



Vanyarakshak: Intelligent System Approach To Intrusion And Rain Detection In The Forest

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Abstract: According to the International Consortium on Combating Wildlife Crime (ICWC), wildlife crime is a widespread issue in India that threatens ecosystems, jeopardizes food security, and impairs rural communities' quality of life. For addressing this challenge, we propose VanyaRakshak, an intelligent surveillance system leveraging IoT (Internet of Things) devices for intrusion and Rain detection in forests. To monitor and catch poacher invasions in forest areas, the system combines a person and rain identification model using pre-trained models, Rainwater sensor and PIR sensor, and deploying IoT-enabled devices such as Arduino Uno. The system sends an SMS alert using GSM and GPS model.

Index Terms - Animal Safety, Rainwater sensor, Passive Infrared sensor (PIR), Intrusion detection.

I. INTRODUCTION

India is a bio-diverse country, with nearly 6.5% of the world's known wildlife species. Approximately, 7.6% of the world's mammals and 12.6% of the world's birds are found in India. Tiger, rhino, and star tortoise poaching are among India's most serious wildlife crimes. Due to poaching for their skin and bones to provide an illegal market, tigers are a threatened species. Asian medicines use their body parts, while tiger claws were used in jewelers. Due to the Indian forest and wildlife coverage being vast covering 80.9 million hectares which is 24.62% of the total geographical area up to 2021, a high volume of resources that can withstand various changes in weather conditions are required to protect every nook and corner. Hence, the paper has implemented a technology-based surveillance system for Indian rainforests by leveraging IoT devices, wireless network equipment and an intelligent hybrid model which will detect Person in the forest and alert the government officers promptly. The technology also has Rainwater detection and GSM and GPS Models, allowing it to deliver real-time aural alerts.

II. OBJECTIVES

The main goal of this project is to develop a system capable of detecting driver drowsiness and issuing timely alerts. Our primary aim was to explore various algorithms for intrusion and rain detection using openly accessible datasets. Additionally, GSM and GPS model was incorporated for detailed intrusion and rain Alert of optimizing resource allocation and channeling manpower for response activities. Our focus was on using technology and data-centric approaches to protect forest regions from unlawful activities while preserving ecological sanctity.

III. BLOCK DIAGRAM REPRESENTATION

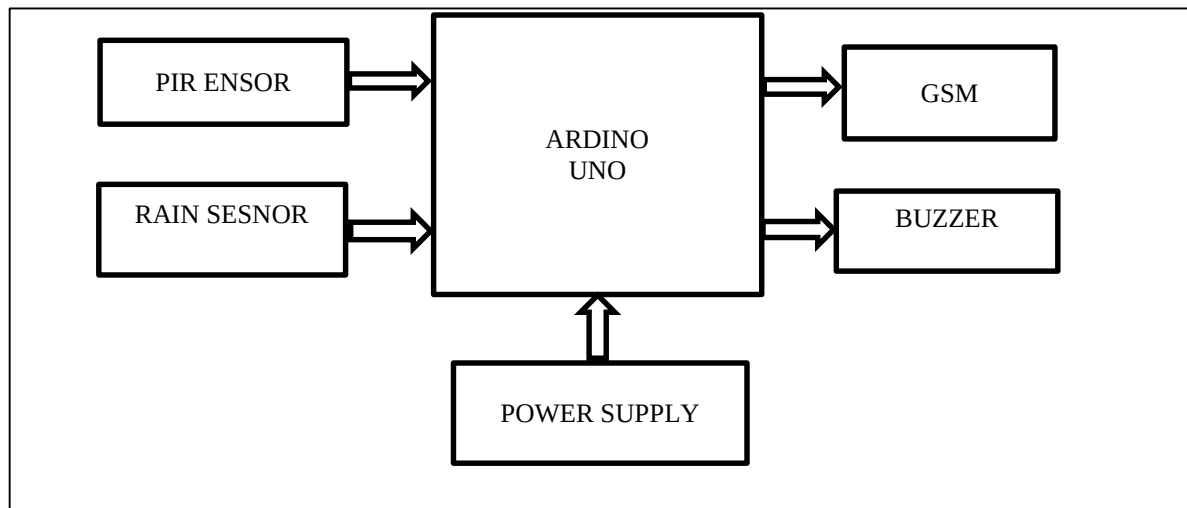


Figure 1: Block diagram.

