

Tree Protection System based on IOT and Automation Device

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Abstract—

Illegal logging is an ongoing environmental problem that threatens ecosystems and sustainability. To combat this problem, we propose an innovative tree protection system using IoT and automation. Two different prototypes with same boards have been developed: one integrating sensors such as an accelerometer and communication modules to monitor vibrations caused by attempts to cut down trees, and the other with GSM capabilities for real-time alerts.

This system aims to detect and quickly report unauthorized felling of trees, thereby contributing to sustainable forest management and environmental protection. The primary objective of the proposed system is to detect and alert authorities to any suspicious or unauthorized activities related to tree felling.

Using this tree protection system based on the Internet of Things and automation, we aim to contribute to the protection of our natural environment by discouraging illegal tree felling and promoting sustainable forest management practices.

I. INTRODUCTION

Reckless destruction of trees through illegal logging and unauthorized felling of trees continues to be a serious problem for our environment and ecosystem. These actions threaten not only the balance of our planet, but also the livelihoods of countless species and communities. To address this pressing issue and promote sustainable forest management, we present an innovative tree protection system based on the Internet of Things and automation designed to prevent and combat illegal tree felling. The first prototype integrates an Arduino Nano board, an accelerometer (vibration sensor), a

rechargeable battery, a solar panel, a lithium-ion cell, an NRF module, a DHT11 sensor, and a small LCD display. The second prototype is designed around an Arduino Nano board, a repeater and a GSM module. Together, these components create a comprehensive and robust system capable of monitoring and responding to threats in real time. In the following sections, we will dive into the specifics of each prototype and explore their role in detecting and preventing illegal logging. We will also explore the wider implications of this IoT and automation-based solution and highlight its potential to act as guardians of our forests and guardians of the environment. By proactively addressing the problem of illegal logging, we can take a significant step toward protecting the vital natural resources upon which the health and well-being of our planet depend.

II. REVIEW OF LITERATURE

A. Study of Existing System

The existing tree protection system includes a range of IoT devices and sensors designed to address potential problems in forested areas. Selected based on specific forest-related conditions and scenarios, these devices include accelerometers and vibration sensors. These sensors are combined with offline communication modules to detect and alert the authorities in case of unauthorized tree felling. This system plays a key role in preventing illegal tree felling and provides valuable data for forest analysis, including information on temperature and humidity. In addition, this system emphasizes the integration of renewable energy sources such as solar panels and rechargeable batteries. This integration increases sustainability by ensuring continuous and reliable monitoring in remote forested areas. The system includes a GSM-enabled alert mechanism that is proving effective in quickly informing the authorities of potential illegal felling of trees in the forest. This mechanism facilitates rapid response and intervention and increases the overall effectiveness of the tree protection system.

B. Findings from Literature Review

Effectiveness of IoT integration.
Need for Renewable Energy Integration.
Role of GSM-Based Alerting.

III. PROPOSED SYSTEM/PROBLEM DEFINITION

A. Problem Statement

The ongoing problem of illegal logging remains an urgent threat to forests and ecosystems and requires innovative and comprehensive solutions. To address this challenge, we propose an IoT and automation -based tree protection system with the primary objective of identifying and preventing unauthorized tree felling. Our system is equipped with a variety of sensors for detection, advanced communication modules for rapid warning and integration of renewable energy sources to enhance real-time monitoring and enable early intervention.

B. Project Scope

The proposed tree protection system aims to overcome the persistent problem of illegal tree felling through an IoT and automation-based approach. The scope of this system includes a wide range of potential applications and impacts with a focus on technology advances and environmental protection.

C. Key High-Level Goals and Problems

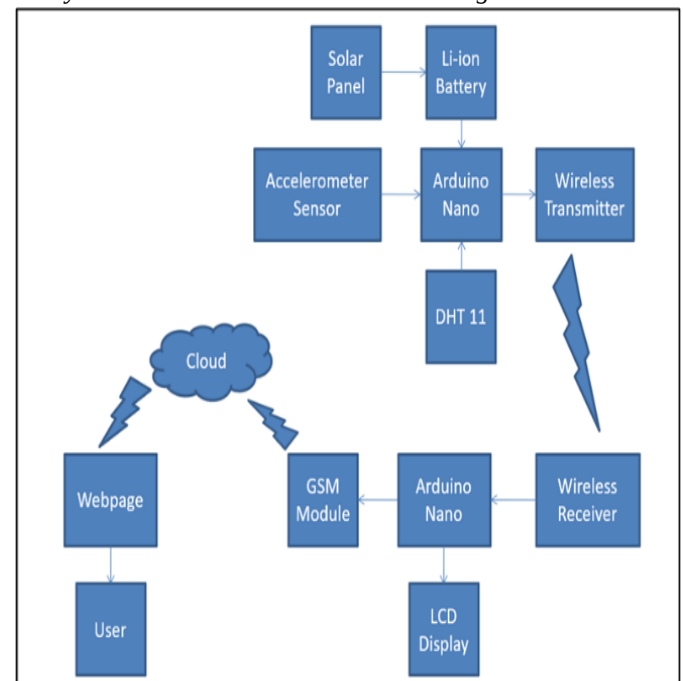
The main objectives and challenges of the proposed project are as follows. The primary goal is to create an innovative solution that effectively combats the ongoing problem of illegal tree felling in forested areas. To achieve this, the project aims to create a comprehensive system that can continuously monitor the forest environment in real time, providing insight into factors such as temperature, humidity and the incidence of unauthorized activities. This proactive monitoring is critical for the rapid detection of potential illegal tree felling and ensures timely responses and interventions by notifying the relevant authorities. In addition, the project seeks to address the issue of sustainability by integrating renewable energy sources such as solar panels and rechargeable batteries to power the system in remote and challenging forested areas. In summary, the main objectives of the project revolve around preventing illegal logging, enabling real-time monitoring, ensuring rapid responses and improving sustainability, while related issues include illegal logging, early detection, remote monitoring, energy supply and effective data. analysis within forest ecosystems.

