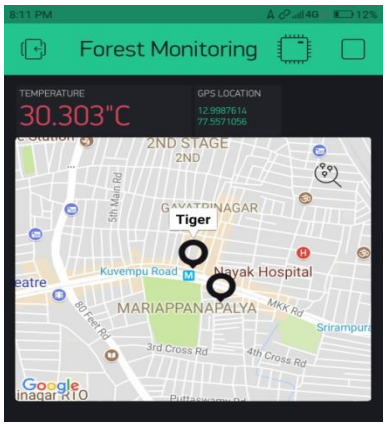

Fig 5. Tracking of animal location

4. CONCLUSION

This paper presents design, development and prototype of wireless sensor network for forest and wildlife monitoring. This prototype system comprises of two modules namely the sensor and the sink module. Here we show the deployment of multi-sensors needed to cover the forest area. In addition to alerting of forest officials during forest fire accidents and animal monitoring, this system may also be implemented in wildlife sanctuaries and zoos. It can also be implemented as pet tracking system. It mainly targets animal health monitoring, alerting the forest officials during forest fire hazards, smuggling of valuable trees and poaching of endangered species. This system is also highly beneficial in preventing trespassing of wild animals into the living areas in the forest's vicinity. It also aims on animal location and tracking applications. This paper presents a low power consuming, less complex and an economic solution to the existing problem.

ACKNOWLEDGMENT

We would like to express our special thanks of gratitude to our mentors for their kind support and guidance, which helped us to improve this paper.

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