This block diagram (figure 1) illustrates a system built around an Arduino Uno that manages inputs from two sensors and controls two output devices. PIR sensor detects motion, such as human presence, and sends a signal to the Arduino. Rainwater sensor senses the presence of rain and also communicates its data to the Arduino. Arduino Uno Acting as the central controller, it receives signals from both the PIR and Rain sensors. Based on the programmed logic, it processes these inputs and decides how to respond. When system triggered by the Arduino, the GSM module can send text messages or alerts to a mobile phone, informing about detected motion or rain. The buzzer serves as an audible alarm that is activated by the Arduino when certain conditions are met, such as motion detection or rainfall. Power Supply provides the necessary electrical power to the Arduino and the connected components to ensure smooth operation.

IV. COMPONENTS

4.1 Arduino Uno

The Arduino Uno is one kind of microcontroller board based on ATmega328, and Uno is an Italian term which means one. This board includes digital I/O pins-14, a power jack, analog i/ps-6, ceramic resonator-A16 MHz, a USB connection, an RST button, and an ICSP header. The power supply of this board can be done with the help of an AC to DC adapter, a USB cable, otherwise a battery. Arduino Uno is used to control all the system and operate automatically, such as, alerting, real time monitoring etc.

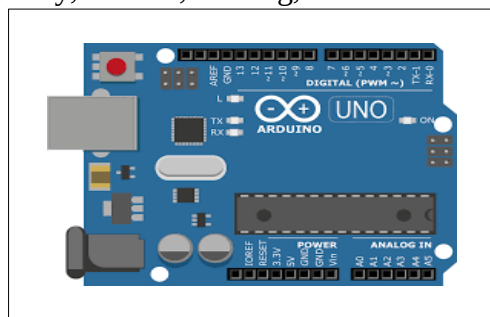


Figure 2: Arduino Uno.

4.2 Piezo Buzzer

The buzzer's primary function is to alert the user to take immediate action. The piezoelectric buzzer produces sound by utilizing the piezoelectric effect. When an electric potential is applied, it generates pressure variations, creating an audible alert.



Figure 3: Piezo buzzer

4.3 PIR Sensor

PIR sensors mostly used in PIR-based motion detectors. The PIR sensor consists of 3 pins. Generally, PIR sensor can detect animal/human movement in a requirement range. PIR is made of a pyroelectric sensor, which is able to detect different levels of infrared radiation. The detector itself does not emit any energy but passively receives it.

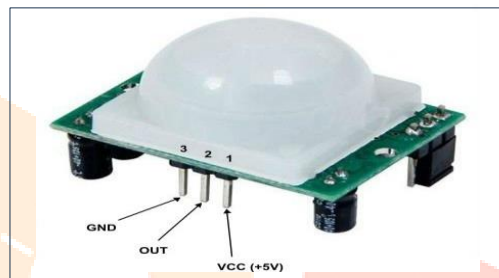


Figure 4: PIR sensor

4.4 GSM Module

GSM (Global System for Mobile Communications) has proven to be a valuable tool for remote communication and data transfer, especially in areas with limited internet connectivity. GSM technology plays a crucial role in enhancing the efficiency and effectiveness of intelligent systems designed for forest surveillance and environmental monitoring. By enabling real-time alerts, remote communication, and data transfer from inaccessible regions, GSM significantly contributes to the proactive protection. This GSM technology is providing real time alert to the Respected officers through SMS alert, whenever the intrusion or rain detected in the forest.



Figure 5: GSM module

4.5 Rainwater Sensor

With the weather being as unpredictable as ever, it's easy to leave your skylights open, only for it to suddenly start raining, leaving the interior below at risk. With this rain sensor, however, you can stop this from happening. This sensor detecting the real time monitoring sensor which detecting rain in the forest.

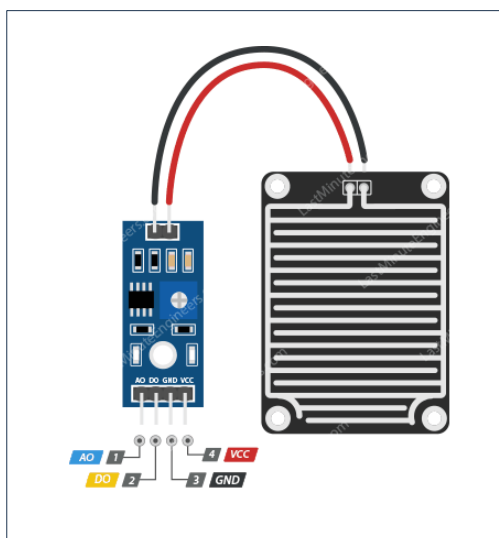


Figure 6: Rainwater Sensor

4.6 Voltage Regulator 7850

A DC power supply system, which maintains constant voltage irrespective of fluctuations in the main supply or variation in the load, is known as Regulated Power supply. The 7805 regulator is known as fixed voltage regulator.