IV. OBJECTIVE OF PROPOSED SYSTEM

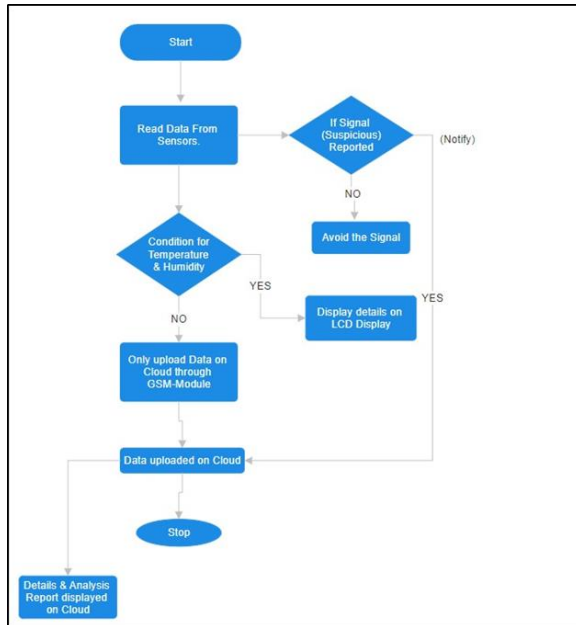
The primary objective of the proposed system is to create a highly effective and technologically advanced solution to combat the pressing problem of illegal tree felling in forested areas. The aim of the system is to use the latest IoT and automation technologies to detect and prevent unauthorized tree felling. It aims to provide real-time monitoring of the forest environment, providing insight into key factors such as temperature and humidity. The capability of the rapid response system will play a key role in notifying the authorities in time when potential illegal tree felling is detected. In addition, the integration of renewable energy sources will enhance sustainability and ensure continuous and reliable operation in remote forested areas. Overall, the proposed system aims to protect forests, ecosystems and valuable natural resources by proactively addressing the problem of illegal logging.

V. METHODOLOGY

A. System Architecture/Flow/ER/DFD Diagram



System Architecture example



Flow-Chart Diagram

B. Modules of Software System

A software system consists of several key modules that work in tandem to achieve its goals. These modules include real-time sensor data collection and analysis that continuously monitors the forest environment. The warning and notification module immediately informs the relevant authorities about detection of unauthorized tree felling. An important part is the renewable energy management module, which provides stable power in remote areas through solar panels and rechargeable batteries. In addition, the data analysis module provides valuable information about forest conditions, including temperature and humidity. These interconnected modules form a comprehensive software system that aims to prevent illegal logging, improve real-time monitoring and support the sustainability of forested ecosystems.

VI. REQUIREMENTS

A. Hardware Requirement

- Arduino Nano Boards
- ADX- 335 (Vibration Sensor)
- DHT11 sensor
- 6V/5W Solar Panel & Rechargeable Battery (Li-ion cell)
- NRF 24L01-Module
- Charging kit
- GSM-Module SIM 800

- 12V DC Adapter
- 16*2 LCD Display

B. Software Requirements

- Arduino IDE
- Embedded C
- Communication Protocols (e.g., NRF 24L01, GSM Protocol)
- Database (Ubidots)
- Web Development Technologies (e.g., HTML, CSS or JavaScript)
- Security Libraries and Practices

VII. APPLICATION OF PROPOSED SYSTEM

The proposed system has a wide range of applications, making it a versatile solution to address the problem of illegal tree felling. Its primary use lies in the conservation and protection of forests and ecosystems. By continuously monitoring the forest environment and quickly detecting unauthorized cutting of trees, it helps authorities respond quickly and minimize environmental damage. The system is also used in data analysis, which provides valuable insights for forest management, research and decision making. Its adaptability to remote and inaccessible areas makes it an ideal option for protecting large, forested areas. The integration of renewable energy sources also makes it suitable for off-grid placement, contributing to sustainability. In short, the programs of the proposed system range from environmental conservation to scientific research, all while promoting responsible forest management and protecting our natural resources.

VIII. PROJECT PLAN

Sr.No.	Description	Start Date	End Date
1	Project Planning	24/July/2023	31/July/2023
2	Requirement Gathering	01/August/2023	10/August/2023
3	Design	11/August/2023	20/August/2023
4	Coding or Implementation	21/August/2023	14/October/2023
5	Testing	15/October/2023	27/October/2023
6	Deployment	28/October/2023	10/November/2023

IX. ADVANTAGES, DISADVANTAGES

Early Detection of Illegal Tree cutting, Environmentally Sustainable, Enhanced Forest Conservation, Community engagement and awareness, prompt-alert mechanism, Scalability and Adaptability.

Initial close setups, Maintenance and technical expertise, dependence on Technology, Privacy and Data security, Limited Internet Connectivity, Environmental Impact of Production.

X. CONCLUSIONS AND FUTUREWORK

Conclusion:

The tree protection system based on the Internet of Things and automation represents a pioneering solution in the fight against illegal tree felling and the promotion of responsible forest management. By combining advanced technology and community engagement, it seeks to protect forests and ecosystems while empowering communities. Challenges lie ahead, but the project's potential to transform our approach to environmental protection is promising.

Future work:

In the future, we envision improving the system with cutting-edge sensors, AI-driven analytics, predictive models, and wider global adoption. Energy efficiency, collaboration, public awareness and improved user interfaces will increase the impact of the project. We aim to expand its reach, support regulatory advocacy and continually evaluate its environmental impact, all while keeping data security and community engagement at the forefront.

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