GEETHANJALI COLLEGE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Title: “SPECIES CLASSIFICATION WIRELESS CAMERA FOR FOREST SURVAY AND MONITORING”

BATCH – 17

21R11A04P8 – M. VIGNESH
21R11A04N0 – J. NAVYA SREE
21R11A04N5 – K. VIGNESH

Guide: G.Venkateshwarlu
Assistant Professor

INTRODUCTION

Wildlife monitoring is crucial for conservation and ecological research, but traditional methods can be invasive and time-consuming. This project introduces a **Species Classification Wireless Camera** designed to survey and track wildlife efficiently. Using deep learning and a wireless camera, the system can identify different species in real time and send data remotely for analysis. Built with **Python, TensorFlow, and Raspberry Pi**, it ensures high accuracy, even in challenging environments. The setup is energy-efficient, portable, and ideal for remote forest regions. With potential applications in biodiversity studies and conservation, this smart system aims to revolutionize wildlife tracking with minimal human intervention.

PROBLEM STATEMENT

Monitoring wildlife in forests is challenging due to difficult terrains, unpredictable animal movements, and the need for non-invasive methods. Traditional techniques like manual tracking and trap cameras are time-consuming, labor-intensive, and often lack real-time data processing. There is a need for an **automated, efficient, and remote** solution to classify and track species accurately. This project addresses these challenges by developing a **wireless camera system with deep learning** to identify wildlife in real time. By using **low-power devices and AI-driven image recognition**, it enables researchers to **monitor biodiversity, track animal behavior, and assess ecosystem health** without disturbing natural habitats.

OBJECTIVES

- **Automated Wildlife Monitoring:**

  Develop a **smart, AI-powered wireless camera system** that can **automatically detect, classify, and track wildlife** in real time. This reduces the need for manual observation and enhances research efficiency.

- **Energy-Efficient and Remote Deployment:**

  Ensure the system operates **independently in remote forest regions** using **low-power devices, solar energy, and wireless communication** for seamless data transmission and long-term monitoring.

- **Contribution to Conservation and Research:**

  Provide valuable data for **biodiversity studies, ecosystem analysis, and wildlife conservation** by enabling researchers to track animal movements, identify endangered species, and monitor habitat changes effectively.

EXISTING SYSTEM V/S PROPOSED SYSTEM

- **Existing System:**

  Traditional wildlife monitoring relies on **manual surveys, camera traps, and satellite tracking**, which are **time-consuming, labor-intensive, and lack real-time data processing**. These methods often require **physical retrieval of data**, limiting efficiency and responsiveness. Additionally, conventional cameras may struggle with **low-light conditions and species misidentification**.

- **Proposed System:**

  The proposed system **automates species identification** using a **wireless camera with deep learning (CNNs trained in Python and TensorFlow)** for real-time classification. It transmits data remotely, operates on **low power using solar energy**, and works efficiently in challenging environments. This ensures **accurate, real-time, and non-invasive wildlife monitoring** for conservation and research.

SYSTEM ARCHITECTURE AND METHODOLOGY

- **System Architecture:**

The system consists of a **high-resolution wireless camera** connected to a **processing unit (Raspberry Pi or Jetson Nano)** running a **deep learning model (CNNs trained with TensorFlow/Py Torch)**. Captured images are transmitted via **Wi-Fi, LoRa, or 4G** to a central server for analysis and visualization. The system is housed in a **weatherproof, solar-powered enclosure** for continuous operation in remote forests.

- **Methodology:**

1. **Image Capture** – The camera captures wildlife images in real time.
2. **Processing & Classification** – AI models analyze images to identify species.
3. **Wireless Transmission** – Data is sent remotely for monitoring.
4. **Analysis & Conservation** – Researchers track biodiversity and ecosystem changes.

COMPONENTS AND TECHNOLOGY USED

Hardware Components:

- **Camera Module** – High-resolution, night-vision capable (e.g., Raspberry Pi Camera).
- **Processing Unit** – Raspberry Pi or NVIDIA Jetson Nano for real-time AI processing.
- **Wireless Communication** – Wi-Fi, LoRa, or 4G for remote data transmission.
- **Power Source** – Solar panels and batteries for long-term deployment.
- **Enclosure** – Weatherproof housing for protection in harsh environments.

Software Technology Used:

- **Programming Language** – Python 3.x.
- **Libraries & Frameworks** – OpenCV, TensorFlow/Py Torch, Scikit-learn.
- **IoT Communication** – MQTT/HTTP for seamless data transfer.
- **Web Interface** – Flask/Django for monitoring and visualization.

IMPLEMENTATION PLAN

- **Requirement Analysis** – Identify necessary hardware (Raspberry Pi, camera module, power source) and software (Python, TensorFlow, OpenCV).
- **Hardware Setup** – Assemble the **wireless camera module, processing unit, and communication modules** in a weatherproof enclosure.
- **Model Training & Integration** – Train a **CNN-based deep learning model** for species classification and integrate it with the camera.

- **Wireless Communication Setup** – Configure **Wi-Fi, LoRa, or 4G** for real-time data transmission.
- **Testing & Optimization** – Deploy in a controlled environment, refine accuracy, and ensure **energy efficiency** before field deployment.
- **Final Deployment & Monitoring** – Install in forest regions for **continuous wildlife tracking and ecosystem monitoring**.

CURRENT STATUS AND CHALLENGES

- **CURRENT STATUS:**

  Currently, **30% of the project has been completed**, including the integration of the **wireless camera and deep learning model** for species classification. Initial testing has shown promising results, but further improvements are needed. The next steps involve **enhancing species detection accuracy, optimizing real-time data transmission, and ensuring reliable power management**. With continued development, this system will become a powerful tool for **wildlife monitoring and conservation efforts**.

- **CHALLENGES:**

  Key challenges include **ensuring continuous power supply** in remote areas, improving **species identification in low-light conditions**, and handling **network connectivity issues** for real-time data transfer. Additionally, expanding the **species database** and optimizing **tracking algorithms** remain critical for enhancing accuracy and efficiency.

FUTURE SCOPE

The **Species Classification Wireless Camera** has immense potential for future advancements in wildlife monitoring and conservation. One key improvement is **expanding the species database** to recognize a wider range of animals, including rare and endangered species. Integrating **advanced tracking algorithms** and AI-driven behavior analysis can further enhance its capabilities by identifying animal movements, migration patterns, and interactions.

Future versions of the system can incorporate **thermal imaging and night-vision enhancements** to improve accuracy in low-light conditions. Additionally, using **edge AI processing** with more powerful hardware like **NVIDIA Jetson Nano** can reduce dependency on remote servers, making real-time processing faster and more efficient.

The system can also be adapted for **anti-poaching surveillance**, helping authorities track illegal activities in protected areas. Further, collaboration with **environmental organizations and research institutes** can help deploy this technology on a larger scale, making it a game-changer for biodiversity conservation and ecological studies worldwide.

THANK YOU