Forest Alert System

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Abstract **- The Python Forest Alert System is an intelligence alerting solution that leverages Artificial Intelligence and Convolutional Neural Networks (CNN) to identify animal in real time using CCTV video footage. In agriculture, one of the major social problems that is existing in the present is the damaging of the crops by the wild animals. Wild animal intrusion has always been a persisting problem to the farmers. Some of the animals that act as a threat to the crops are deer, wild boar, moles, elephants, monkeys and others. These animals may feed on crops and also run around the field in the absence of farmer and thus cause damage to those crops. This may in turn results in significant loss in the yield and will cause additional financial protection in order to deal with the aftermath of the damage. Every farmer, while utilizing his production, should also be aware of the fact that animals are also existing in the same place and that they need to be protected from any probable suffering. This problem must be attended immediately and an effective solution must be created and accomplished. Thus, this project aims to address this problem. One of the significant issues that is faced by farmers are their yields get damaged by wild animals that intrudes their crops. Wild animal interruption has forever been a continuing issue to the ranchers. A portion of the animals that go about as a danger to the yields are wild boar, deer, wild buffalo, elephants, tiger, monkeys and others. These animals might benefit from crops and furthermore go around the field without any rancher and accordingly make damage those yields. This may thus bring about critical misfortune in the yield and will make extra monetary security all together arrangement with the result of the damage. In any case, wildlife-friendly cultivating regularly brings about lower effectiveness. In this manner, endeavor have been made to foster programmed frameworks fit for identifying wild animals in the harvest without superfluous discontinuance of the cultivating activity. For instance, a recognition framework in light of infrared sensors has been answered to lessen wildlife mortality in Germany A UAV-based framework for roe deer grovel location is introduced. The creators show that warm imaging can be utilized to identify roe deer grovels based on elevated film, but the location is as yet performed physically.**

Keywords: **convolutional neural network (CNN), Artificial intelligence (AI), Deep learning, Crop protection, Rural area protection**

I. INTRODUCTION

In many regions, farmers suffer significant crop losses every year because animals such as deer, wild boars, elephants, monkeys, and other wildlife enter agricultural fields in search of food. This ongoing human–wildlife conflict not only affects agricultural productivity but also creates economic instability for farmers and rural communities. In addition to crop destruction, forest areas are also vulnerable to illegal activities such as unauthorized tree cutting and poaching, which further damage the environment and disturb ecological balance .Traditional monitoring methods, including manual patrolling and basic fencing systems, are often inefficient labour-intensive, and unable to provide real-time alerts. There is therefore a critical need for a smart, automated, and reliable monitoring system that can detect threats instantly and notify authorities or farmers before major damage occurs. The Python Forest Alert System addresses this need by integrating Artificial Intelligence (AI) and Con volutional Neural Networks (CNN) to analyze live CCTV video footage and accurately identify animal presence in real time. By continuously monitoring surveillance cameras installed in forest borders and farmland areas, the system can detect animal movement, classify the detected species, and trigger immediate alert notifications. This proactive approach helps in preventing crop damage, reducing financial losses, protecting wildlife habitats, and minimizing conflicts between humans and animals. Overall, the proposed system provides an intelligent, cost-effective, and scalable solution aimed at enhancing environmental protection, safeguarding agricultural resources, and supporting sustainable rural development.

1.1 Methodology

The proposed system is developed using Artificial Intelligence and Convolutional Neural Network (CNN) to detect wild animals in real time. Initially, a dataset of various wild animal images such as deer, elephants, monkeys, and wild boars is collected from

different sources. These images are then pre processed by resizing, labeling, and normalizing to ensure consistency and improve model performance. The processed dataset is used to train a CNN model, which learns to extract important features like shape, texture, and patterns of animals. Once the model is trained, it is integrated with CCTV cameras installed in agricultural fields. The system continuously captures live video footage, converts it into frames, and analyzes each frame using the trained CNN model. Whenever an animal is detected, the system identifies the type of animal and immediately triggers an alert mechanism such as an alarm or notification to the farmer. This real-time detection and alert system helps in preventing crop damage by enabling timely action against wild animal intrusion.

