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Wild Animal Intrusion Detection System Using Raspberry PI

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Abstract: This project is used to protect the farmland from animals by using Raspberry pi. Wild animals are special challenge for the farmers throughout the world. Animals like wild boars, elephants, monkeys etc. cause serious damage to crops. In this project we are presenting a procedure to ward them off, by creating a system which detects the animal and creates the different sound that irritates the animal.

After the detection the intimation is sent. Wild Animal Intrusion Detection System (WAIDS) is a technologically advanced solution designed to monitor and detect the presence of animals in specific areas, with applications ranging from wildlife conservation to agricultural protection. This system integrates data processing algorithms, and communication mechanisms to accurately identify and respond to animal intrusions

Keywords: Image Processing, Protection, Raspberry PI, Human Safety, Object Detection

I. INTRODUCTION

The Wild Animal Intrusion Detection System harnesses the power of Raspberry Pi coupled with a Raspberry Pi camera, utilizing cutting-edge technologies such as OpenCV and TensorFlow.

This project aims to address the growing concerns surrounding human-wildlife conflicts by providing an effective and scalable solution for early intrusion detection. At its core, the system employs the Raspberry Pi, a versatile and cost-effective single-board computer, as the main processing unit. Paired with the Raspberry Pi camera module, it captures high-resolution images and videos of the monitored area. OpenCV, an open-source computer vision library, is leveraged for real-time image processing tasks such as object detection, tracking, and classification.

TensorFlow, a powerful machine learning framework, further enhances the system's capabilities by enabling the development and deployment of custom deep learning models for wildlife detection. The integration of these technologies enables the system to analyze live camera feeds and identify potential instances of wild animal intrusion accurately.

Upon detection, the system can trigger various responses, such as sounding alarms, sending alerts to designated authorities or individuals, or activating deterrent devices to mitigate the risk of human-wildlife conflicts. With its efficient hardware configuration and advanced software capabilities, the Wild Animal Intrusion Detection System offers a cost-effective and scalable solution for protecting human habitats while promoting harmonious coexistence with wildlife.

II. RELATED WORK

The project on wild animal intrusion detection system utilizing Raspberry Pi and Raspberry Pi Camera with OpenCV and TensorFlow builds upon several existing works in the field of wildlife monitoring and computer vision. Numerous studies have explored the use of camera traps and image processing techniques for wildlife surveillance, aiming to mitigate human-wildlife conflicts and enhance conservation efforts.

Previous research has demonstrated the effectiveness of using Raspberry Pi and its accessories for low-cost, energy-efficient computing tasks, including image capture and processing in remote environments. Additionally, the integration of OpenCV provides robust capabilities for image preprocessing, feature extraction, and object detection, while TensorFlow facilitates the implementation of deep learning models for more advanced classification tasks. By leveraging these technologies, the proposed intrusion detection system aims to improve the accuracy and efficiency of wildlife monitoring, enabling real-time detection and alerting of animal intrusions in vulnerable areas. This project contributes to the ongoing efforts to develop innovative solutions for wildlife conservation and conflict mitigation, with potential applications in various ecosystems and conservation scenarios.

III. LITRATURE SURVEY

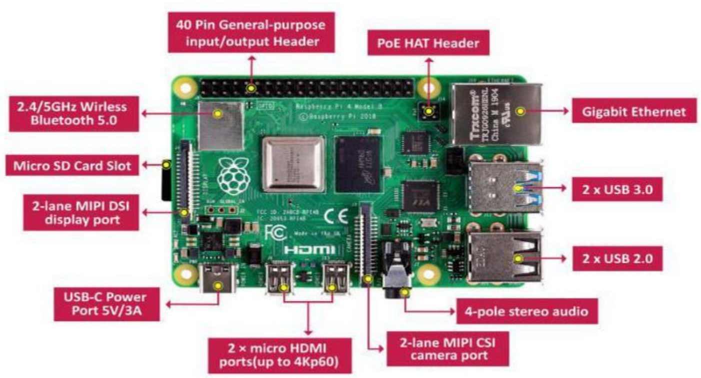
Recent literature spanning diverse fields like ecology, computer science, and sensor technology reveals a dynamic landscape of research endeavours. This survey entails an analysis of sensor technologies, including but not limited to thermal imaging cameras, passive infrared sensors, acoustic devices, and radio-frequency identification (RFID) systems, each catering to different environmental conditions and animal behaviour patterns.

