FOREST MONITORING SYSTEM

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Abstract: Newspaper articles about the global smuggling of trees like teak, sandal, and others are frequently read. These trees are more in demand, hence their price is higher. As a result of the huge profit that may be made from selling the wood of these trees, it is possible that they are being smuggled, which is against the law. Some actions must be made in order to restrict the smuggling of these trees. This system's primary goals are to minimize deforestation and limit smuggling in order to preserve precious trees and maintain a healthy eco-system.

Keywords: Tilt sensor, fire sensor, forest, trees microcontroller.

I. INTRODUCTION

Newspaper articles about the smuggling of trees are common. These trees are very pricey and are frequently used in the fields of medicine and cosmetics. Due to the enormous amount of money involved in selling their timber, these trees are increasingly being smuggled. It is not just India that is struggling with this problem; other countries are as well. Even with the costs involved, these priceless trees should be protected. Even though the Indian government is working to stop this illegal smuggling, the same title is still displayed on some newspaper corners. As can be seen, the problem is that there is no system or method in place to detect illegal tree cutting. limiting their smuggling and preserving forest.

These trees are very pricey and are frequently used in the fields of medicine and cosmetics. The illegal trade due to the enormous sum of money involved in selling their timber, whose number is perpetually increasing. It is not just India that is struggling with this problem; other countries are as well. Even with the costs involved, these priceless trees should be protected. Even though the Indian government is working to stop this illegal smuggling, the same title is still displayed on some newspaper corners. As can be seen, the problem is that there is no system or method in place to detect illegal tree-cutting. limiting their smuggling and preserving forests. II. RASPBERRY PI The newest model of the well-known Raspberry Pi line of computers is the Raspberry Pi 4 Model B. In comparison to the Raspberry Pi 3 Model B+ of the previous generation, it offers revolutionary improvements in processor speed, multimedia performance, memory, and connectivity while maintaining backward compatibility and a similar level of power consumption. Raspberry Pi 4 Model B offers desktop performance for users that is on par with budget x86 PC systems.

The Raspberry Pi Zero, RPi1A, RPi3A, and RPi4 can be used as a USB device or "USB gadget" by connecting them to another computer using a USB port on that computer. It can be set up to operate in a variety of ways, such as as a serial or Ethernet device .This was incorporated into the primary Raspbian distribution in May 2016 despite initially requiring software patches .Models of the Raspberry Pi with more recent chipsets can boot from USB mass storage, like a flash drive. The original Raspberry Pi models, the Raspberry Pi Zero, the Raspberry Pi Pico, the Raspberry Pi 2 A models, and the Raspberry Pi 2 B models with versions lower than do not support booting from USB mass storage

II. LITERATURE SURVEY

Pooja Baraddi, Ritika Jadhav, Nanda Hanchinal, Shushma. developed IoT based Anti- Poaching Alarm System for Valuable Trees.According to the proposed plan a system that can be applied to limit smuggling. Three sensors—a tilt sensor, a temperature sensor, and a sound sensor—are used in the design system.The Blynk App is used to continuously monitor the data produced by these sensors. Regarding the sensors, a relay switch is used to turn on their output devices. A buzzer is actuated for the tilt and sound sensors, and a water pump is turned on for the temperature sensor. Over the Wi-Fi module, generated data is stored in Blynk Server. Any incidence that occurs is reported to forest officials so that necessary action can be taken[1].

 A constant economic hazard, forest fires often result in human casualties as well as significant economic loss. Early fire detection is one of many safety measures. The importance of detection cannot be stressed. Fire detection employs observation methods such as moving observers, putting fixed observers on land, and aerial observations. Satellite recording is one of the most effective methods. The technology of wireless sensor networks (WSNs) holds great promise for the early detection of fires. The use of WSN in preventing forest fires has a variety of distinct elements..

The monitored values are gathered at a central sensor node using temperature, humidity, and smoke detection sensors,and then sent to the operating center using web service[2].