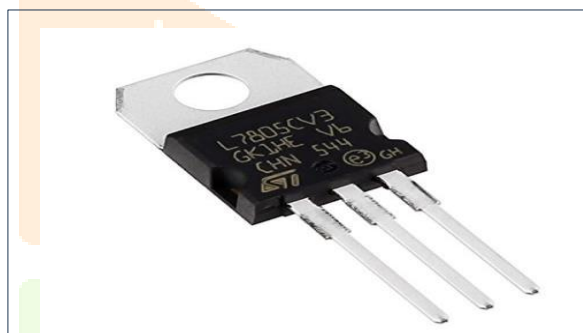


Figure 7: Voltage Regulator 7850

4.7 LCD Display

A 16×2 LCD display is a liquid crystal display which is providing 16 characters in each of its two rows, providing a total of 32 characters of information. This was commonly used to display status information of various electronic devices. This display is displaying real time rain the intrusion detected.

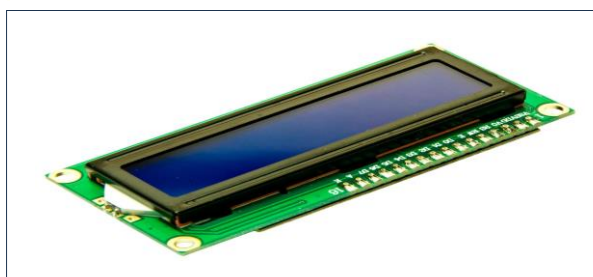


Figure 8: LCD Display

v. WORKING

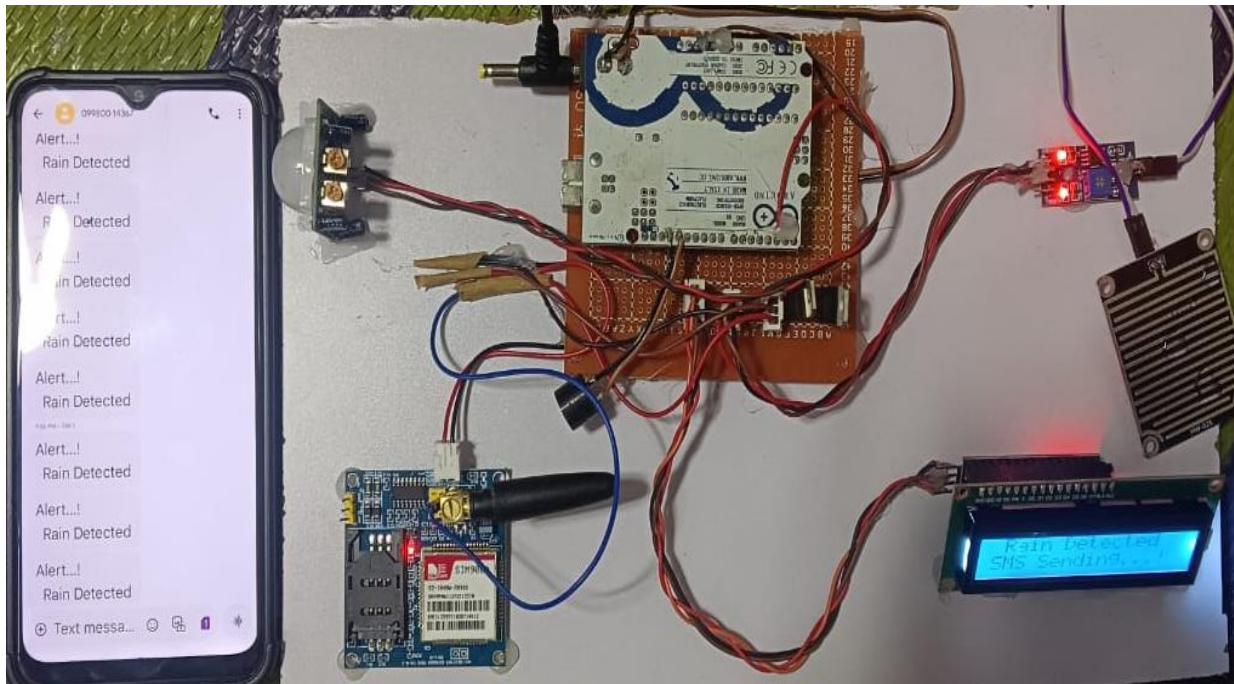


Figure 9: Working System.