A predominant trend observed across these studies is the integration of advanced computational techniques such as machine learning algorithms, deep learning models, and computer vision methods to process and analyse data collected by these sensors, enabling automated identification, classification, and tracking of wildlife species. Furthermore, the deployment of wireless sensor networks, coupled with the advancements in data transmission protocols, has expanded the reach of these systems into remote and challenging terrains, allowing for real-time monitoring and response to animal intrusion events. Nevertheless, gaps in the literature reveal the necessity for comprehensive field trials, standardized evaluation metrics, and robust, cost-effective solutions to address the complexities mitigating human-wildlife conflicts and supporting conservation efforts effectively.

IV. DISCRIPTION OF COMPONENTS

A. Raspberry PI

1) The Raspberry Pi 4 is a versatile and affordable single-board computer developed by the Raspberry Pi Foundation. It features a quad-core ARM Cortex-A72 processor running at 1.5GHz, with options for 2GB, 4GB, or 8GB of RAM. The board includes dual-band 802.11ac Wi-Fi, Bluetooth 5.0, Gigabit Ethernet, two USB 3.0 ports, two USB 2.0 ports, and micro-HDMI ports for dual-display support at resolutions up to 4K.
2) It also has a microSD card slot for storage and GPIO pins for interfacing with external devices. The Raspberry Pi 4 supports various operating systems, including Raspbian (now Raspberry Pi OS), Ubuntu, and others, making it suitable for a wide range of projects such as home automation, media centres, retro gaming consoles, and more. Its low cost, small form factor, and community support have made it immensely popular among hobbyists, educators, and professionals alike.



B. Relay

1) A 1-channel relay has a single switch or channel, which means it can only control one load or circuit at a time. This type of relay is typically used in simple applications where only one load needs to be switched, such as turning a single light on or off.
2) It is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load

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C. Speaker

1) A wireless Bluetooth speaker is a sound device that is aimed at making it easier for you to enjoy.

2) Wireless Bluetooth speaker uses the same technology as a car radio. It connects directly to the source of the sound, instead of needing wires.

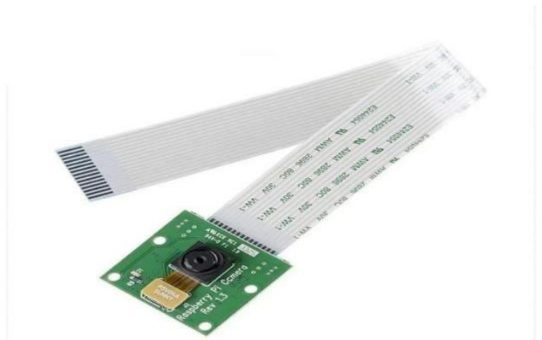
D. Camera

1) This is a Raspberry Pi 5MP Camera Module

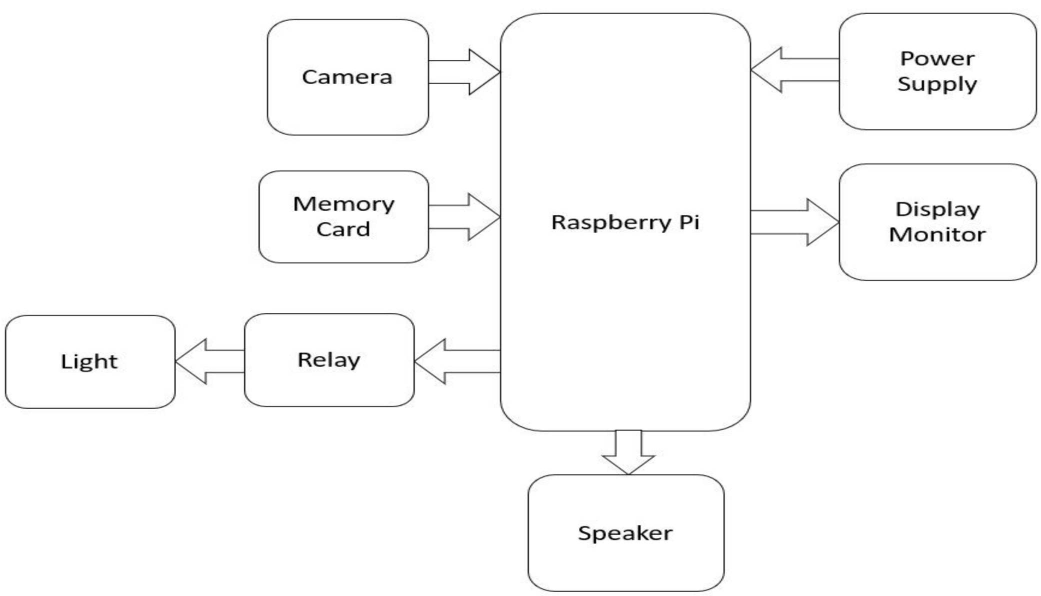
2) This raspberry pi camera has a 5-megapixel native resolution sensor capable of 2592 x1944 pixel static images.