On Android-powered phones, which include the mobility function, our application runs. Through the mobile phone, the user can access the data at any time, from anywhere. It offers the sandalwood trees with security. Officers are immediately notified by alert messages if anything unusual occurs in the forest. This application is developed for forest department to protect sandalwood trees from smugglers [3].

The creation of devices to stop this tiredness presents a significant problem. We attempt to place sensors in every tree to detect any unexpected increase in vibration frequency and store the data in the cloud so that forest officials may immediately access it in order to stop the theft of sandalwood trees. The concept of IOT enters the picture for the communication of mobile and email with the vibrational sensor. There is a system of physical devices that are equipped with hardware, programming, sensors, actuators, and availability enabling these items to associate and exchange information, assisting in effective monitoring facilities and supplying a dependable security system.We have been hearing about the smuggling of trees like sandal and Sagwan for a long time[4].

Each tree unit will use a GSM module to transmit information to the base station. employing a single authenticated person at the main server GUI whom the message was sent to, and he will take steps to provide security. Concerned forest authorities can employ this information to take preventative action [5].

This is a time-consuming and ineffective process. In the suggested paper, this issue is resolved by building a network of sensors, each with a controller acting as a node, and the data is transferred to the Raspberry Pi, a more potent central station. At the controller located at the node, data from the various sensors is gathered. The central station receives this data and transmits it for processing. The conditions under which an alarm is being sent will be included in the central station code.It must be sent.This protocol was chosen as it guarantees the security of the destination and source addresses, secure data transmission, and a reliable connection. An email notice is sent to the relevant officials if an abnormal condition is found.Forests are vast regions where trees and other plants are gathered. They are crucial for preserving the environment because they clean the air and water, give animals food and shelter, and help control the climate[6].

In remote areas, human error commonly occurs in other wildfires. A wildfire's rapid ignition and spread are driven by dry vegetation.Wildfires can devastate property and endanger human health with their smoke and air pollution. Because they spread quickly, Early warning systems that are more accurate are absolutely needed.We noticed that the majority of the communication channels used in this situation are based on one of these protocols: WiFi, ZigBee, or GSM.We have been reading about the smuggling of priceless trees like sandalwood, teakwood, rosewood, etc. for a number of days now. These trees cost a lot of money. A system including a Micro Controller, accelerometer sensor, flame sensor, vibration sensor, GPS, and GSM module is created to prevent smuggling.. At the primary server, there will be one designated person who has the authority to receive communications and respond appropriately to ensure security.The accelerometer sensor will be able to detect tree chopping. [7].

A microcontroller-based anti-poaching system using WSN and MEMS accelerometer is proposed. WSN is a technology that is frequently utilised in remote monitoring applications. The PIC16F877A microcontroller is utilised here. The tilt of the tree is detected by a MEMS accelerometer. A microphone and associated processing circuits make up a sound sensor. It detects sound from silence and outputs digital trigger the signal. The temperature increase is detected using a fire sensor. Gases that are lubricating in nature are picked up by smoke sensors. Latitude, longitude, and altitude measurements are provided by GPS. The UART is utilised for serial communication [8].

The Overall, there was a substantial risk of human influence on forests. Rapid city development and excessive population growth resulted in the invasion of forest regions There are several illegal activities occurring in forest areas, such as poaching, logging, etc. The majority of Maoist actions originate in vulnerable forest regions. Due to accessibility issues, a lack of appropriate tools, and manpower shortages, forest rangers can only effectively manage a limited area. Additionally, it is difficult and highly boring to continuously monitor these forests. The forest protection unit will be set up in fantastic locations to provide helpful information. This appliction will facilitate and improve forest monitoring. By creating these new methods, it will be possible to both achieve sustainable development and stop the emission of reducing the amount of greenhouse gases [9].

In this paper, a wireless sensor network for monitoring forests is designed, developed, and prototyped. the use of many sensors. It is now complete to conceal the wooded area.This system rapidly alerts forest officials during fire accidents and animal monitoring. It can even be used as a technique for tracking pets. It primarily focuses on monitoring animal

health, warning forest officials about potential fire threats, smuggling of valuable trees, and poaching of species. This method is also very helpful in reducing trespassing by wild animals into the regions where people live close to the forest. It also targets applications for tracking and locating animals. This essay offers a seldom used, simpler, and more affordable alternative to the current [10].

