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AN AUTOMATIC SYSTEM FOR CONTROLLING DEFORESTATION USING IOT AND GSM

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ABSTRACT

The manual monitoring of the forest to prevent unauthorized activities is practically difficult job. The four major operations that are essential in monitoring the forest are developed in this work, namely tree cutting detection, fire detection, human detection and contaminated water detection using vibration sensor, fire sensor, Passive Infrared Sensor (PIR) and PH sensor respectively. A SST89E516RD2 microcontroller is used along with GSM to communicate to central server from remote place. The sensed data from sensors is collected and sent to the authorized person via GSM. IOT is widely used technology in forest monitoring application. In addition this paper uses Wi-Fi router module through which employee and forest officer can communicate with each other in case if network is disabled.

Keywords: *Global System for Mobile communication (GSM), Passive Infrared Sensor (PIR), Fire, Vibrator, Wi-Fi router.*

I. INTRODUCTION

Forest is very important in our life; we totally depend on the forest for survival. The forest trees help us to breathe by pump outing the oxygen and absorbs carbon dioxide. The significance of wooded area can be visible inside the latest exchange inside the climatic fluctuation due to deforestation.

This paper goal is to monitor forest by preventing tree cut, fire prevention, detecting contaminated water in the forest whether it is safe for the animals are not and also detect presence of human in the forest. Set up the vibrator sensor in the area of forest in which precious trees such as sandalwood trees present. Suppose unknown people or thief trying to cut the trees, vibrator sensor vibrate, immediately send tree cut message to microcontroller that will send this information to GSM module, and it send an alerting message to the forest officer so that they can take necessary actions and location tracking system facility also provided to android application. Similarly if fire happens by high temperature or by human, fire sensor will detect that fire happened and send signal to the microcontroller and microcontroller to GSM to send alerting message of fire detection to the forest officer. The PH sensor used to detect whether the water is contaminated or not and PIR sensor is used to detect movements of humans in the forest. In addition using Wi-Fi router facility in proposed system in which suppose certain activities such as fire detection, tree cutting detection operations happens, if the employee of forest officer is unable send an alerting message to forest officer due to the network problem at that situation employee can use this concept of Wi-Fi module. In this paper set a router between sender and receiver so that they can communicate with each other by calling, sending text message, sending photo and video streaming. Application of environmental data from real time forest monitoring used the total of 180 samples consist of temperature, humidity and hydrogen gas taken and analysed. GPS used to detect the location on of system within forest to monitor environmental data [1]. Wireless sensor network used for forest fire monitoring and provided the efficient approach to sensor node for continued monitoring of forest [2]. The protection of forest trees such as sandal wood tree used the microcontroller system that employees the wireless sensor network technology and ZigBee to communicate to central server from remote place

Forest fire monitoring and faulty nodes detected using wireless sensor network [4]. The number of forest trees has reduced from forest by humans that creates unhealthy environment for animals to survive in forest used technology GATA [5]. The framework for forest monitoring requires three parts such as sensor deployment scheme, network architecture and intra-cluster communication protocol [6]. Forest fire monitoring system using wireless sensor network used novel energy-efficient routing protocol that is maximize unsafe path (MUP) and used IPV6 over low

power wireless personal area networks protocol [7]. Forest fire monitoring controlled using Wireless sensor network consist of ZigBee used as communication protocol [8]. To prevent illegal logging of forest trees PIC controller, ZigBee transmitter and IEEE 802.15.4 standard protocol used which defines physical and mac layer [9]. Automatic selection of trees in real time mode in the process of selective cutting in which full automation of operator's functions is made on the basis of operator's action analysis and revealing stages during which maximum time is taken, maximum errors are made due to human operator's fault. The fuzzy logic used to develop a method for selection of trees in the process of harvesting [10].

The work reported in above survey describes that most of the problems are solved using ZigBee transmitter and wireless network technology. But the work reported in this paper is use of Wi-Fi router between sender and receiver that is how two devices can communicate if network is disabled to alert about fire, tree cutting in the forest. This concept is developed using IOT technology. This application is helpful for communication between forest officer and employee of forest. IOT is a system in which network of physical devices embedded with sensors, actuators and connectivity that allows the objects to connect and exchange data. IOT plays important role in monitoring forest to send alerting signal.

