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IOT Based Anti-Poaching Sensor System for Commercial Trees

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***Abstract*—** It is very often heard about the Smuggling of the trees such as Sandal, Teak etc. are taking place throughout the world. These trees are highly expensive as well as less available in the world. Because of huge amount of money involved in selling of such trees, lot of incidents are happening in cutting of trees. In order to avoid the illegal activities on these trees some measures are to be taken. The main objective of the anti-poaching sensor system is to monitor the smuggling of trees and forest fires using flex and flame modules and alerting the user about the same.

***Keywords*—** Smuggling, Anti-Poaching, Sensor system, Flex and Flame modules, Wireless technology

I. INTRODUCTION

Forests are the heart of nature and it plays a vital role in the human survival and social development. Forest fire and tree poaching are most serious problems in recent times. The problem is that when the forest if affected by fire, there will be enormous amount of harm to humans, ranging from air pollution and the destruction of natural ecosystems in the forest itself, starting from animals who lose their life as well as the place where they reside. To restrict such illegal activities and to save the forests around the globe some preventive measures need to be deployed.

This project notifies when the trees are being logged and attacked by fire. Today internet application development demand is very high. So IoT is a major technology by which we can produce various useful internet applications. Project aims to help in the monitoring of trees. A huge spread of forest are getting destroyed often because of illegal cutting of trees [2]. A system will be deployed to detect the tree cutting and to prevent illegal smuggling of trees. It is critical to have a system to monitor the cutting of trees and report it to the forest officers immediately. Therefore, the project is implemented to monitor the trees all day and night to notice any illegal activities taking place and, it has to be informed immediately.

The rest of the paper is organized as follows, Section II contains the related survey. Section III contains methodology, Section IV contain proposed study, Section V and VI describes experimental results and discussion. Finally section VII gives the implementation details.

II. RELATED WORK

[1] IOT based Anti-Poaching Alarm System for trees in Forest using Wireless Sensor Networks: This paper describes a system implemented to avoid smuggling. This design uses three sensors that are tilt sensor, temperature sensor and sound sensor. Data captured from these sensors were continuously tracked by the user on Blynk App. The output devices were activated by using a relay switch. A buzzer is connected to the tilt sensor and the sound sensor and a water pump is connected to the temperature sensor. The captured data from sensor is stored on the blynk server over Wi-Fi module. The forest authority are alerted in case of any illegal action taking place.

[2] Forest Monitoring System Using Wireless Sensor Network: This project presents a system for monitoring forest and its vicinity supported IOT based wireless sensor network technology. This technique have to be able to accurately monitor forest cover and quality is crucial to understanding the prices of deforestation. This project is a trial to eliminate illegal forest activities, the invasion of animals around the forest areas, calamities within the forest by using wireless sensor technology and eliminating manual power to the very best possible extent.

[3] Implementing accelerometers and temperature sensors developing a smaller than expected sensor organizing is presented here. Android based idea is the best suitable for current situation since every single Mobile handset are Android based. The users can quickly get messages on their handsets i case of any interference to the trees. Accelerometers are mainly based on MEMS Technology – Micro Electro Mechanical Systems

[4] Real Time Forest Anti-Smuggling Monitoring System based on IOT using GSM. This system consists of 2 units: Tree unit – accelerometer, flex, fire sensor. Main server unit.

Tree unit will give the information to base station using GSM module. At main server GUI, The authorized person who received the message will take action. It divides the area into smaller parts to keep track in a better way.

[5] Theft of Sandalwood trees using IOT and Aurdino It uses non-intrusive system which can detect any kind of illegal activities using Horus software and also involves in alerting the forest officials. The advantage here is that wide area can be monitored at same time. For the working of this deign requirement of internet is mandatory.

[6] IoT based Anti-Poaching System for Trees and Wildlife Monitoring System in Remote Area. The developed system in this paper describes a system that is far more real-time in the given situation. Many ideologies and attempts worked into the system to provide this sort of performance that verifies and validates it. The trees and animals are given the first priority for the method and help everyone to get close to our nature.

[7] Forest Fire Detection using LoRa Wireless Mesh Topology. The system that is implemented here is placing several nodes in the forest where each node is equipped with a DHT 11 sensor as a temperature reading sensor and humidity and MQ2 sensor as a smoke detector. They have designed a wireless mesh network system.

