

# Anti-Smuggling System for Trees in Forest Using Flex Sensor and Zigbee

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**Abstract:** Many days we are reading in the newspapers about smuggling of the trees like sandal, “Sagwan” etc. These trees are very costly as well as less available in the world. These are use in the medical sciences as well as cosmetics. Because of huge amount of money involved in selling of such tree woods lots of incidents are happening of cutting of trees and their smuggling. To restrict such smuggling and to save the forests around the globe some preventive measures need to be deployed. We are developing such a system which can be used to restrict this smuggling. Our life is dependent upon trees. There is a long association of man and trees. Since the hoary past man and trees have been the two major creations of Nature. In his prehistoric days man turned to trees and plants to collect the things vitally necessary for his existence.

**Keywords:** Flex sensor, Zigbee module, GSM Module, GPS, Visual basic.

## 1. Introduction

We are developing such a system which can be used to restrict this smuggling. 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 A SMART automated unit has been thus devised to tackle these issues. The Combination of Latest Wireless communication systems and Embedded solutions offer us such modules. The Module is intended to operate in a particular area and this Module will consist of two Units:

1. Tree Unit
2. Main Server Unit (base station).

Each Tree should have one little Embedded System-Unit with: Renesas Microcontroller, Sensors, GPRS and Solar power.

## 2. Literature survey

1. 200 teak trees cut, timber smuggled LUCKNOW [1].
2. Endangered red sandalwood seized from smugglers in Berhampur [2].
3. The town of Suifenhe in China is home to a timber factory that processes more than 5 billion pounds of wood per year,

most of which comes from Russia by smuggling [3].

4. Punjab news line network on Saturday, 18 December 2010.
5. The situation has gone quite worse as timber, worth lakhs and lakhs of rupees is being illegally sold right under the nose of the concerned department.
6. The Times of India, Ahmedabad. Plan to curb inter-state smuggling of forest woods.

## 3. Proposed system

Sensor which fitted on tree is tree unit, Control room consisting the sub server unit and finally in city where we are living is main server unit with our personal computer. The signal Propagation through various units as shown in Fig. 1.



Fig. 1. Functional block diagram

## 4. Methods

The suggested system will consist of three different modules as follows, Bock diagram of various unit as shown in Fig. 2.

### A. Tree Unit

In big forest, each tree will be having sensor unit which is fitted on stem of tree will communicate with their sub server unit. The communication between tree unit and sub server unit take place by using zigbee module. The bending motion detected by the Flex sensor will allow the microcontroller to transmit the signal to the sub server via Zigbee module.

1. *Micro Controller AT 89C51:* The most effective criteria for choosing AT89C51 as controller is application area of the

project, in our project the function of a controller is limited, which is Serially communicate with zigbee module and PC.

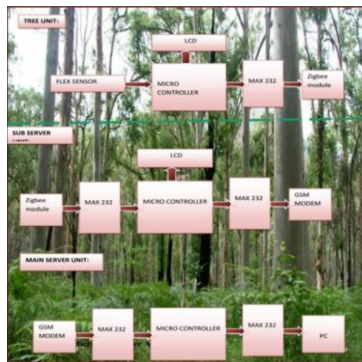


Fig. 2. Block diagram

2. *Flex Sensor*: A simple flex sensor 4.5" in length. Fig. 3, indicate the flex sensor. As the sensor is flexed, the resistance across the sensor increases. The resistance of the flex sensor changes when the metal pads are on the outside of the bend.



Fig. 3. Flex sensor bending movement we are able to increase the length of sensor as per our requirement

- a) Angle Displacement Measurement
- b) Bends and Flexes physically with motion device
- c) Simple Construction
- d) Possible Uses
  - Robotics
  - Gaming (Virtual Motion)
  - Medical Devices
  - Computer Peripherals

- Musical Instruments
- Physical Therapy
- e) Electrical Specifications
  1. Flat Resistance: 10K Ohms
  2. Resistance Tolerance:  $\pm 30\%$
  3. Bend Resistance Range: 60K to 110K Ohms
  4. Power Rating: 0.50 Watts continuous. 1 Watt Peak.

3. *Zigbee Module*: The Zigbee standard uses small very low-power devices to connect together to form a wireless control web as shown in Fig 5. A Zigbee network is capable of supporting up to 254 client nodes plus one full functional device (master). Zigbee supports 2.4 GHz (worldwide), 868 MHz (Europe) and 915 MHz (America) unlicensed radio bands with range up to 75 meters. Zigbee is the set of specs built around the IEEE 802.15.4 Because Zigbee can activate (go from sleep to active mode) in 15 msec or less, the latency can be very low and devices can be very responsive — particularly compared to Bluetooth wake-up delays, which are typically around three seconds [5]. Because ZigBee can sleep most of the time, average power consumption can be very low, resulting in long battery life. The Zigbee module is used in this project for wireless data transmission and reception between the attendance unit and server unit up to a distance of 50m as per our requirement we are able to increase the rang of zigbee. Fig. 4. Shows the Zigbee module used in our Project.

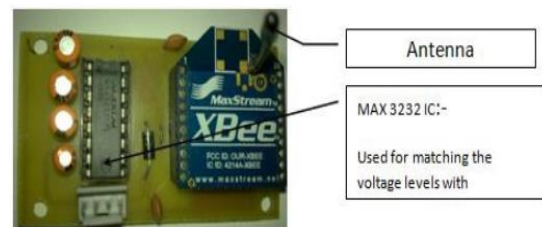


Fig. 4. Zigbee module

Zigbee module specifications and features of the zigbee module used in our project are as mentioned below,

- a) RF Data Rate - 250 Kbps.
- b) Range up to - 50m.
- c) Serial Data Rate 1200 bps-1 Mbps.
- d) Frequency Band - 2.4 GHz.
- e) Serial Data Interface - 3.3V CMOS UART.
- f) Supply Voltage - 2.1 - 3.6VDC.
- g) Industrial temperature rating (-40°C to 85°C)

The ZiBee RF Modules were engineered to meet IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between devices.