II. SYSTEM DESIGN

Hardware design of system provides detail description of forest monitoring system which is based on IOT technology. Hardware design is representation of system, which provides the detail description about components. The forest monitoring system mainly contains the components such as SST89E516RD2 Microcontroller, PIR Sensor, PH Sensor, Vibrator Sensor and Fire Sensor.

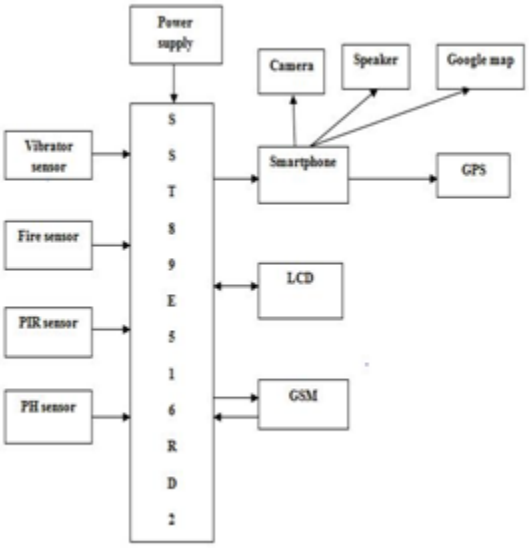

Fig.1. Block diagram of forest monitoring module

In Fig1 the block diagram consists of microcontroller used to process the data and output of microcontroller is in two forms, an alert message is displayed on Liquid Crystal Display (LCD) and at the same time alert message is sent to the forest officer about illegal activities such as tree cutting, fire using GSM module who is away from the forest.

GSM is used to transfer alerting message to forest officer and Liquid Crystal Display (LCD) used to display the alerting messages. The microcontroller is equipped with GSM to send alerting message to registered phone and the microcontroller can control the all activities of sensor nodes.

Following section deals with working of microcontroller, PIR sensor, vibrator sensor, fire sensor, PH sensor.

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A. SST89E516RD2 Microcontroller

It is an 8-bit microcontroller product synthetic with SST patented and proprietary notable flash CMOS semiconductor manner generation.

Fig.2. SST89E516RD2 Microcontroller

Fig2 shows snapshot of microcontroller and it supports external address range up to 64kbyte of program and data memory. It uses 8051 instruction set and it is compatible with standard 8051 microcontroller devices for pin to pin configuration. A microcontroller plays an important role to get the data from sensor and send this information to the android application to alert forest officer about fire or illegal activities such as tree cutting in the forest.

B. Passive Infrared Sensor (PIR Sensor)

Fig.3. PIR Sensor

A passive infrared sensor is an electronic sensor that measures the infrared (IR) light radiating from objects. It is used to sense the movements of people or animals or other objects in the forest. When an object such as human passes nearer to this motion detector it will detect and send a signal to microcontroller that will send to LCD (Liquid Crystal Display) simultaneously send the message to Smartphone of forest officer. Fig3 shows snapshot of PIR sensor.

C. Vibrator Sensor

The Fig4 shows snapshot of vibrator sensor and is useful in different fields and it has ability to detect vibration in the given area. This is used to alert someone to trouble with system for example if someone is trying to cut tree the vibrator will detect and send alert message to forest officer.

Fig.4.Vibrator Sensor

When vibrator sensor alarm recognizes movement or vibration, it sends signal to control panel developed a new type of omini-directional high sensitivity security vibration detector with omini- directional detection.

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D. Fire Sensor

The fire sensor is used to gather all of the techniques and processes that contribute to early detection of a fire. In this system fire sensor is used to detect the fire in the forest in order to minimize biological loss of environment and to save wild lives in the forest.

Fig.5. Fire Sensor

E. PH Sensor

The PH sensor is mainly used to measure the water quality, aquatic organisms. This paper aims to monitor the PH of a water body because it affects, determine whether the water is contaminated or not. An alteration in normal PH in water will be the indication of increased pollution.