Suggested system employs three sensors in its architecture. Sound sensor (for effective detection of illegal logging, in which even the sounds made when felling the tree are sensed), temperature sensor (to identify forest fires), and tilt sensor .These sensors continuously monitor the data they produce. It is capable of sending data promptly to the monitoring computer while keeping track of associated parameters in real-time, such as temperature and relative humidity. Here, we demonstrate how to install multiple sensors in order to fully cover the forest. During a forest fire, in addition to warning forest officials. It focuses mostly on monitoring animal health, warning forest officials about potential forest fires, smuggling valuable wood, and poaching endangered animals. This method is also very helpful in preventing wild animals from entering residential areas close to the forest. It also targets animals [11].

Remote monitoring and control are designed by the Network Based on Zigbee. A real-time home monitoring subsystem and a light control subsystem make up the system. This system was granted because the wireless web-based system has so many real-time uses. a tool that tracks forest fires by analysing satellite data almost instantly and turning the information into immediate messaging and email notifications. A system that automatically sends SMS messages and uses satellite data to track and evaluate the damage caused by forest fires.SMS and emails to district forest officers and rangers will help them better monitor a fire's growth and direction and warn people when an evacuation may be necessary. This approach will help prevent a fire from spreading quickly.When the temperature rises above the critical fire point, it gathers the signal of increased temperature and reacts to the driver display unit. [12].

These trees are both expensive and crucial to the world. These are employed in both the fields of medicine and cosmetics. Due to the huge sums of money involved in the commercialization of these tree woodlands,Indian sandalwood trees have recently become endangered, and in an effort to protect them from outside sources,The government is attempting to restrict sandalwood exports. Three different units are positioned appropriately to conduct experimental tests. The system has been established completely. A stroke has been delivered, and the tree unit has noticed it. Subserver unit continues to process the signal. We have an associated LCD display for understanding purposes. where the main unit is fixed and detected at the control station [13].

By placing a Wi-Fi router between the employee and the forest ranger, they made another innovative suggestion. When the case network is disabled, this Wi-Fi router enables communication between the employee and forest officer.Division of Forestry After planting 2.18 crore saplings in a day in 2016, the government of Maharashtra planted 13 crore during the 2017 rains, and has since taken on the challenge of planting 13 crore saplings in 2018 and another 33 crores in 2019, Department comprises 61 Forest Divisions made up of 14 Forest Circles. The Western Marathawada Region's largest forest circle is the Dhule Forest Circle Maharashtra [14].

In this paper, we introduce our WSN, which can monitor many ecosystem and forest metrics. defending and Monitoring forests and rainforests is essential for our balanced and sustainable growth and goes beyond an agricultural issue. Based on smoke detection and temperature sensors, we developed a WSN that can identify and track forest fires. The network is built in a straightforward, topology of stars and as a result, there is a minimal demand for processing and electricity. Furthermore, low-cost, low-power technology is used, creating a versatile and simple-to-implement sensor network.A growing number of industrial fields, agricultural storage facilities, and environmental monitoring systems are being equipped with wireless sensor networks (WSN) [15].

Based on temperature and fire sensors, we developed a WSN that can identify and track forest fires. The network is established in a simple, star topology and as a result, the computation and power requirements are kept low. Additionally, low-cost, low-power technology is used, resulting in a flexible and simple-toimplement sensor network. WSN is a rapidly developing technology that is employed in numerous industrial applications.WSN are frequently employed in forested areas for environmental monitoring,wild animal surveillance, and fire detection [16]. Fundamental concept is the creation of a mobile wireless sensor node that functions as a node in a wireless sensor network. It will be fixed to the trunk of every tree and be capable of detection of theft and automatic activation and transmission of any alarm signals to a remote terminal using wireless media. The network interface utilised in this instance, an Xbee RF module,ZigBee, an open global standard for wireless technology that enables the core communication interface of wireless sensor networks that are low-cost and low-power [17].

