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Implementation Of Wildlife Conservation Using AI

Mrs. Sushma Varadaraja, Rakshitha K H, Shashikala V, Yashashwini K V, Sahana R Assistant Professor, Student, Student, Student, Student,

Dept. of Computer Science and Engineering, ATME College of Engineering, Mysuru, India

Abstract:

In recent years, wildlife conservation efforts have increasingly turned to technological solutions to mitigate threats to animal populations and their habitats. This project proposes an AI-based wildlife conservation system that integrates multiple sensor-based features for comprehensive monitoring and protection of animals in the wild. The system includes real-time animal health tracking through heartbeat and temperature sensors connected to an ESP-32 module, providing vital information on the well-being of monitored animals. An anti-poaching mechanism, utilizing an accelerometer, detects unusual movement patterns associated with poaching incidents, ensuring prompt alerts to forest officials. Additionally, a forest fire detection module uses camera-based image processing to identify potential fires, automatically activating a water pump system to mitigate the fire's spread. In any detected incident, notifications are instantly sent to forest officials for rapid response. This AI-driven system aims to support wildlife conservation by offering a proactive, real-time solution to protect endangered animals and their habitats from both natural and human threats.

Index Terms – Fire detection, Anti-pouching, Health Monitoring.

I. INTRODUCTION

Wildlife conservation is crucial for maintaining biodiversity and ecological balance. However, wildlife faces various threats, including poaching, health issues, and natural disasters such as forest fires. Traditional monitoring methods are often labor-intensive and lack real-time intervention capabilities. To address these challenges, artificial intelligence (AI) and sensor technology offer innovative solutions for continuous wildlife monitoring and protection. This project presents an AI-enabled conservation system, integrating animal health tracking,anti- poaching measures, and forest fire detection to provide a comprehensive approach to wildlife preservation. However, wildlife is greatly distressed due to deforestation which forces them to move into human habitats. Forest fire is an important hazard that occurs periodically due to natural changes, human activities,and other factors. In the contemporary years there is a persistent increase in forest fires that causes damage to crops, wildlife as well as humans. Therefore, a network-based wireless sensor is used for forest fires to achieve high verdict accuracy for early detection. The approach targets detecting animals and sending cautionary messages using a bot. Also,Anti-pouching aims to develop and implement technology systems within wildlife conservation areas to monitor for potential poaching activity. The first part describes the segmentation technique we use to extract persistent dynamical envelopes of pixels into the images. We describe the temporal algorithm at the pixel level and the spatial analysis to bring together connected pixels into the same envelopes. One such solution involves the integration of accelerometers and artificial intelligence to detect and mitigate unauthorized tree-cutting activities in wildlife conservation areas. Accelerometers, which measure motion and vibrations, can be deployed on trees to sense activities indicative of tree cutting, such as sawing or chopping. The goal of Wildlife conservation is to protect the diversity of life on earth and promote the sustainable use of natural resources.

II. OBJECTIVE

1. To monitor and analyze animal health in real-time using heartbeat and temperature sensors connected to ESP-32, identifying early signs of illness or distress.

2. To detect and prevent poaching activities through an accelerometer that senses unusual movement, alerting forest officials to potential poaching incidents.

3. To enable rapid detection and response to forest fires using a camera-based fire detection system, which triggers an automated water pump to control fire spread.

4. To establish a notification system that promptly informs forest authorities of health issues, poaching events, or fire outbreaks, facilitating timely intervention and rescue operations.

III. PROPOSED SYSTEM

The proposed AI-based wildlife conservation system is designed to address the limitations of existing solutions by integrating various monitoring and detection capabilities. Animal Health Tracking: Using heartbeat and temperature sensors connected to ESP-32, this module monitors the health of animals continuously, enabling real-time alerts if abnormalities are detected.Anti- Poaching Detection: An accelerometer tracks movement patterns, identifying unusual or sudden movements associated with poaching activities. When abnormal activity is detected, notifications are sent to forest authorities for rapid intervention. Forest Fire Detection and Response: A camera- based AI algorithm detects smoke or fire within the forest. Upon detection, an automated water pump is activated to contain the fire until emergency res ponders arrive. This module also sends immediate notifications to forest officials. Notification System: The system sends alerts to forest officials via mobile notifications, providing details on the type and location of each incident for quick response.

1. To Detect Tree Cutting in the Field a sensor Connected to Node MCU is used to detect the motion. When the Sensor inputs the alert will be given to the concerned person.

2. To Detect fire the Field-Sensor Connected to Node MCU is used to detect the fire. When the fire Sensor inputs the alert will be given to the concerned person.