III. MODULE DESCRIPTION

The proposed system is divided into two modules.

A. Forest monitoring module

The forest monitoring module mainly consist of components such as microcontroller which acts as main controller and GSM, LCD, fire sensor, PIR sensor, PH sensor are connected to it. The GSM plays an important role in forest monitoring module by sending alert messages to forest officer.

Suppose if fire happens in the forest, fire sensor detect that fire happened send this data to microcontroller. The microcontroller processes the data and transmits this data to GSM. And it will send alert message to forest officer to take necessary action. The forest officer can also track the location of fire by using GPS.

B. Wi-Fi router module

Wi-Fi is a technology through which two devices can exchange data in case of network is disabled in the range of radio frequency 3 GHz and 30 GHz. As shown in Fig6 Wi-Fi router module is use between two devices through the wireless network access point.

Fig.6. Block diagram of Wi-Fi router module

In this proposed paper concept used is how forest employee and forest officer can communicate with each other through a router in case network is disabled, if some illegal activities such as tree cutting and fire happens in the forest. First sender (employee) has to register the IP address of router, now employee (sender) can send photo of incident place, can do video streaming, can call and can do the text message to forest officer (receiver).

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IV. DATA FLOW DIAGRAM

Data flow diagram will give the brief idea about proposed system. Initially when power supply given to the microcontroller it will reset and display the welcome message on the liquid crystal display.

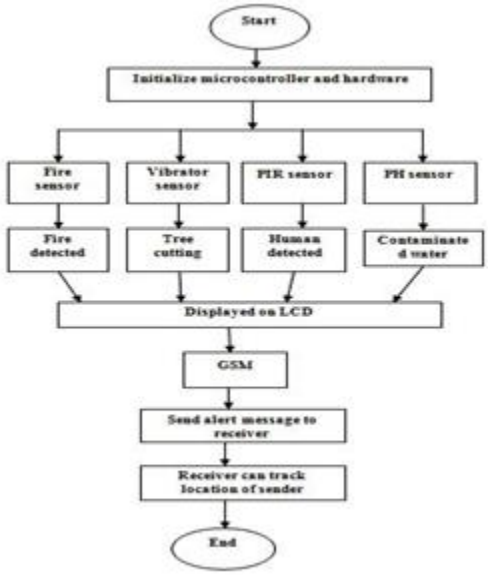

Fig.7. Data flow diagram of forest monitoring system

Suppose fire happens in forest by nature or humans automatically fire sensor will detect that fire happened and send this information to microcontroller which process the data and send it to GSM. And GSM send alerting message to forest officer. The forest officer can track location of place where fire happened.

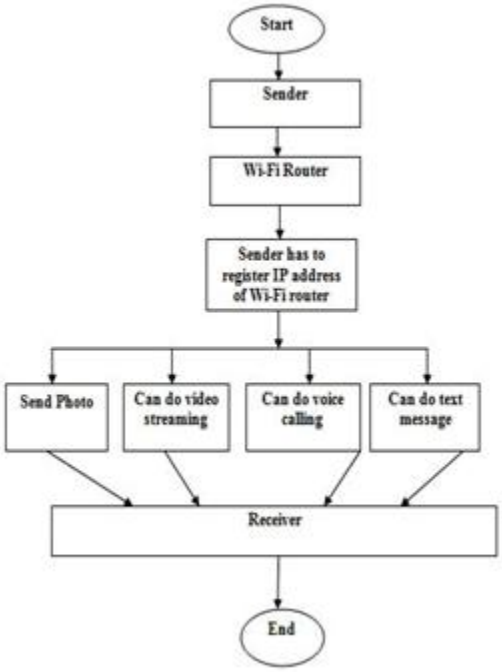

Fig.8. Data flow diagram of communication between sender and receiver via Wi-Fi router

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The Fig8 shows the dataflow diagram of communication between sender and receiver in which Wi-Fi router is used as intermediary. First the sender (employee) need to register the IP address of Wi-Fi router and sender can now send the photo, can do video streaming, voice call and text message to the receiver (forest officer).