The VanyaRakshak system is designed to enhance forest safety by detecting both human intrusion and weather conditions like rainfall. It uses a combination of sensors and communication modules integrated with an Arduino Uno to create a real-time alert system. PIR Sensor constantly scans the surroundings for movement or heat signatures typically associated with humans or animals. If any motion is detected, it instantly sending a signal to the Arduino Uno. Rainwater Sensor continuously monitors for rainfall. When it detects water droplets, it alerts the Arduino Uno about the rainfall. The Arduino Uno acts as the brain of the system. It receives inputs from both the PIR and rain sensors. Once data is received it verifies if motion has been detected (possible intrusion). It checks for rain conditions. Based on the type of input or combination of inputs, it decides what actions to perform. When an intrusion or rain is detected, the buzzer sounds an alert to notify nearby person or act as a deterrent for intruders. Simultaneously, the Arduino sending a signal to the GSM module to transmit an SMS alert to designated mobile numbers. This ensures that forest rangers or concerned authorities are informed even if they're far from the site. The system is powered using a regulated power supply to ensure consistent performance, even in remote forest areas. VanyaRakshak is a smart forest monitoring system that detects unauthorized entry and weather changes using basic electronics. It acts as a first-level security and awareness system that can be crucial in preventing illegal activities like poaching or logging, and can also help in environmental monitoring. (Fig. 9).

vi. RESULTS

The rain sensor responded instantly upon the presence of water, allowing the system to notify about rainfall events promptly. Upon detection by either sensor, the Arduino Uno processed the data and correctly activated the buzzer and GSM module. The buzzer emitted a clear audible signal, useful for alerting forest personnel or scaring away potential intruders. The GSM module reliably sent SMS alerts to the registered phone number, confirming remote notification functionality. The system operated smoothly using a stable power supply, and all components interacted efficiently without delay. These results indicate that the VanyaRakshak system can serve as a low-cost, effective solution for basic forest surveillance, environmental monitoring, and real-time alerting in remote areas.

VII. FUTURE SCOPE

The VanyaRakshak system has strong potential for future enhancements to make it even more efficient and reliable for forest protection. Adding cameras could allow the system to capture images or live video whenever movement is detected, providing visual evidence of intrusions. Incorporating solar panels can make the system self-sustainable, eliminating the need of external power sources in remote forest locations. Employing thermal imaging sensors and sound detectors can improve detection accuracy, especially during night time or harsh weather conditions. Expanding the system into a network of multiple nodes would enable large area monitoring, where all units communicate with a central station. Machine learning models can be used to distinguish between human, animal, and environmental movements, reducing false alarms. Developing a dedicated mobile app for real-time notifications, live monitoring, and system control would enhance usability for forest officers. By incorporating these improvements, VanyaRakshak can evolve into a comprehensive, intelligent surveillance and monitoring system for large-scale forest management.

VIII. CONCLUSION

The VanyaRakshak system successfully demonstrates an effective and affordable solution for enhancing forest security and environmental monitoring. By utilizing simple yet powerful components like the PIR sensor, rain sensor, GSM module, and Arduino Uno, the system can reliably detect human presence and rainfall in real-time. It provides immediate alerts through both audible alarms and SMS notifications, ensuring timely response to potential threats or weather changes. Through its practical design and reliable performance, VanyaRakshak proves that technology can play a crucial role in forest conservation efforts. With further enhancements, it has the potential to become an integral part of smart forest management systems, helping protect wildlife, natural resources, and maintain ecological balance.

IX. ADVANTAGES

- This enhances the overall safety of wildlife and natural resources.
- Timely response through real-time alerts by delivering immediate alerts to officials.
- The system minimizes the need for constant human patrols.
- Real time threat detection
- Enhanced Wildlife protection

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