**B. Area unit**

The sub sever unit will collect the data from all tree unit

through Zigbee module and such all sub server unit will transmit data to the main server unit through GSM modem.

1) *GSM-Modem*

G-2403R delivers all the power of instant wireless connectivity to your multiple applications. Because the modem is fully type approved, it can dramatically speed up the time to market with SMS features. Housed in a rugged aluminum extrusion casing with good aesthetics and surface finish to withstand toughest field environments. The open interfaces and AT commands can embed and run your applications very efficiently.



Fig. 5. GSM module

With its proven technology, the modem can be relied on for enduring and dependable performance. This GSM modem is a highly flexible plug and play GSM 900 / GSM 1800 / GSM 1900 modem for direct and easy integration RS232, voltage range for the power supply and audio interface make this device perfect solution for system integrators and single user [10].

Voice, Data/Fax, SMS, DTMF, GPRS, integrated TCP/IP stack and other features like the GSM / GPRS modules on this homepage. AT Commands (Entering a set command). The standard format for entering a set command is [11]. AT<command>=<parameters> <CR> Where: AT Notifies the Infrared Modem that a command is being entered. <Command> The name of the command being entered. <Parameters> The values to be used by the command. <CR> All command lines are terminated by pressing the <CR> (Return or Enter) key.

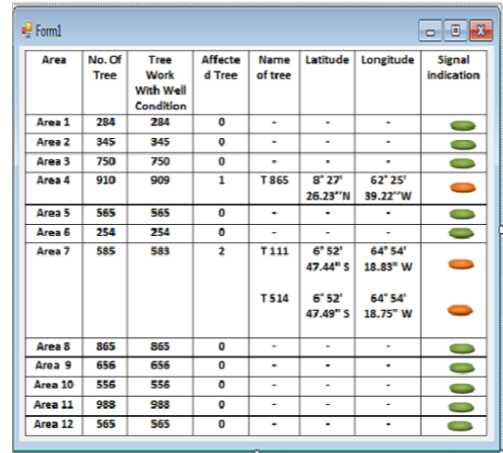
2) *CMGF Message format*

The AT command +CMGF (command name in text: Message Format) is used to select the operating mode of the GSM/GPRS modem or mobile phone. It takes one parameter. The value of the parameter can either be 0 or 1. The values 0 and 1 refer to SMS PDU mode and SMS text mode respectively. SMS PDU mode is the default mode if it is implemented on the mobile device. Description: In forms the TA which input and output format of messages to use. Set command: +CMGF=<mode> Options: <mode> 0 PDU mode.

Example: AT+CMGF=0 Select PDU mode. OK Read command: +CMGF? Example: AT+CMGF? +CMGF: 0 PDU mode. OK Test command: +CMGF=? Example: AT+CMGF=? +CMGF: (0) Only PDU mode available. OK.

3) *Main Server Unit*

The server will be having Microsoft Visual Basic which will open the Google maps in background and show the location of smuggling and it also gives the information in tabular format with overall analysis of tree as shown in Fig 6. It provides location latitude and longitude by using GPS [12] module when used advance technique.



Area	No. Of Tree	Tree Work With Well Condition	Affected Tree	Name of tree	Latitude	Longitude	Signal Indication
Area 1	284	284	0	-	-	-	Green
Area 2	345	345	0	-	-	-	Green
Area 3	750	750	0	-	-	-	Green
Area 4	910	909	1	T 865	8° 27' 26.23" N	62° 25' 39.22" W	Orange
Area 5	565	565	0	-	-	-	Green
Area 6	254	254	0	-	-	-	Green
Area 7	585	583	2	T 111 T 514	6° 52' 47.44" S 6° 52' 47.49" S	64° 54' 18.83" W 64° 54' 18.75" W	Orange
Area 8	865	865	0	-	-	-	Green
Area 9	656	656	0	-	-	-	Green
Area 10	556	556	0	-	-	-	Green
Area 11	988	988	0	-	-	-	Green
Area 12	565	565	0	-	-	-	Green

Fig. 6. Visual basic output window

With the help of GSM modem whenever any tree will get cut down then we get the sms on our registered mobile as shown in fig. 7.

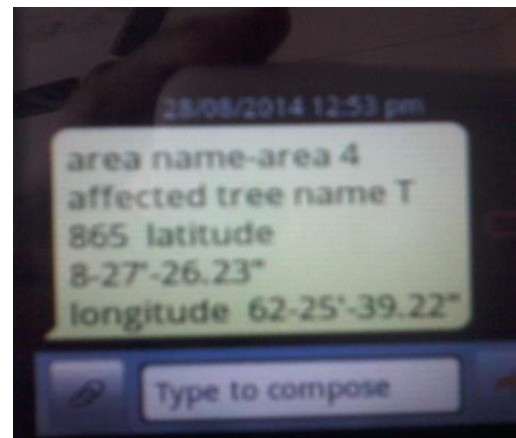


Fig. 7. Message format through the GSM modem on mobile phone

After getting sms on registered mobile phone which contains information regarding Area name, Tree Name, Longitude and Latitude of the tree location from this information we are able to track location and restrict the smuggling.

**5. Conclusion**

In this way we are developing the system which able to restrict the smuggling of tree in forest where the human being not able to provide security. Such system we are developing in the forest where the tree are costly and their protection is important fact. In this area we are provide such kind of system.

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