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Preventive system for forests property using wireless communication

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***Abstract*—Past decades onwards the forest property (sandalwood and teak trees) is victimizes within the kind of exporting. The objective of this paper is to prevent the exporting of forest property unauthorized and protect the nature. For the implementation pf this system PIR sensor, FSR sensor and Flex sensors network is required. These sensors are used to detect the signal where the unauthorized cuttings are takes place and this detected signal information carries through wireless communication to the concerned forest authorities to take preventive action.**

Keywords—PIR sensor, FSR sensor, Flex sensor, wireless communication.

I. INTRODUCTION

From couple of decades on wards by observing in newspapers regarding to smuggling of trees in the forests. But what are the causes behind this smuggling, the main cause is trees are mostly useful in the medical sciences as well as cosmetics. Based on this usage vast quantity of currency is concerned in deal of such tree woods. So unofficially cutting of these trees and exporting to other countries. For example, in India, forest authority declared prices of 12000 to 13000 per kilogram for Santalum album but same trees are in international market demanded a high worth. The Indian Santalum album has become high worth in recent years, based on this an Indian government is trying to limit the exportation of sandalwood. Even though the government taking more actions on cutting of trees, but these situations are occurred in frequently and related articles are showed in newspapers. These kinds of things are happening not only in India but also in China, Australia and African countries for various trees [1].

The problem what ascertained is there's no system or any medium to observe the felonious work related to cutting of trees. A mean by that, at your geographic point, you'll understand what happening in forest. Such type of system can accommodate you to provide information with a warning signal by that authority will be able to take necessary actions.

II. PROPOSED SYSTEM

The proposed system mainly having sensor network at transmitting section and the information which is related to the sensors are transmitted through wireless communication using Xbee to the receiver section. The below fig 1 gives the general idea of proposed system

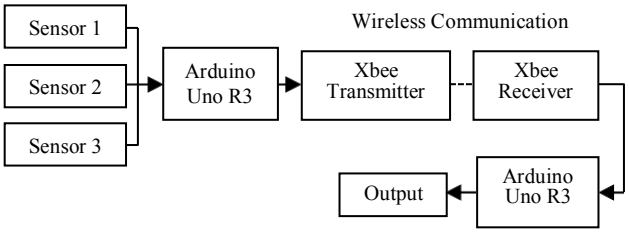

Fig 1. Block diagram of proposed system

A. Transmitting Section

The proposed system is mainly established with three types of sensors such as force sensitive resistor (FSR), passive infrared (PIR) and flex sensors at transmitting end. These three sensors are arranged on different places of same tree or on nearest tree. Among three sensors two sensors are giving the output in the form of resistance variation but this variation is not accepted by the Arduino. So the signal conditioner is required to converts the resistance variation in to voltage and sends it to Arduino. The Arduino converts these values into digital values which are used in writing conditions for the program. In this way easily customize the requirements of this paper. The transmitting section of the module is exhibited in the fig 2.

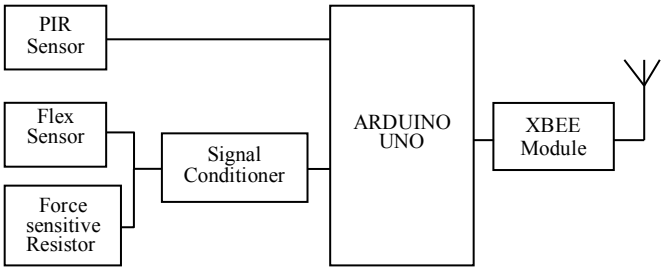

Fig 2. Transmitting section

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1) PIR sensor module

Human being body produces an IR radiation and this radiation is invisible to human being but this can be sensed by PIR sensor. These PIR sensors are mainly constructed by the material called pyroelectric and these materials having the property of low level IR radiation detection. Based on this principle of detecting, if any person is moving in the area of PIR sensor region then immediately sensed by the PIR sensor and producing the related output signal to the Arduino [2].This arrangement is viewed in the below fig 3.

Fig 3. Physical view of PIR

When an IR radiation emitted from the objects like human or animal passes in the region of PIR Sensor, it initial intercepts one 1/2 the PIR device, that causes a positive differential modification between the 2 halves. When the warm body leaves the sensing area, the reverse happens, where by the sensor generates a negative differential change pulses are what detected [8].The below fig 4 describes principle operation of PIR detection.

