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# IOT Approach for Anti-Plundering: Halting the Erasure of Endangered Trees

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**ABSTRACT:** Smuggling of the most important trees such as sandal wood in forests, poses a serious threat to forest resources, causes significant economic damage and ultimately has quite a devastating effect on the environment all over the world. This paper proposes a microcontroller based anti-poaching system employing WSN technology, which is capable of detecting theft by monitoring the vibrations produced by the cutting of trees/branches using a 3 axis MEMS accelerometer. A microcontroller is used along with mobile so that the information can be uploaded. WSN is widely used technology in remote monitoring applications. The embedded system architecture and the hardware/software designs are described in detail. Vibration data collected by various tests on wood and simulated using Arduino IDE.

**KEYWORDS:** Internet of Things, Blynk Application, microcontrollers, data collection, WSN technology.

## I. INTRODUCTION

The project addresses the pressing issue of tree plundering by developing a portable wireless sensor system. It integrates advanced electronic components such as Node MCU ESP8266, Arduino UNO, LED buzzers, ultrasonic theft detection, MPU-6050 accelerometer, LCD display, and DHT11 sensor. These components collectively form a robust defense mechanism against unauthorized access to trees. The Node MCU ESP8266 serves as the central communication hub, enabling seamless data exchange among the various sensors and components. The ultrasonic theft detection module, coupled with the MPU-6050 accelerometer, acts as the primary line of defense, monitoring and detecting any suspicious activity or movement around the designated tree. Upon detecting unauthorized access, the system triggers an alarm, alerting nearby individuals and serving as a deterrent to potential intruders. Furthermore, the DHT11 sensor provides real-time environmental data, ensuring the well-being of the protected tree. The Arduino UNO microcontroller processes incoming data and controls output devices like LED buzzers and the LCD display, effectively communicating the status of the protected area to stakeholders.

To empower users with real-time monitoring and control, an intuitive Android app has been developed. Utilizing the Blynk application, the app offers a user-friendly interface for tree guardians. Users can remotely activate and deactivate the alarm system, receive instant notifications in case of a security breach, and access live data from the DHT11 sensor. Additionally, the app integrates a tracking feature, enabling users to trace the location of protected trees through GPS technology.

## II. RELATED WORK

A.Kulkarni et.al.[1] highlight on Wildlife prevention has become an important practice due to negative effects of human activities such as cutting of trees on large scale and unregulated hunting which causes major threat to wildlife. This article presents the design of a system for detection of vibration for prevention of cutting of trees, detection of temperature for prevention of forest fires also detection of pulses of animal for prevention wildlife using wireless sensor networks to prevent a disaster (forest) that could lead to loss of a significant number of natural resources. S.Veerasingham et.al.[2] emphasize about portable wireless data logging system for temperature monitoring in real time

process dynamics. Process variables (like temperature, pressure, flow, level) vary with time in certain applications and these variations should be recorded so that a control action can take place at a defined set point. M.Upadhye et.al.[3] address Vibration analysis provides relevant information about abnormal working condition of machine parts. Vibration measurement is prerequisite for vibration analysis which is used for condition monitoring of machinery. Also, wireless vibration monitoring has many advantages over wired monitoring. This Paper presents, implementation of a reliable and low cost wireless vibration monitoring system. H.Hamza et.al.[4] points on the development of a system designed to combat tree theft, a prevalent issue in various regions. the proposed system integrates Texas Instruments technology and educational methodologies to create an innovative solution for monitoring and preventing unauthorized tree removal. By leveraging advanced technologies, the authors aim to address the challenges associated with tree theft, providing a practical and effective means of control. N.Shilpa et.al.[5] present a comprehensive exploration of an Internet of Things (IoT) solution to combat tree poaching. Utilizing sensors and connectivity, the system enables real-time tracking of environmental conditions and detects unauthorized activities. The authors emphasize the integration of innovative technologies for proactive antipoaching measures.