3) This supports 1080p30, 720p60 video.

4) The camera is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system

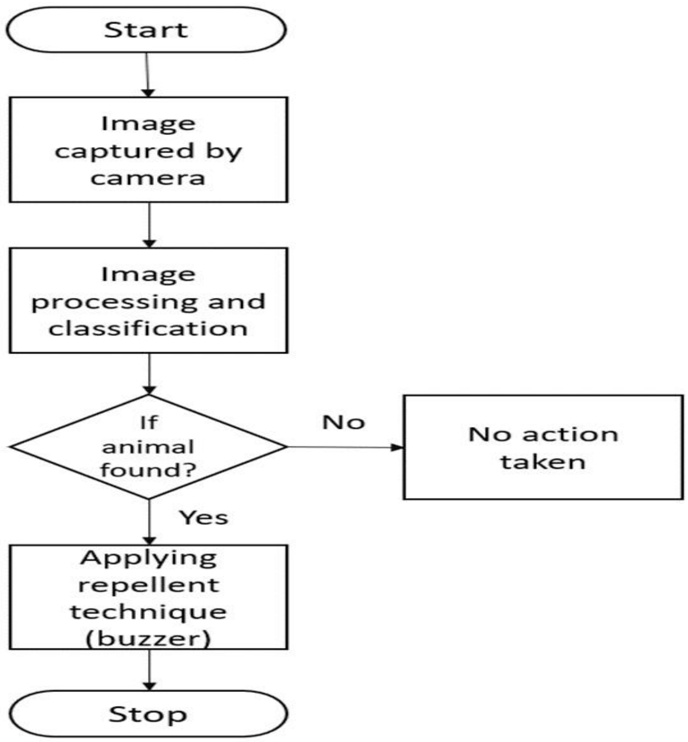


V. BLOCK DIAGRAM



VI. METHDOLOGY

1) Step 1-Start.
2) Step 2-Image/video capturing from the camera.
3) Step 3-Convert video into frames using OpenCV.
4) Step 4-Compare camera captured frames with the pre-trained model.
5) Step 5- Store the data of animal that is its image and name, id with timestamp attached in a database. Step 6-If animal is not present in the database store its names as {none} in a different database with timestamp attached . display the output on the monitor (using Rasp controller).
6) Step 7- Stop



VII. PRACTICAL IMAGE

1)

2)

VIII. CONCLUSION

The project aimed to develop an advanced Wild Animal Intrusion Detection System by integrating Raspberry Pi, Raspberry Pi Camera, OpenCV, and TensorFlow. Through the fusion of image processing, machine learning, and real-time analysis, the system achieved robust detection and classification of wild animals in designated areas. Leveraging OpenCV, the Raspberry Pi Camera captured images and videos, while TensorFlow facilitated the implementation of deep learning models for animal recognition. This allowed for more accurate identification of wildlife species, enabling proactive measures to be taken in response to intrusions.

By utilizing Raspberry Pi's compact form factor and low power consumption, the system offered a cost-effective and scalable solution for remote monitoring of wildlife habitats. Alerts were triggered upon animal detection, notifying users via email or SMS, thereby enabling timely intervention to mitigate human-wildlife conflicts and ensure the safety of both humans and animals. The project showcased the potential of combining edge computing, computer vision, and deep learning techniques to address wildlife conservation challenges, offering valuable insights for habitat monitoring, ecological research, and wildlife management initiatives.