IV. To send Notifications to farmers and Forest Officials intimation alert is sent to farmers about animal presence. We Use Twilit Messenger to send intimation alert to farmer.

V. METHODOLOGY

In today's complex systems, a well-designed system architecture is crucial for ensuring the efficiency, scalability, and maintainability of the system. A system architecture provides a blueprint for the system's components, interactions, and data flows, enabling developers to design and implement the system in a structured and organized manner.

The system architecture of our Wild Life Conservation Using Artificial Intelligence contains:

a) **Fire Detection**.

Sensors: Use flame sensors, smoke detectors, and temperature sensors.

AI Models: AI models can analyze sensor data for patterns indicative of forest fire

Io T: Deploy a network of Io T-enabled sensors to monitor large areas in real time.

b) **Heartbeat and Temperature Monitoring**.

Purpose: Monitor the health of endangered species.

Sensors: Attach non-invasive wearables (e.g., collars with heartbeat and temperature sensors) to animals.

AI Models: Analyze fluctuations in animal vitals to detect distress or unusual activity.

IoT: Real-time data transmission to central monitoring systems via wired networks.

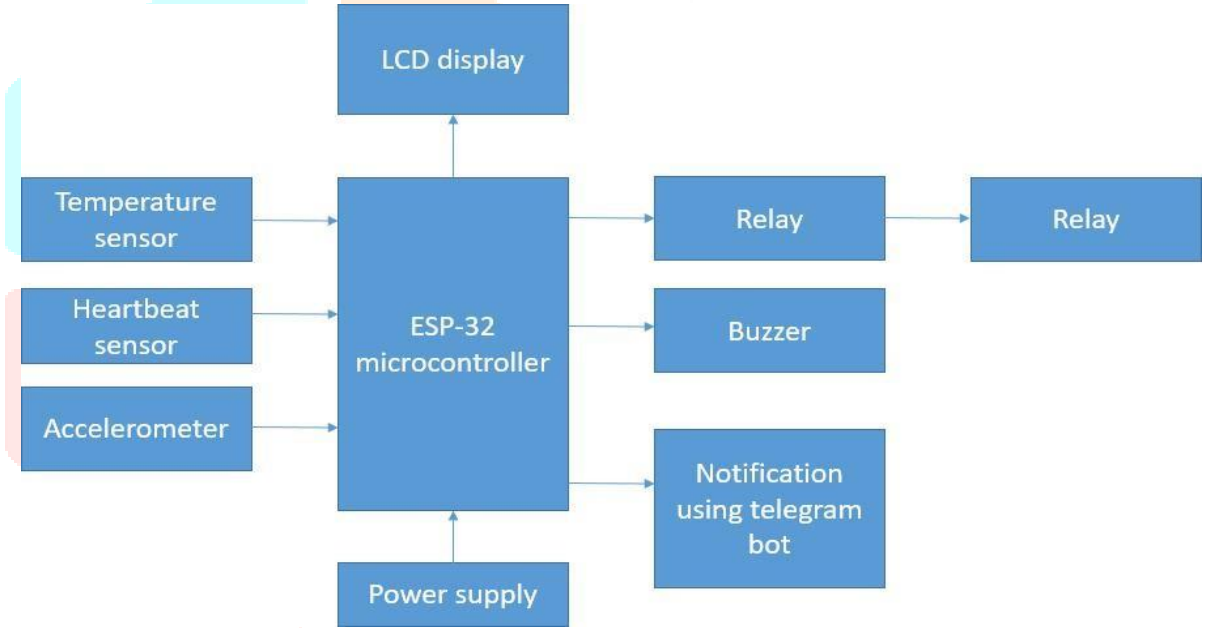
c) **Anti-poaching and Tree Cutting Prevention**.

AI Cameras: Use infrared cameras and motion sensors to detect human activities in restricted zones.

Image Recognition: AI models identify unauthorized individuals, vehicles, or tree-cutting equipment.

Io T Alarms: Trigger alarms and send alerts to authorities when unauthorized activity is detected.