II. LITERATURE SURVEY

We focus on a Smart Agriculture application that uses computer vision and ultrasound emission to create virtual fences to protect crops from ungulate attacks, resulting in considerable reductions in production losses. This is an innovative technique that can generate ultrasound to drive away ungulates and thus protect crops from attack, this paper details the design, development, and testing of an intelligent animal repulsion system that can detect and recognise ungulates as well as generate ultrasonic signals tailored to each ungulate species. The proposed system is based on image processing platforms that offer a good balance of performance, cost, and energy consumption while also taking into account the constraints imposed by the rural environment in terms of energy supply and network connectivity. Experiments show that by deploying animal detectors on power-efficient edge computing devices, the intelligent animal repelling system can be implemented without sacrificing mean average precision or meeting real-time requirements. This article also highlights best practices, as well as how the integrated technology can aid farmers and agronomists in their decision-making and management processes. Computer neural networking, deep learning.

Manual ways such as constructing different kinds of fences and using natural repellents are effective but they are not cost efficient. Increasing the manpower is not an ideal solution to this problem. Initially projects were taken up to drive away the animals automatically by using hardware components like controllers and sensors. One such approach is - Camera interfaced to the raspberry pi module. Camera is used to captures an image of wild animal and send captured image to the Raspberry pi module. When image taken by the raspberry pi, it is compared with database image. After comparing images, if the wild animal is detected then it gives commands to GSM (Global System for Mobile communication) module. GSM used to send the message to the owner of the farm. To get the output in the form of audio, connect raspberry pi to the speaker.

2.1.EXISTING SYSTEM

Animals are shocked by electric fences, and there is a risk of fire if plants or shrubs grow too close to the fence. If the fence is not adequately maintained, electromagnetic interference occurs, interfering with telephone and radio signals. Despite being the most often utilized farm protection measure, electric fencing is harmful to both animals and humans. Thorn fencing, which is also a widely used tactic, provides a similar effect to the prior technique. Manual monitoring by farmers or forest guards is commonly used, which requires continuous human presence and is not practical during night time. Watch towers and patrol systems are labour-intensive and cannot guarantee 24/7 surveillance. Alarm systems based only on motion sensors may trigger false alerts due to wind, rain, or moving plants. Traditional fencing methods (electric and thorn fencing) only create a physical barrier but do not provide real-time identification or alert notifications. These systems do not differentiate between animals and humans, leading to unnecessary panic or delayed response .Lack of remote monitoring facilities makes it difficult for authorities to respond quickly to emergencies. Maintenance cost of electric fences and physical barriers is high over long-term usage. Existing systems do not store data for future analysis, making it difficult to track animal movement patterns. No intelligent classification of animal species is available in traditional systems. Many rural areas lack advanced technological solutions due to high installation and operational costs.

2.2 PURPOSE OF THE WORK

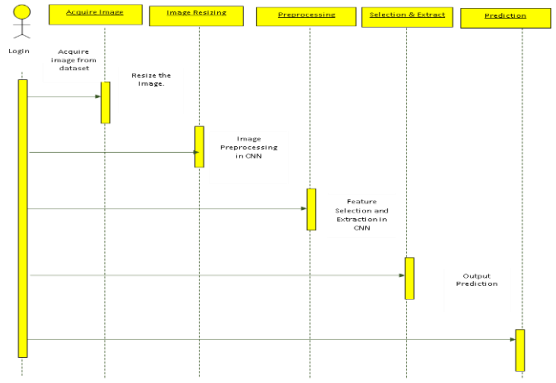
The main purpose of the Forest Alert System is to prevent wild animals from entering agricultural lands and causing crop damage. The system aims to: Detect animal movement near farmland boundaries in real time. Alert farmers immediately when wild animals

approach or enter the field. Reduce crop destruction caused by animals such as deer, wild boar, elephants, and monkeys. Minimize financial losses faced by farmers due to wildlife intrusion. Protect both farmers and animals by preventing harmful physical confrontation. Replace traditional methods like electric fencing with a safer and smarter solution. Provide continuous 24/7 monitoring without the need for constant human supervision. Support sustainable agriculture and reduce human–wildlife conflict.

III. PROPOSED SYSTEM

The proposed prototype uses a software that recognizes animals and classifies them accordingly. The software required can be developed using open CV and deep learning algorithms. This can be embedded with a ultrasonic repellant hardware system that drives the animal away from the farm and also intimates the farmer about this. This is a low cost project that aims at driving the animals away without causing any lethal harm or death to them, as well as not destroying the natural resources in the deployed environment.