IX. FUTURE SCOPE

1) *Integration with IoT:* Explore the potential integration of the Raspberry Pi-based system with Internet of Things (IoT) devices for real-time data transmission and remote monitoring. This could enhance the scalability and accessibility of the system.
2) *Enhanced Machine Learning Algorithms:* Investigate advanced machine learning techniques, such as deep learning, for improving the accuracy and efficiency of animal detection. This includes optimizing models for edge computing on Raspberry Pi to handle complex computations.
3) *Energy Efficiency:* Focus on optimizing the system's energy consumption to prolong battery life, especially in remote or off-grid areas where power sources may be limited. This could involve the development of low-power algorithms and hardware optimizations.

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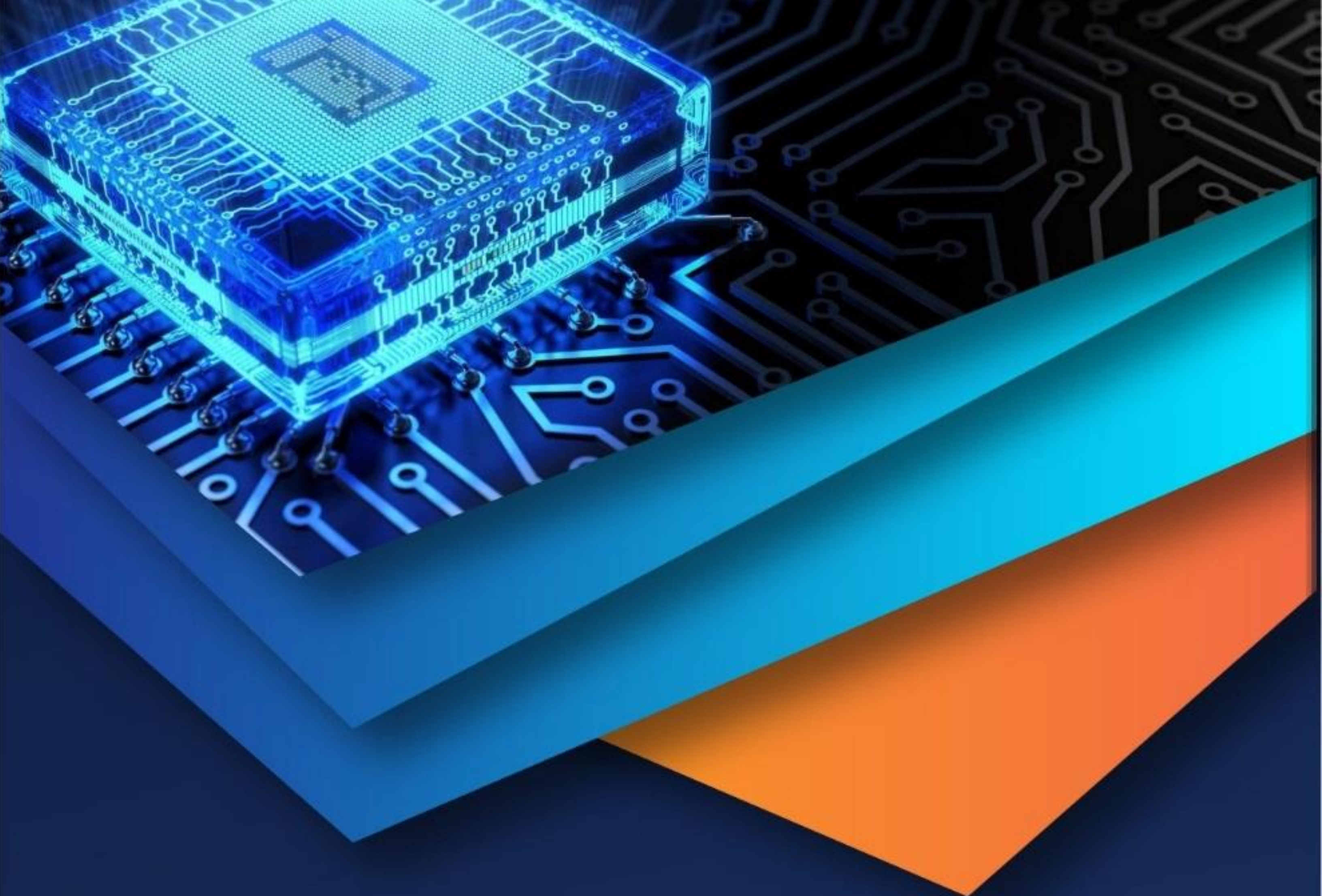

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