Figure 1: Methodology of Wildlife Conservation using AI



VI. IMPLEMENTATION

1. Fire detection:

Flame sensors: (e.g., IR Flame Sensor Module)

Smoke Sensor: (e.g., MQ-2)

Temperature Sensor: (e.g., DHT11/DHT22)

2. Heartbeat Monitoring:

Pulse Sensor :(e.g., SEN-11574)

3. Anti-Poaching & Tree Cutting:

PIR Motion Sensors: (to detect human presence) **Sound Sensors:** (to detect chainsaw sounds)

Camera Module: (for image capture and AI processing)

4. Microcontroller:

Arduino U no, Mega, or ESP32 (ESP32 for Io T-enabled capabilities)

5. Communication Modules:

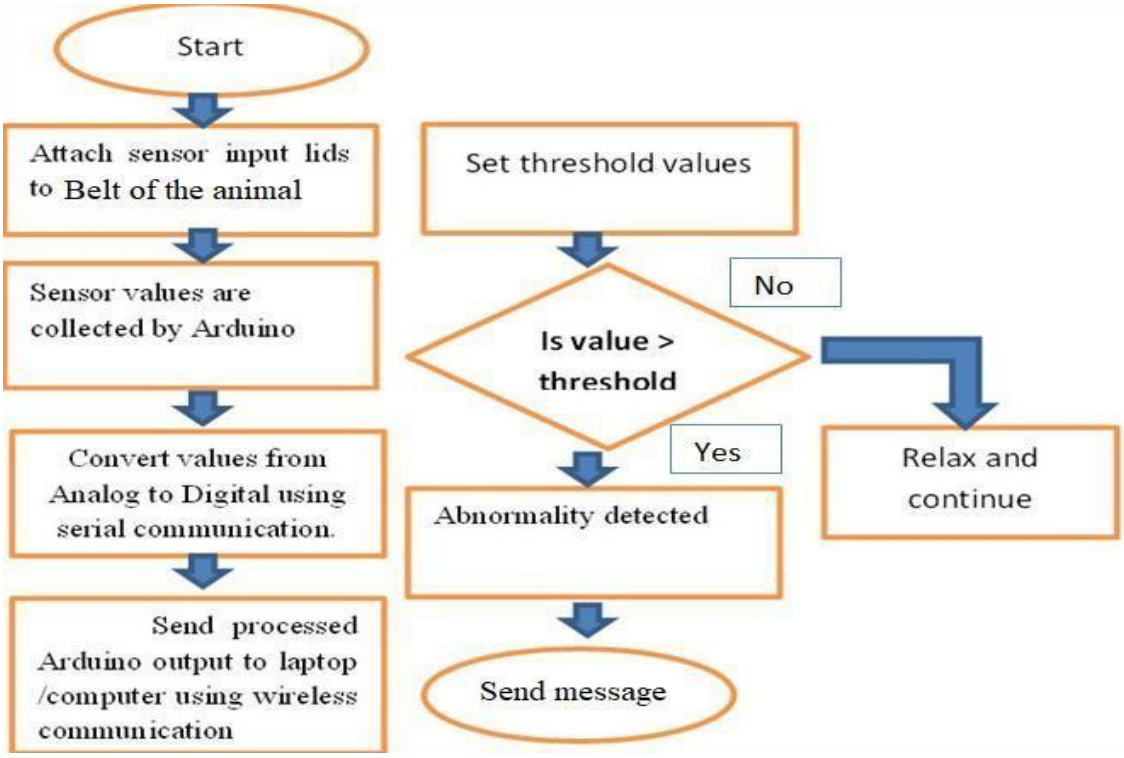
Wi-Fi Module (e.g., ESP8266 or ESP32)

GSM Module (e.g., SIM900) for SMS alerts in low-network areas

6. Power Supply:

Solar Panels (for remote operation) Rechargeable Battery Packs

Figure 2: Flowchart of Wildlife conversation using AI implementation



VII. RESULTS

1. Enhanced Safety and Protection:

Early fire detection reduces the risk of catastrophic damage to forest ecosystems.

Real-time anti-poaching and tree-cutting alerts bolster conservation efforts.
Monitoring animal health ensures timely interventions, improving survival rates for endangered species.

2. Operational Efficiency:

AI and Io T technologies automate monitoring, minimizing the need for manual intervention. Salable solutions can cover vast forest areas with fewer resources.

3. Data-Driven Insights:

AI analysis provides actionable intelligence, aiding decision-making for forest officials. Block-chain ensures transparency and accountability in operations.

Fig 3: Implementing wildlife conservation using camera AI

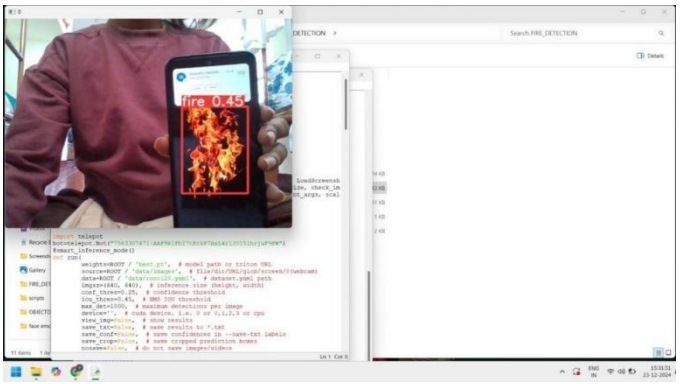


Fig 4: Fire detection is identified through web through the display unit.