### III. METHODOLOGY

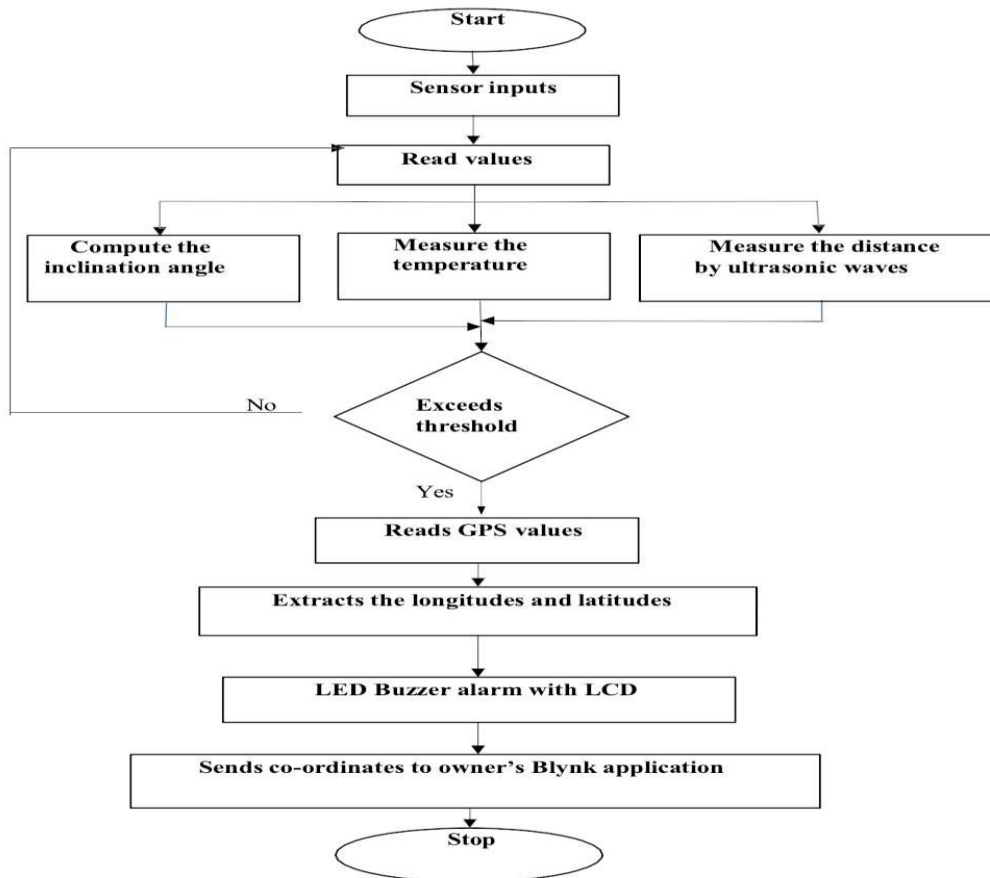


Fig. 1. Work Flow of the project

The "IOT approach for Anti-Plundering: Halting the erasure of Endangered trees " project aims to address the critical issue of illegal logging and protect endangered trees through an integrated system. The methodology encompasses a multifaceted approach, utilizing a combination of hardware components and advanced technologies. The central components include a 12V battery power supply, Node MCU ESP8266 for wireless connectivity, LED Buzzer, Ultrasonic theft detection, MPU 6050 accelerometer for motion sensing, Arduino UNO as the main controller, LCD for on-site display, and DHT11 Temperature and humidity sensor for environmental monitoring. The holistic nature of this system allows for comprehensive surveillance, ensuring the safety of endangered trees.

The hardware setup involves the intricate interconnection of components to establish a robust monitoring infrastructure. The Arduino UNO serves as the brain of the operation, orchestrating data collection and processing from the Ultrasonic sensor, MPU 6050 accelerometer, LCD, and DHT11 sensor. The Ultrasonic sensor is strategically employed for proximity-based theft detection, while the MPU 6050 accelerometer detects abnormal vibrations or movements that may indicate unauthorized activity. The DHT11 sensor monitors the environmental conditions around the tree, adding an additional layer of protection by triggering alerts for unfavorable changes in temperature or humidity. The Node MCU ESP8266 facilitates wireless communication, enabling real-time data transmission to the Android app. To enhance on-site security, an LED and Buzzer system has been incorporated, serving as immediate visual and audible alerts in response to potential threats. The alert patterns are customized based on the severity of detected incidents, ensuring that the response is proportional to the perceived risk. The interconnectedness of these components forms a cohesive hardware framework designed to thwart illegal activities and protect endangered trees effectively.