[8] Modelling of Wireless Sensor Networks for Detection Land and Forest Fire Hotspot. Development of WSNs nodes for land and forest fire detection and monitoring have been modelled. Air temperature and humidity, haze and Co2 sensor are the main components in this case. ZigBee model, with low power sensor nodes is used for long life as node powered by battery.

[9] IoT based Anti- Poaching Alarm System for Valuable Trees. The main intent is to develop a portable wireless sensor node which will be a part of a Wireless Sensor Network. This system will include two modules, one involving sensors and controller module which will be at tree spot another one is android mobile phone.

[10] Design and Development of Wireless Sensor Node for Anti-Poaching of Valuable Trees. The system is composed of two nodes known as Master node & Slave nodes. Master Node: Receives the messages from all sensor nodes and sends it to Base station. Base Station: receives the messages from one or more master node and sends the messages to the server.

III. METHODOLOGY

The method proposed here is, prevention of smuggling and monitoring of trees by using various sensors. The values are sensed through the sensors which are then interfaced with microcontroller Arduino Uno. The data is captured through the sensors and the live streaming of this data are been processed and an LCD is placed in tree module to display the working and some messages will appear a according to the conditions and these message will also be displayed on the IOT app (Blynk app) installed by the user.

IV. PROPOSED SYSTEM

The aim here is to design a Wireless sensor node based on Wireless Sensor Network. The system developed here consists of three modules. They are, Capturing data from sensors, Processing of data and Output unit. The first two modules comprises of sensors and microcontrollers that involves in capturing the data such as sound sensor capturing any sounds, flame sensor capturing the change in temperature, flex sensor detecting the bending of tree, a camera recording the activities around the tree and these data are processed on the microcontroller. The output unit here is an Android mobile handset that displays the data captured as well as the live streaming of the video to the user through an IOT application.

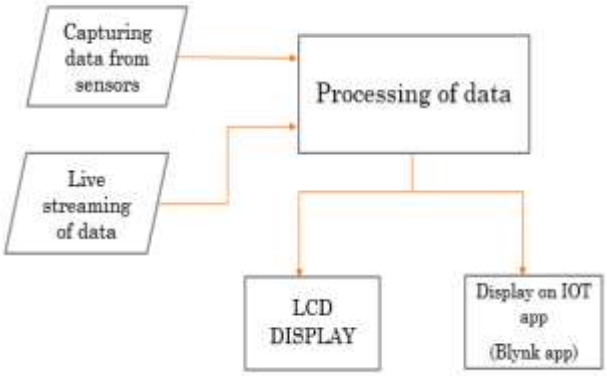

Figure 1. System Design

V. DESIGN

Module Name: Capturing data from sensors.
Description: Consists of sensors to measure the parameters like fire, flexibility, vibration, posture and sound.

Methodology: These parameters are sensed through the sensors which are interfaced with microcontroller Arduino Uno[5]. The values of these sensors are read through ADC of microcontroller .The values of all the sensors vary according to the conditions it is reading. The alert messages will be updated to the IOT app and frequently sending the values of all the sensors to IOT app. LCD is placed in tree module just to display the working and some messages will appear according to the conditions and the message has to be displayed.

To connect to the IOT a nodeMCU module with built in Wi-Fi is used and to live stream the video data ESP32 module with built in Wi-Fi will be installed and all the data and video stream will be displayed in BLYNK IOT app which is freely available. Hotspot will be provided to connect the internet to Wi-Fi modules. This section discusses the outcome obtained by implementing different modules of this proposed design. The model proposed here is designed using Spyder IDE (ANACONDA 3) and the accuracy rate will be around 96%.

Accelerometer sensor

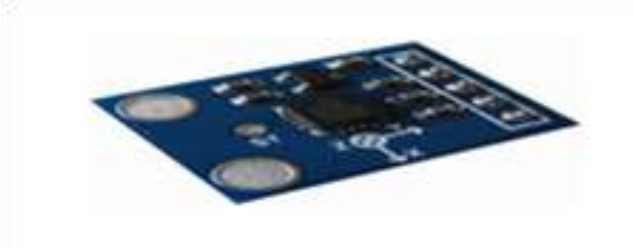

Figure 2. Accelerometer Sensor

Accelerometer sensors are electromechanical devices that sense forces of acceleration. The forces can be either Static or Dynamic. Examples of Dynamic forces comprises of vibrations and movement whereas examples of Static forces includes gravity. Accelerometers can measure acceleration up to three axes. The working principle of the Accelerometer is that the force developed by vibration causes the mass to "compress" the piezoelectric material which produces an electrical charge that is correspondent to the force acting upon it [4].