Fig 5: Fire detected alert message comes through message the display unit

Fig 6: Fire detected response is given through the

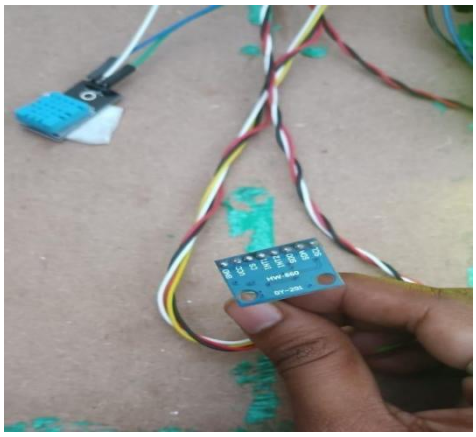


Fig7: The tree cutting sensor

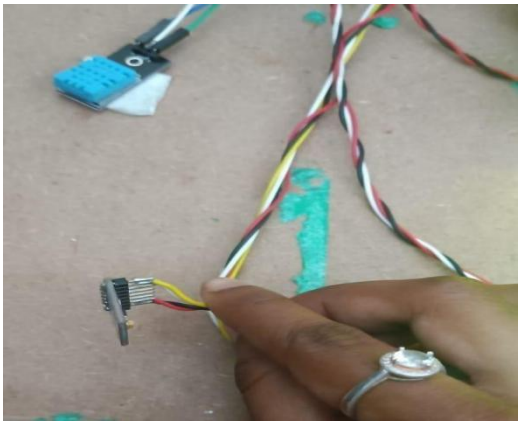


Fig8:The tree cutting sensor gets activated

When it gets distracted vertical and Horizontal

Fig9: Tree cutting happening alert is displayed Through the display unit

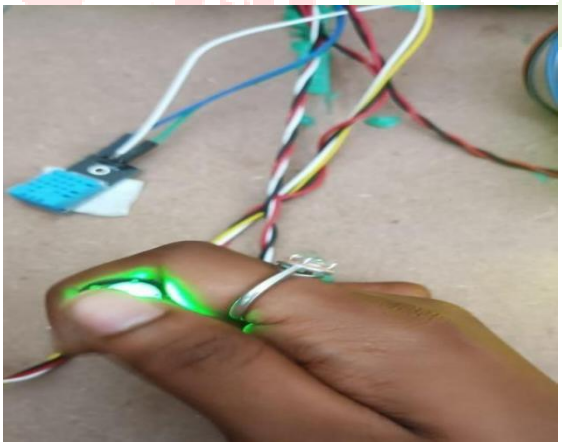


Fig 10:Heart beat sensor checks the heartbeat

Fig 11:Detects both normal and abnormal heart rates.

Fig 12: Displays the temperature value in the display unit

VIII. CONCLUSION

The main idea of this paper is to integrate two existing modules developed in different platforms and technologies into a single module and platform. The four different sensors along with the GP module are compatible to perform in an embedded system. The accuracy of the values relies on the microcontroller which uses explicit ADC to give the accurate details in case of health monitoring and location tracking. This model will work as a strong backbone in the case of analyzing any health-related issues for an animal. The future of this paper will lie in developing the hardware further to a wearable device that can be connected to any device using the Internet of Things. However since the wearable device can pose a serious security threat i.e., the device can be removed from the animal's body and can result in theft. Hence, a smart theft detection system or burglar alarm can be placed on the hardware to alert the user and send a notification to their device in case someone hampers the wearable device. This AI-powered conservation system ensures real-time monitoring and response to threats like fire outbreaks, illegal deforestation, and animal health emergencies. By integrating AI with sensors, a proactive approach to wildlife safety is achieved, reducing risks and enabling efficient intervention. The implementation of AI-powered wildlife conservation using display units provides an innovative and efficient approach to protecting forests and endangered species. By integrating fire detection, health monitoring, and anti-poaching mechanisms with AI, IoT, and cloud computing, this system enables real-time threat detection and response. Despite challenges like power supply and connectivity in remote areas, the long-term benefits—such as early fire detection, improved animal health monitoring, and enhanced law enforcement—make this a promising and scalable solution for conservation efforts.

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