The Android app, developed using the Blynk application, complements the hardware system by providing users with remote control and monitoring capabilities. Users can activate the LED and Buzzer remotely through the app, providing a deterrent effect and alerting nearby individuals to potential threats. Additionally, the app incorporates a tracking facility, allowing users to monitor the location of the protected trees in real-time. This adds a layer of transparency and accountability to the system, enabling efficient response to incidents.

Throughout the project, rigorous testing and calibration procedures are implemented to ensure the reliability and accuracy of the system. User training and comprehensive documentation accompany the deployment phase, empowering users to effectively operate and maintain the anti-plundering system. Continuous improvement remains a focal point, with regular feedback loops and updates to the system based on emerging technologies and user insights, ensuring the sustained effectiveness of the project in halting the erasure of endangered tress.

#### IV. EXPERIMENTAL RESULTS



Fig.2 : Shows the Anti Plundering model which must be mounted on to the trunk of the tree.

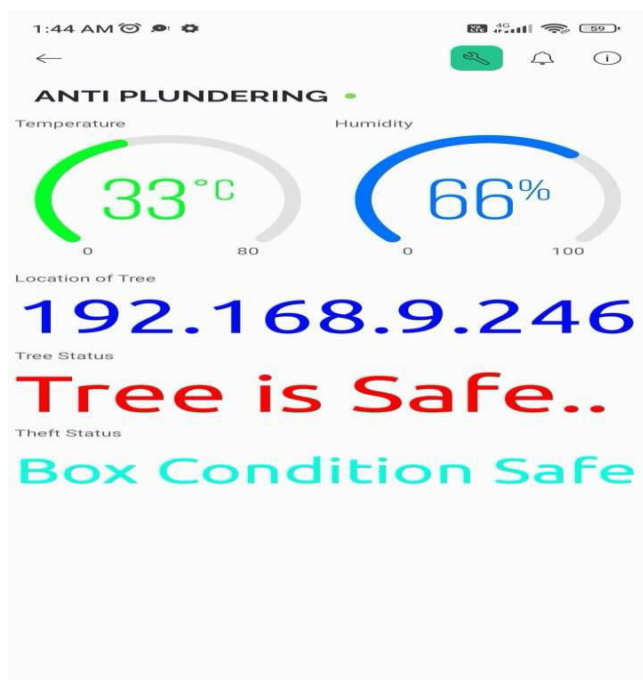


Fig 3: Shows the live app interface of the Blynk app displaying temperature, humidity, location and status of the tree, also including theft status of the model.

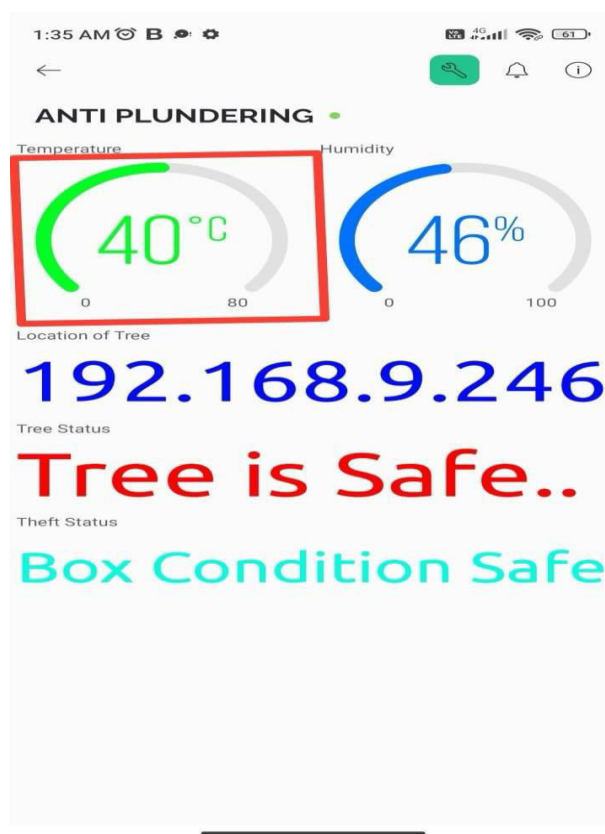
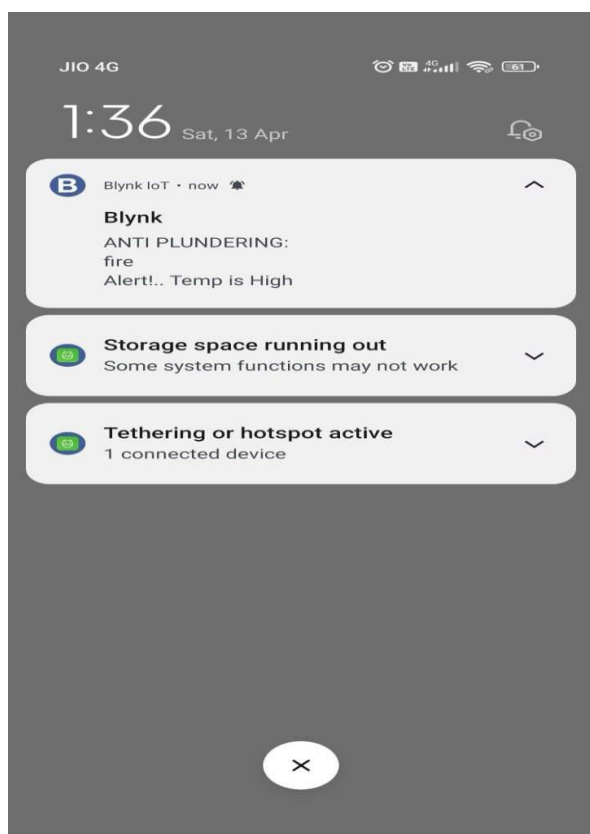