Fire Sensor

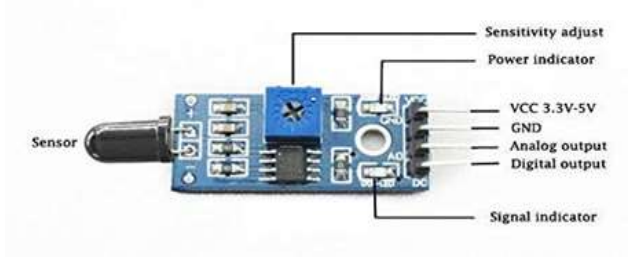

Figure 3. Flame Sensor

A Flame Sensor is designed in order to recognize and respond in case of an occurrence of flames or fires.[4] They are more precise and react quicker than a heat or smoke sensor. Flame sensor module has a photodiode to detect the light and an opamp to control the sensitivity. When the fire is sensed by the sensor it issues a HIGH signal. Arduino processes the received signal and indicates the alert by turning on the buzzer or the LED. Input is flame or fire should be given in front of photo diode and the output will be according to the flame intensity the output is read from ADC of microcontroller. In code the conditions are written according to which the output (alert message) will be sent.[4]

Flex sensor

Figure 4. Flex Sensor

A Flex sensor is also known as a bend sensor that is commonly used to measure the deflection. It is placed on the surface whose bending has to be identified [4]. In order to act like a variable resistor, the flex sensor uses carbon on a plastic strip. The resistance changes by flexing the component. When the sensor starts bending in any direction, the larger it bends, greater the resistance it gets. This principle is used in our project to show the demonstration of bending and ADC of microcontroller is used to read the sensor values.

Sound sensor

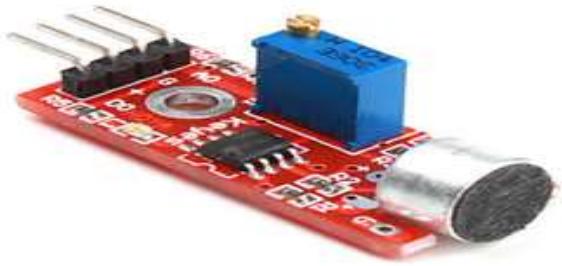

Figure 5. Sound Sensor

A sound sensor acts as a module that identifies sound waves through its intensity and converts it to electrical signals.[1] The working of Sound detection sensor is almost identical to our Ears, consisting a diaphragm which converts vibration into signals. The difference is that a sound sensor comprises of an in-built capacitive microphone, peak detector and an amplifier (LM386) which is highly sensitive to sound.
This principle is applied in our project to determine the demonstration of bending and ADC of microcontroller is used to capture the sensor values.

Vibration sensor

Figure 6. Vibration Sensor

A Vibration sensor measures the frequency of vibration in a given system. The Transducer present in the vibration sensor converts the force caused by vibration into electric current. When the sensor is static the values from the sensor will be constant and when we shake it, the sensor will give different values according to the shaking/vibrating and using these values we will set the threshold to detect the tree cutting.

When the sensor is static the values from the sensor will be constant and when it is shaken, the sensor will give different values according to the shaking/vibrating and using these values the threshold will be set to detect the tree cutting.

Arduino Uno

Figure 7. Arduino Uno

Arduino Uno are microcontroller boards that can sense inputs and convert them into outputs. The Arduino consists of a 10-bit ADC which means that the ADC is capable to detect 1,024 (2^10) distinct analog levels [5]. A few microcontrollers consists of 8-bit ADCs (2^8 = 256 distinct levels) and some consists of 16-bit ADCs (2^16 = 65,536 discrete levels).The way an ADC works is highly complex. The ADC (Analog-to-Digital converters) converts analog signals, real world signals like temperature, pressure, current, or light intensity into a digital representation of that signal. This digital representation produced can then be processed, computed or stored.