Remote sensor networks are a new technology with a wide range of possible applications. Identification and prevention of disasters in conditions like forest fires, floods, and earthquakes is one such application. In these catastrophe conditions, the events being watched can result in the destruction of the sensing equipment, such as when they are burned in a fire or submerged in water. flood, melted in lava from a volcano, shorted out in toxic chemicals, etc. The suggested solution introduces a Wi-Fi router, which enables communication between an employee and a forest officer in the event that the network is down.Sandalwood, teak, and pine have all seen significant increases in poaching in recent years as a result of people's excessively self-centered desires too Rosewood[18].

This will be done to Detecting theft as well as repeatedly signalling the central base station. The system is designed for a low power proposal, allowing for a longer system life. The device has a low power architecture and works best with rechargeable batteries that can be powered by the sun's natural solar system. a solar panel installed in the system for the purpose of charging the batteries of nodes. Regular manual battery changes could be avoided.Forest fires can be started by human activity, such as unattended campfires, arson, improperly burned materials, or by natural causes, such as high temperatures that can trigger the spontaneous combustion of dry fuels like sawdust, leaves, lightning, trash, etc[19].

Forest fires raise the amount of carbon dioxide in the atmosphere, which aids in the greenhouse effect and climate change. Ash also significantly reduces the amount of nutrients in the soil and can lead to erosion, which can lead to floods and landslides.Watchtowers were used in the past to identify forest fires, but they weren't very effective because they were relied on human observation.Wireless sensor network-based forest fire detection system is suggested as a solution to these disadvantages[20].

III. BLOCK DIAGRAM
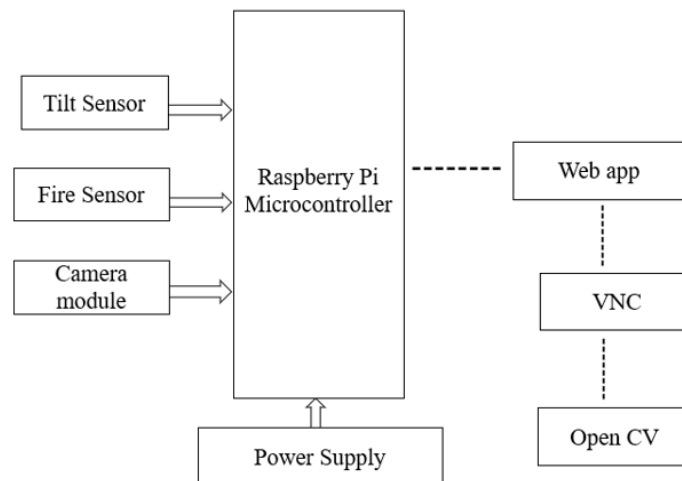
Raspberry pi is used as a heart of our project. Tilt sensor is used to detect the cutting down of trees. And fire sensor is used for detecting the fire. Camera module is used to detect the humans and animals using deep learning technology. Power supply of 12V has to be given to the microcontroller. Where the alert is received by the forest authorities using open CV python web app.

IV. METHODOLOGY

The designed system consists of microcontroller, tilt sensor, fire sensor, Camera module.
The system consisting of TWO stages:

 Transmitter unit
 Main server unit

 The designed system consists of microcontroller, tilt sensor, fire sensor, Camera module. The system consisting of TWO stages: Transmitter unit Main server unit for the implementation of the system. This unit would consist of two sensors to give the information of getting Cut Down the trees, Damage with fire. The tree unit consists of two sensors:1. Tilt Sensor 2. Fire Sensor. These sensors would be responsible to send the data to the controller. Also this system uses camera module that will used for the detection of objects(animals, humans). If human passes around restricted forest area, it detects and gives an alert only when it detects humans about it. B. Main receiver Unit: This unit is responsible for the user interface and displaying the datathat was transmitted from the transmitter unit. A sub server unit (Node MCU) be