FIG 4: Displays the notification and status of the tree in the blynk app also in the IoT model when temperature around the tree is more than 38C.

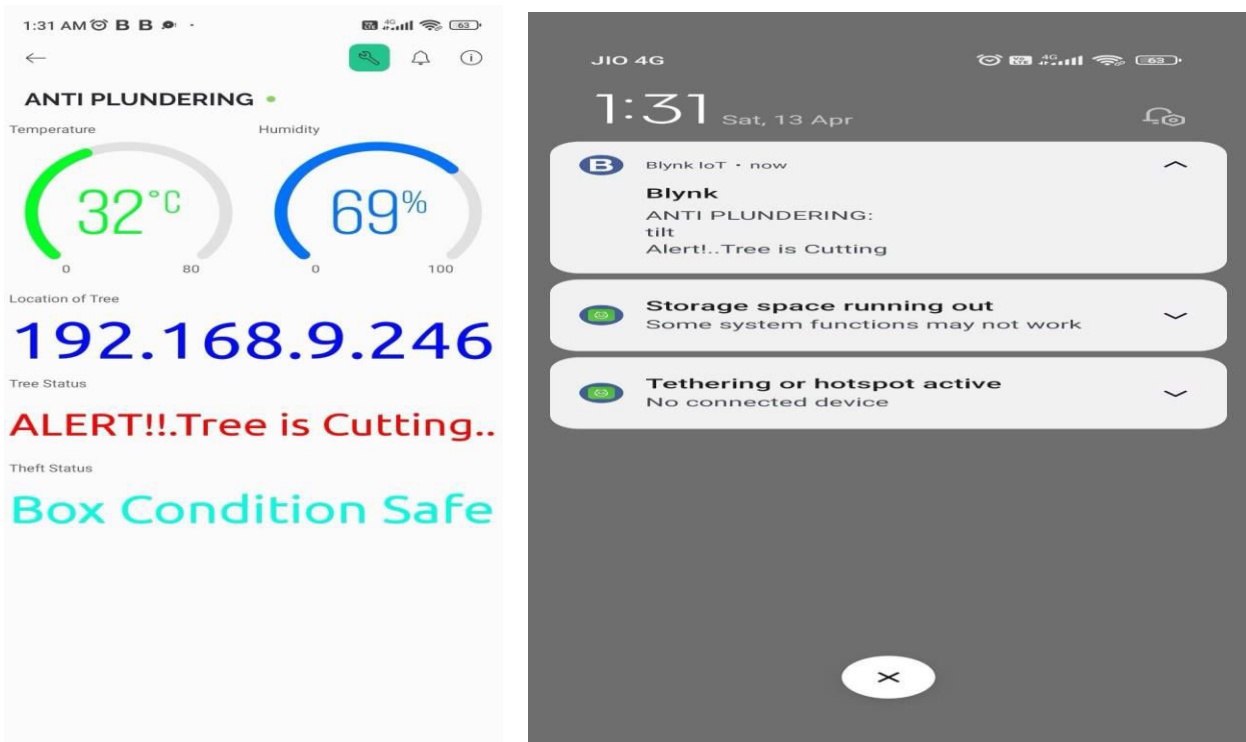


FIG 5: Displays the notification and Shows the status of the blynk app and in the IoT model when the tree is being cut or tilted.

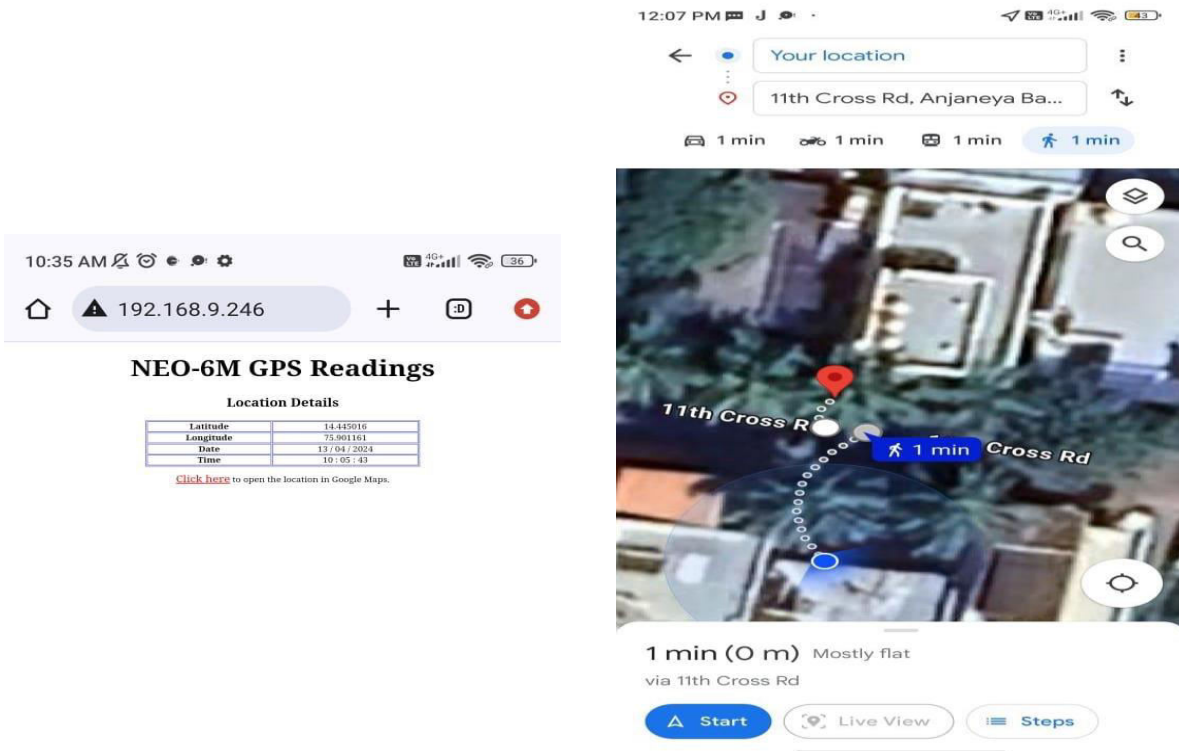


FIG 6 : shows the Neo-6M GPS readings and the map associated with those readings



## V. CONCLUSION

This paper aims to viewed the project as a journey where we learnt many lessons and gained insights to the subject which we tried to share in this report and summarized in this chapter. We tried to look at the problem from many points of view which generated some new ideas that could be explored in future. We suggested formal approaches for modelling and analyzing the system which are by no means complete but could become the initiation for further research. We also created a working system and algorithms which we claim to be useful and extensible. However, as we have seen in these chapter, all these achievements are only partially successful. Personally, we would consider this project a success if the ideas described in the report can be a useful reference for future work on the subject.

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