V. EXPERIMENTAL RESULTS AND DISCUSSIONS

The Fig 9 shows the microcontroller interfaced with sensors and GSM in which that has been developed by researchers to detect the location of fire in the forest, tree cutting and presence of human for illegal logging of forest resources.

Fig.9. SST89E516RD2 Microcontroller interfaced with sensors and GSM module.

Suppose fire happens that information send to microcontroller and it send this data to GSM to send an alerting message to forest officer. Similarly tree cutting prevention, human detection and detection of contaminated water alerting messages are send to forest officer.

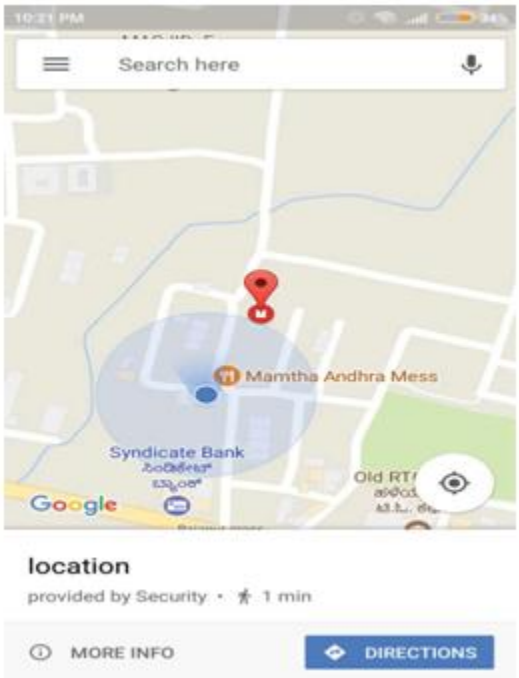

Fig.10. GPS location tracking for illegal activities in forest

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Suppose thief is trying to cut tree, vibrator sensor vibrate and microcontroller process data and send signal to GSM to send alert message to forest officer. The forest officer can track location of tree cutting by using GPS.

Fig.11. Multimedia data transfer using Wi-Fi router

The Fig11 shows the multimedia data transfer using Wi-Fi router at sender (employee). The sender and receiver first need to connect to Wi-Fi router through which they can send photo of illegal activities. And can do video streaming, voice message and text message respectively.

Fig.12. Text message between employee and forest officer using Wi-Fi router

The Fig12 shows the Wi-Fi router between employee and forest officer in which both can communicate if network is disabled. This concept is useful for forest monitoring for early detection of illegal activities in the forest so that employee can call, send photo, can do video streaming and can also do the text messages to forest officer. In fig12 both sender and receiver can communicate with each other by sending and receiving text messages.

TABLE1: Comparison between proposed system and existing system

s.no	Proposed System	Existing System
1	It provides multiple objectives to monitor forest through the single application.	It provides single objective to monitor forest through the single application.
2	Cost is low compare to existing system.	Cost is high compare to proposed system.
3	SST89E516RD2 microcontroller is used which supports 64kbyte of program and data memory.	Arduino Uno microcontroller is used in existing system.
4	GSM is used which provides wide range communication.	ZigBee used which provides low range communication.
5	Keil c and android technology is used.	Android technology is used.
6	Wi-Fi router is used between sender and receiver in case network is disabled.	Wi-Fi router is not used between sender and receiver.

The forest area is a very huge area so it requires more sensors for forest land. This paper plans to place sensor in particular area of forest and the cost is depends on sensor nodes used in the forest monitoring operation. In future this paper will work on how to provide fault tolerance mechanism so that the components may not damage.

VI. CONCLUSION

The objective of proposed system is to control deforestation by attempting to detect four illegal activities using IOT technology compared to past research and observed good results for all types of detection carried out in this paper. The proposed system presents another novel idea by introducing Wi-Fi router between employee and forest officer. This Wi-Fi router provides communication between employee and forest officer in case network is disabled.

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