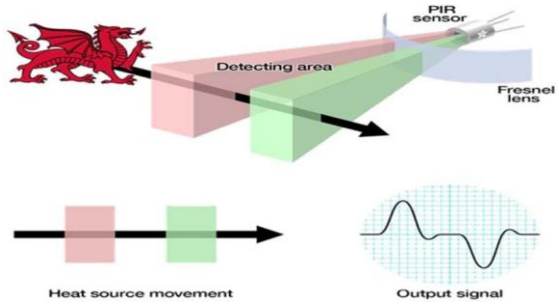

Fig 4. Working principle diagram of PIR

2) Force sensitive resistor

This sensor is manufactured form a polycarbonate material and the property of the material is changing its resistance by applying force. The output is mainly dependent on the area of the sensor's surface to which force is applied [3]. Same operation can do by using strain gauge also but by the FSR gives some advantages such as the output is wider swing and low cost [10].

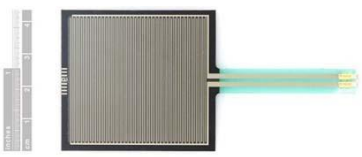

Fig 5. Basic FSR

Mainly the FSR consists of 2 membranes that are separated by a skinny air gap. This air gap is maintained by a spacer round the edges and by the rigidity of the 2 membranes. Among the two membranes one membrane has two sets of inter digitized fingers that are electrically distinct, with each set connecting to one trace on a tail. The other membrane is coated with FSR ink. When force is applied then the FSR ink shorts the two traces together then change in resistance occurred [11].The inside surface of one substrate is coated with FSR carbon-based ink. Figure 6 shows FSR ink under a microscope observation. The FSR sensor output resistance between the conducting fingers is always inversely proportional to the applied force. If low force applied, then maximum change in resistance is occurred at FSR output and vice versa [3].

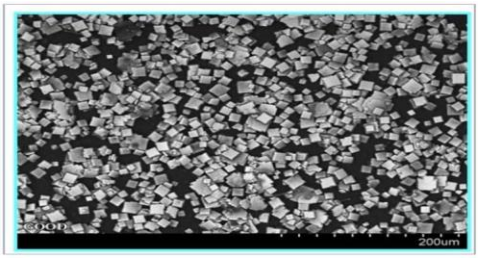

Fig 6. FSR ink micrograph

3) Flex sensor

Flex sensors are mainly constructed by Copper foil laminate and based on the principle of bending If the flex sensor is more bending then the output resistance also more that means bending and resistance both are directly proportional to each other. In this paper bi directional flex sensor is used for the experimental set up that change its resistance in proportion to the bent in either direction [4].

Fig 7. Bidirectional Flex Sensor

4) Arduino

Arduino is code computer file part and package (both hardware and software) of electronic platform, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects which can sense and managed objects within the physical world [5].

5) XBee

XBee is coming under the family of wireless module and it is supported by IEEE 802.15.4-2003 commonplace designed for point-to-point and star communications at over-the-air baud rate of250 kbit/s. This technology permits for devices to speak with each other with terribly low power consumption, permitting the devices to run on easy batteries for many years. XBee is suitable for low rate data communication that means which is good for sensors output data transmission. It's a secure

network technology the rides on prime of the recently legal IEEE802.15.wirelessstandard.[6]

B. Receiving section

The receiving section mainly consists of XBee, Arduino and output devices like LEDs, Buzzer etc. Receiving section is incorporated wherever the authority person's area is present and monitor. The XBee module receives the transmitted information and given to Arduino. This Arduino can perform the information related resultant data to the output devices. Receiver section is always located at monitoring room. The receiving section module is shown in Fig 8.

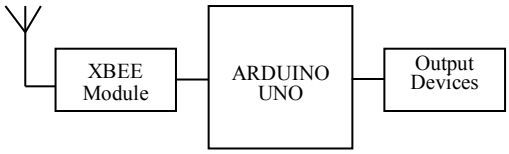

Fig 8. Receiving section.

1) Flow Chart

Initially three sensors are incorporated on single tree or individually on three trees those are nearer to each other where the bunch of trees presents in a forest. If anybody starts to cut the trees PIR sensor gives the output and immediately force is applied on tree then force sensor and flex sensors are producing the signal to the Arduino through required signal conditioning circuits. Arduino converting these sensors output voltage levels in to required digital values from 0-1023.These voltage levels are beyond the thresh hold values that information is transmitted to receiver through XBee. If any two sensors output is high then LEDS starts glow and buzzer is started to ringing in monitoring room where the authority people are present. The below flow chart fig 9 describes the entire operation process of proposed system.