The proposed system is designed as an intelligent and automated solution to prevent animal intrusion in agricultural fields by combining computer vision technology with a non-lethal ultrasonic repellent mechanism. The system continuously monitors the farm area using a camera that captures real-time images or video streams. These images are processed using Open CV techniques such as image enhancement, noise reduction, and object detection to improve accuracy. A deep learning model, particularly a Convolutional Neural Network (CNN), is trained using a dataset of various animals commonly responsible for crop damage. Once an animal is detected and classified, the system immediately activates the ultrasonic repellent device, which emits high-frequency sound waves that are uncomfortable for animals but completely harmless, thereby driving them away from the farmland safely. In addition to repelling the animals, the system also sends instant notifications to the farmer through GSM, Wi-Fi, or mobile application alerts. This ensures that the farmer is informed about the intrusion in real time and can take additional action if necessary. The system can also store detection data such as date, time, and type of animal, which can later be analyzed to understand intrusion patterns and improve preventive strategies. The hardware components, including a Raspberry Pi or microcontroller, camera module, ultrasonic emitter, and communication module, are integrated into a compact and energy-efficient setup. The system can be powered using batteries or solar panels, making it suitable for rural and remote agricultural areas.



IV. MODULES

1.DATASET

For developing this system we have to collect some dataset. Here our datasets are images of wild animals of 8 different classes. After collecting the dataset it will go through an image pre-processing step, it is also called as annotation and we will get our final dataset for training. These dataset

Contains the class file, images and txt files of those images, which is automatically created after successful annotation.

2. TRAINING

Now we can start to train our system, we are using google colab for training and testing. While the dataset is going through training process it will generate some weights that is later useful for testing. Training process may take approximately 12-15 hours, but testing can be done easily with the help of those trained weights.

3. TESTING

While testing the system it will check an image and look for matching class and it will predict an output which have an accuracy near to 1. After that it will send these predicted class name to firebase which is a real-time database, further the class name will be notified to the user's device.

V. RESULT AND CONCLUSION

The Forest Alert System for Animal Detection was successfully designed and implemented using

sensors, camera modules, and an AI-based detection model. The system was tested under different conditions to evaluate its performance. During testing, the system was able to detect animalmove ment using motion sensors and capture images through the camera. The captured images were processed using image processing techniques, and the trained model successfully identified animals with satisfactory accuracy. Whenever an animal was detected, the system generated alerts in real-time through buzzer notifications and message alerts. This ensured that nearby people were informed immediately about the presence of animals. The system demonstrated reliable performance in daytime conditions, while moderate accuracy was observed during night time or low-light conditions. The response time of the system was found to be quick, making it suitable for real-time applications. Overall, the results indicate that the proposed system is effective in detecting animals and providing timely alerts, thereby helping to reduce human-animal conflicts and improving safety in forest border areas.

The Forest Alert System for Animal Detection is an innovative and effective solution designed to minimize human-animal conflicts. By utilizing modern technologies such as sensors, image processing, and artificial intelligence, the system enables real-time detection and alert mechanisms. It enhances safety for both humans and wildlife, especially in forest border areas. Furthermore, the system is cost-effective, scalable, and adaptable to various environmental conditions. With future enhancements such as GPS tracking, drone surveillance, and mobile integration, the system can become more robust and efficient. Overall, this project contributes significantly to wildlife conservation and public safety.

VI. FUTURE ENHANCEMENTS

The proposed Forest Alert System for Animal Detection can be further enhanced in several ways to improve its efficiency, accuracy, and usability: Improved Detection Accuracy Advanced deep learning algorithms can be implemented to increase the accuracy of animal detection under different environmental conditions such as low light, fog, and rain: Integration with Mobile Applications A dedicated mobile application can be developed to provide real-time alerts, notifications, and location tracking for forest officials and nearby residents. GPS-based Animal Tracking Incorporating GPS technology can help in tracking the movement patterns of animals, enabling better monitoring and preventive measures. Drone-based Monitoring System Drones can be integrated into the system to monitor large and inaccessible forest areas, thereby expanding the coverage of the detection system. Solar-powered Operation The system can be powered using solar energy to ensure continuous operation in remote forest areas where electricity supply is limited. Cloud Data Storage and Analytics Storing collected data in cloud platforms can help in analyzing animal movement trends and improving decision-making for wildlife protection. Multi-species Detection Capability Automated Warning Mechanisms Automatic activation of alarms, lights, or voice alerts can be implemented to warn people instantly when an animal is detected.

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