Node MCU

Figure 8. Node MCU

NodeMCU is an IoT Module based on ESP8266 wifi Module. The NodeMCU helps the microcontroller to gain access to our wifi network. This module is capable of hosting an application. NodeMCU uses Lua Scripting language and is an open source Internet of Things (IoT) platform.

ESP32-CAM

Figure 9. ESP32-CAM

The ESP32-CAM is a low power consumption module. It comprises of an OV2640 camera and also contains a card slot. This comparatively small sized camera in the ESP32-CAM module can operate independently as a minimum system. This module consists of microcontroller where we will dump the code. Memory 520KB SRAM +4M PSRAM.

Power supply

Figure 10. Power Supply

In order to provide constant voltage to the module a 7805 regulator and 12v adaptor is used in this design. [1]

Module name: Processing of data.

Description: This part of the project consists of an app called BLYNK which is used to update the sensor data and display it on the terminal window of the app.

Methodology: This app consists of different type of widgets that are used for different applications. A Link widget will be used and when pressed it will take the user to the live streaming section. Those configurations will be done initially.

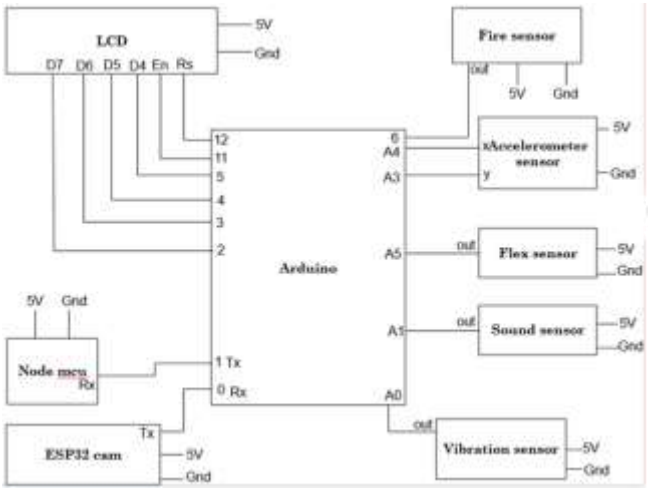

Figure 11. Detailed Design of the Sensor System

Module name: Output unit.

Description: This part of the project consists of a BLYNK app and LCD is placed just to display messages.

Methodology: BLYNK app is used to update the sensor data & display it on the terminal window of the app. Programming is done for reading the sensor values and displaying the alert messages on LCD and send the same to BLYNK app.

Once the user enters the desired inputs, the prediction model in our project runs the permutations and combinations and displays the most suitable crop to be harvested.

Figure 12. Snapshot of the Anti-Poaching Sensor System

VI. EXPERIMENTAL RESULTS

Below figures (15, 16, 17) represent the result of the experiment carried out from initial stage till the conclusion with respect to the connections of the system, monitoring and detection of any poaching of trees.

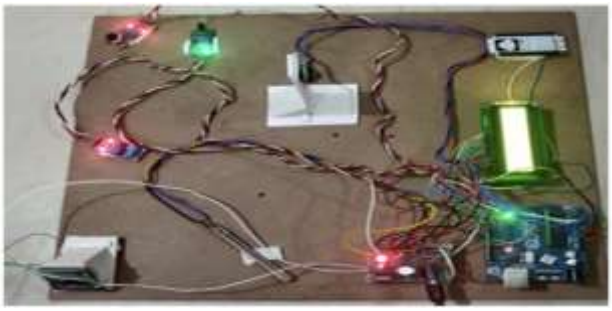

Figure 13. Experimental Connections

Figure 14. Tree Monitoring

Figure 15. Fire Detection

VII. IMPLEMENTATION

In this project, we propose a wireless sensor network paradigm for real-time commercial tree from theft/ cutting and fire [1]. The wireless sensor network can detect and forecast fire detection near the tree for that we used fire sensor, to protect the tree from being cut we are using flexibility sensor to detect bending movement, to detect the sound, sound sensor is used, to detect the posture of tree we are using accelerometer sensor, to detect vibration from mechanical machines we are using vibration sensor. And all the sensor data will be uploaded to IOT app and can be monitored continuously. If some bad conditions detected by the sensor alert messages will be uploaded to IOT app for change in sensor value according to the set threshold. We are using Arduino Uno microcontroller and embedded c programming using Arduino ide. And we are using esp32 cam as ip cam to monitor video data. IOT app Blynk which is free for use that configuration is done on node mcu which is also an Arduino based microcontroller with built in Wi-Fi hotspot should be provided to provide internet to the data Uploading modules.