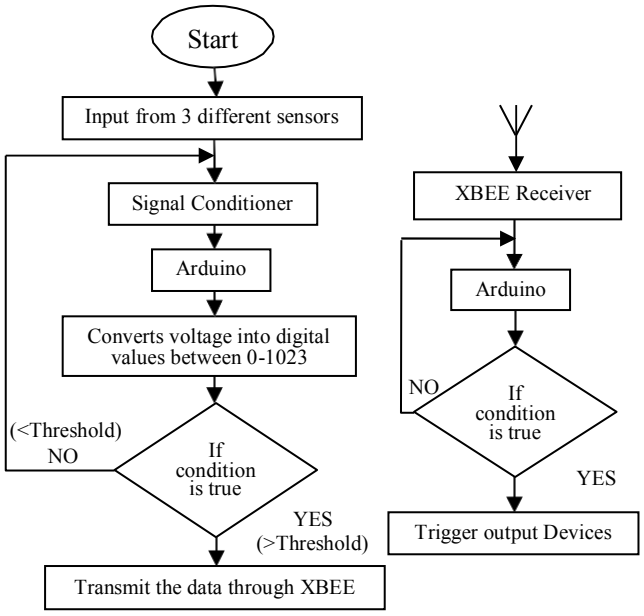

Fig 9. Operation process of proposed system

III. HARDWARE AND SOFTWARE IMPLEMENTATION

A. Interfacing flex sensor with arduino

The below fig 10 shows the arrangement of potential divider circuit with flex sensor and external resistor (this value is depending on flex sensor output resistance) is fixed. If the flex sensor is bending, then the output change in resistance and the value of external resistor is producing output in the form of voltage. This change in output voltage is always varying in between 0-5V only this is done by the potential divider arrangement and this analog signal is applied to Arduino

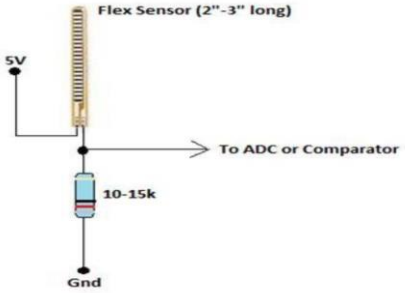

Fig 10. Voltage Divider Configuration of Flex Sensor

When the flex sensor is in its normal position the value in the serial monitor is shows 0 and when the change in resistance of the flex sensor occurred the value shows in serial monitor is 5V.These values are calibrated to Arduino values of 0-1023.As we bend the sensor the value increases up to 100 as shown in fig 11. We use these values for writing the conditions for our paper.

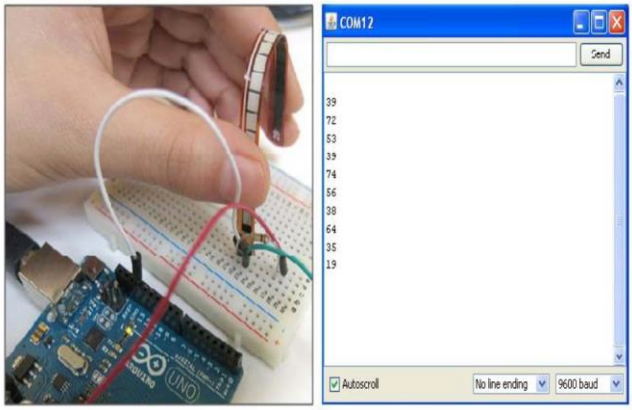

Fig 11. Output of Flex Sensor Interfaced with Arduino

B. Interfacing of force sensitive resistor with arduino

The easiest manner of measuring a force sensitive resistive sensor one terminal is connected to the power and other terminal is connected to the pull- down resistor to ground. The variation of resistance depending on the force or pressure applied on FSR output is collected across where the FSR and pull down resistor is connected to each other. This output is directly connected to the Arduino[15].the below fig 12 describes the interfacing of FSR.

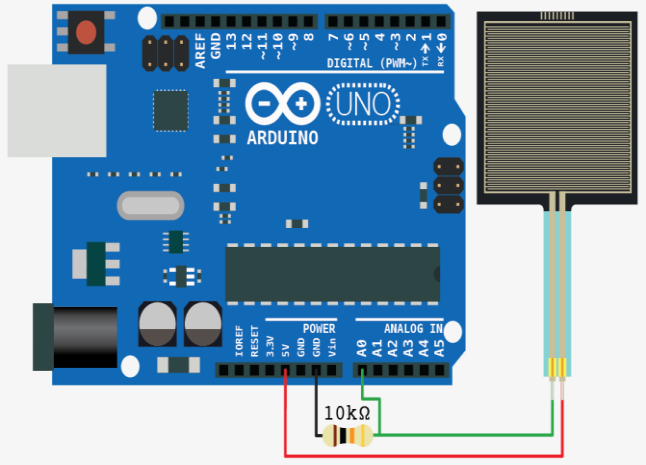

Fig 12. Arduino Interfacing with FSR Sensor

The FSR is in normal position then the serial monitor shown the value as 0 and force is applied on then the relative changes are occurred in serial monitor

C. Interfacing pir sensor with arduino

The below fig 13 describes the cnnectional arrangement of motion sensor with Arduino.PIR sensor Vcc and ground are connected to Arduino 5V and GND pins and output signal of sensor is connected to digital pin.[15].