used in between the transmitter unit and main receiver unit to make the whole process take comparatively less time to alert the forest officer to take preventive action. Camera module can detect human and animal, where it gives a message only when it detects human by using deep learning technology and also for any activities going around the forestcan be detected with this system. This data received at the receiver unit, where Adafruit IO open source web server displays the data received from the transmitter unit, is used by the forest department to take necessaryactions. So that the forest authorities can take necessary actions.
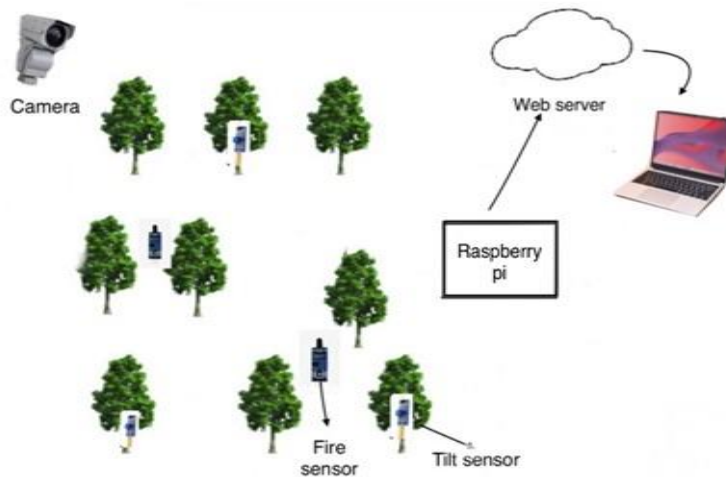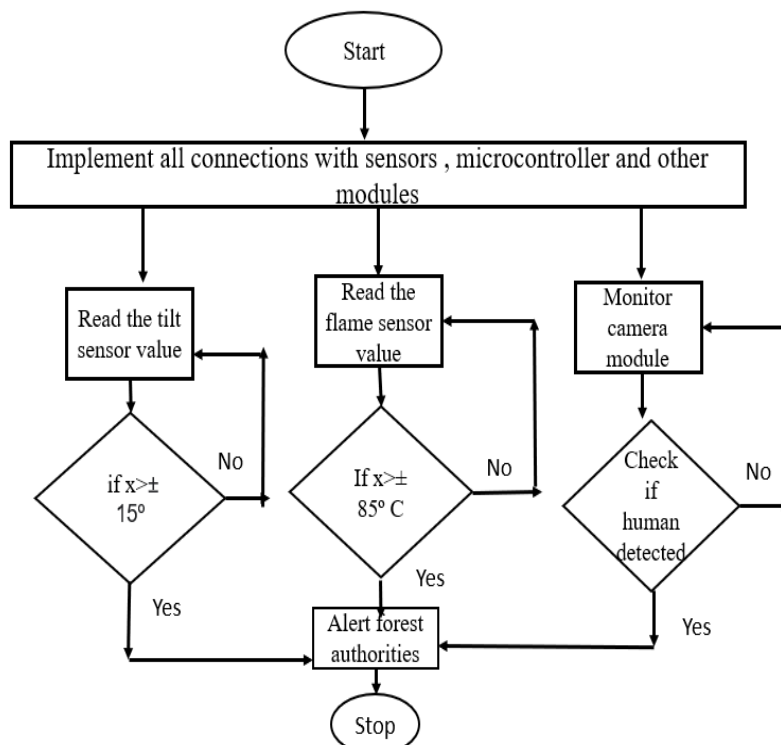

Figure: Complete demo of forest monitoring system

FLOW CHART

V. CONCLUSION

The conclusion is to protect the forest by detecting the forest fire and from cutting down of trees using fire sensor and tilt sensor respectively. Also humans and animals are detected by camera module using deep learning. Based on the survey conducted, forest monitoring system and detection of fire ,which can be prevented by the use of a raspberry pi and a

sensors with the training of camera module using machine learning and deep learning the forest trees can be saved by using tilt and direction of the fire by flame sensor and a camera module can detect human and animal,where it gives a message only when it detects human and also for any activities going around the forest can be detected with this system.

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