Programming is done for reading the sensor values and displaying the alert messages on LCD and send the same to blynk app and also update the values of sensors to the IOT app when abnormal conditions occur.

- Reading the sensor values.
- Setting the threshold for each sensor.
- If the current sensor value read is equal to the threshold alert will be sent.
- If not then normally all the values from the sensor reading will be uploaded.

REFERENCES

[1] Ali, A, "Macroeconomic variables as common pervasive risk factors and the empirical content of the Arbitrage Pricing Theory", Journal of Empirical finance, **5(3): 221–240, 2001**

[2] Basu, S, "The Investment Performance of Common Stocks in Relation to their Price to Earnings Ratio: A Test of the Efficient Markets Hypothesis", Journal of Finance, **33(3): 663-682, 1997**

[3] Bhatti, U. and Hanif. M, "Validity of Capital Assets Pricing Model.Evidence from KSE", Pakistan.European Journal of Economics, Finance and Administrative Science, **3 (20), 2010**

[4] Naveenraj M, Arunprasath, Jeevabarathi C.T, Srinivasan R, "IoT Based Anti-Poaching Alarm System for Trees in Forest", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, **Volume-8 Issue-6S, April 2019**

[5] R. Q. V. P. Chandrasekharan, "Forest Fire Detection Using Temperature Sensors Powered by Tree and Auto alarming Using Gsm", Ijrsi 2(3) 23-28, vol. II, no. 100817, **pp. 23–28, 2015.**

[6] Pushpalatha R, Darshini M.S, "Real Time Forest Anti-Smuggling Monitoring System based on IOT using GSM"

[7] Ketaki Vinod Patil, Chakka Sai Abhishek, "Prevention of Theft of Sandalwood trees using IOT and Arduino", International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, **Volume-8, Issue-5S, May, 2019**

[8] Ghousia Sultana B "IOT Based Anti-Poaching Alarm System for Trees in Forest using Wireless Sensor Network" **Volume 9, Special Issue No. 3, May 2018.**

[9] B S Sudha "Forest Monitoring System Using Wireless Sensor Network". E-ISSN: 2454-8006 **Volume 4, Issue 4 April-2018.**

[10] Ankita Dalvi," Undetected Detective to protect the Forest Trees against Poaching Using WSN Technology" **Vol. 3, No.6, 2018.**
[11] Mr Rohan Solarpurkar, "Real Time Forest Anti-Smuggling Monitoring System based on IOT using GSM" International Journal for Research in Engineering Application & Management (IJREAM) ISSN: 2454-9150 **Special Issue- ICSGUPSTM 2018.**
[12] Dr.Rangarajan, Dr.Sakunthala, "Innovative Protection of Valuable Trees from Smuggling Using RFID and Sensors", International Journal of Innovative Research in Science, Engineering and Technology **Vol.6, Issue3, March 2017**
[13] Sridevi Veerasingam, Saurabh Karodi, Sapna Shukla, "Design of Wireless Sensor Network node on Zigbee for Temperature Monitoring",2009 International Conference on Advances in Computing, Control and Telecommunication Technologies, IEEE Journals 978-0-7695-3915-7/09,**2009.**

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Prof. Shruthi K R pursued Bachelor of Engineering from SJCIT in 2008 and Master of Technology from The Oxford College of Engineering in 2012. She is currently pursuing Ph.D and currently working as Assistant Professor in Department of Information Science & Engineering, Global Academy of Technology since 2012. She has published papers in International and National Conferences and journals. Her main research work focuses on Cryptography Algorithms, Network Security, Artificial Intelligence, Machine Learning, IoT and Computational Intelligence based education. She has 9 years of teaching experience and 2 years of Research Experience.

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