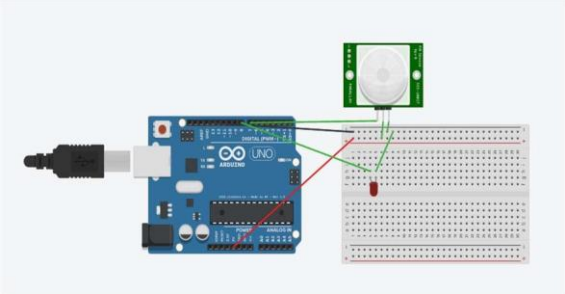

Fig 13. Arduino Interfacing with PIR Sensor

Any motion is takes place in the region of PIR sensor immediately changing its output value from 0 to 1.

IV RESULTS

The below table 1 describes someone is moving into the area of bunch trees located within the forest, then the PIR sensor produces an output signal and if they are beginning to cut trees immediately FSR and Flex sensors are also producing the output signal. By these output signals the information is conveyed to the authorized persons through wireless communication. Sometimes animals were moving in this region at that time PIR only gives an output signal, but in the program any two sensor output is coming then it is transferring the data otherwise it will not send the data. By this proposed system, authorized persons can easily identify the location where the cutting of trees going on in the forest and easily takes them into custody.

TABLE 1. SENSORS INPUT AND OUTPUT VARIATIONS

Input			Output	
PIR sensor	***FSR sensor***	***Flex Sensor***	***LED***	***Buzzer***
0	0	0	OFF	OFF
0	0	1	OFF	OFF
0	1	1	ON	ON
1	1	0	ON	ON
1	1	1	ON	ON

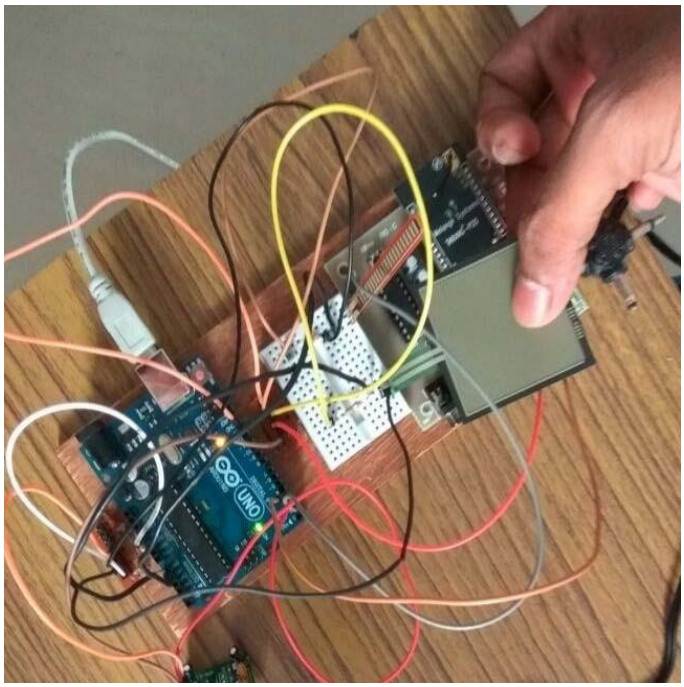

Fig 14. Input to the sensors

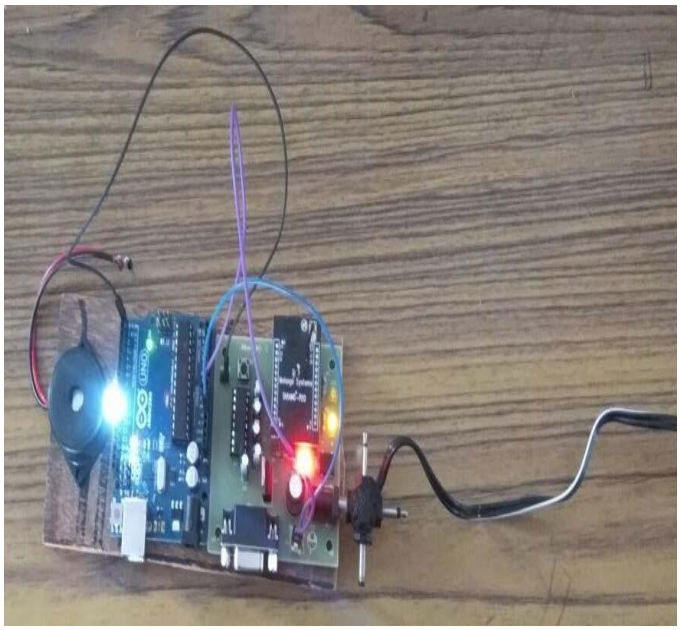

Fig 15. Output of LED and Buzzer presence of input

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