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Elephant Detection System Using AI

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Abstarct: Elephant Detection System Using AI is a comprehensive, multi-stakeholder platform designed to detect and manage wild elephant intrusions using camera-based surveillance. Utilizing advanced detection algorithms and real-time image recognition, the system identifies elephants in human-inhabited or protected areas, triggering automatic alerts and notifications across various sectors such as Forestry, Krishibhavan, Hospitals, Insurance agencies, and Farmers. This platform integrates user roles including Administrator, Forestry, Hospital, Krishibhavan, Insurance, Farmer, and General Public to efficiently manage alerts, complaints, claims, and communications arising from elephant-related incidents. The system not only facilitates early warning and prevention mechanisms through cameras and alarms but also ensures a streamlined post-incident workflow involving reporting, insurance claim processing, and support services. To ensure high detection accuracy in dynamic environments, the system uses feature extraction techniques based on shape, color, and texture, and is trained with datasets curated for real-world elephant images captured under various lighting and background conditions. This increases the model's reliability and reduces false positives, even in cluttered scenes or nighttime footage. Additionally, the system includes modules for report generation, feedback management, and public awareness, making it not just a technological solution but also a platform for community engagement. The alerts are delivered via SMS, web notifications, or alarm systems, allowing residents and forest officers to respond proactively. This improves safety, reduces crop and property damage, and supports conservation efforts by enabling non-invasive monitoring.

Key Words: Elephant Detection, Yolo, Video analytics, CNN, Computer vision

1.INTRODUCTION

Elephant Tracking is an elephant detection and alert system which aimed at classifying elephants as harmful and harmless and invoking diverse stages of alerts when they are nearing to the human habitat. This project has finished the task it set to accomplish. This project has been a similar learning experience to that of first
learning programming languages. The detection and alerts was classified into three levels. The classifier was trained and tested successfully in variety of scenarios

and was able to recognize the elephants accurately. The corresponding alert system was also working correctly. The training loss graph was also generated. To conclude with the project fulfill the tasks it aimed to accomplish by the inspection. Almost every aspect is done. The result was good for students like us, who don't have any prior experience in the area of machine learning. The project helped us to deepen our roots in the field of ml and ai which is regarded as the future of the technological advancements. Also this work made us understand the value of team work and its benefits in future. Elephant detection and recognition based on image processing is a widely concentrating field in research. To better understand the complexities of natural eco-system and to manage and protect them for famers and peoples, it is necessary to classify the elephant species. The motivation for this project is to build an automatic system for detection and recognizing elephant species for elephant researchers and wild life farmers and peoples. The cameras that we use in the industries are quite expensive and there is limitation in shutter on-off cycle. Hence it must have a proper recognition system. In this work a combination of both domestic and wild elephants is considered. Technology used in this research can be further extended to use in monitoring and security purposes. In this work a viewpoint independent inter-species elephant recognition method is proposed using a combination of shape, color and texture features. This method has been tested on four different elephant species. Neural network was used to classify the elephant species. Detailed research was carried out about how individual features perform and the performance of combined features. The system provides facility to access information about nearby hospitals, krishibhavan, forestry according to their needs, within less time and no cost. With the rapid development of smart any devices, it becomes very popular that people more prefer to access the information through this flexible way.
The system has five types: forestry, hospital, krishibhavan, farmers and peoples. There is only one forestry in this application. The application is intended to do different major tasks i.e. Track, claims and search. Claims management keeps track of all the farmers and people related claims. It includes new complaint registration, listing complaints, checking status.

2. RELATED WORK

The concept of detecting animals using technology has been explored in several earlier studies, especially in the fields of wildlife monitoring, human-animal conflict reduction, and agriculture protection. In many cases, researchers used image processing, machine learning, or sensor-based systems to identify animals and track their movement. However, most of these systems were limited in real-time performance, accuracy, or accessibility for common users like farmers.
In the past, researchers have used traditional motion sensors, infrared cameras, or GPS collars to monitor elephant movement.

But these methods had drawbacks – they were either too expensive, not real-time, or could only be used by experts. Recent advancements in deep learning, especially using Convolutional Neural Networks (CNNs) and real-time object detection algorithms like YOLO (You Only Look Once), have made it possible to accurately detect animals from video streams. Projects like SqueezeNet, YOLOv5, and YOLOv8 have shown good results in object recognition tasks.

3. SYSTEM OVERVIEW

Real time object detection as the name suggests is an art of detecting various objects at that particular time. Object detection has always been a daring task. For this purpose, faster computation power is required in the identification of an object. However, any system working in actual time generates data which is unlabeled and which has a requirement of huge set of labeled data for potent training purposes. In this work, there is a presentation of a developed application for detecting specific objects (i.e. elephants) based on OpenCV libraries. Agile detection methods have been proposed via this paper for the purpose of real time object detection. The world's biodiversity has been diminishing at an unparalleled rate in recent years. Many species are on the verge of extinction, and the remaining populations must be safeguarded. Elephant in their native habitats can be reliably monitored. Because of their usefulness and reliability in gathering data on animals in big volumes, more efficiently, and without operator hindrance, the use of automatic hidden cameras for wildlife monitoring has skyrocketed in today's globe. However, manually analyzing and extracting information from such vast datasets gathered by camera traps can be time- consuming and tiresome. This is a significant barrier for biologists and ecologists who want to observe wildlife in a natural setting. The authors have surveyed all the recent papers related to animal recognition and identification in the wild using deep learning. By studying various papers authors have identified different algorithms and techniques for the identification of endangered elephant and found out better approaches with results having higher accuracy and efficiency.

Workflow Summary:

- Live video capture using CCTV or camera in forest/farm areas.
- Image processing with OpenCV to extract frames.
- Object detection using the YOLOv8 AI model to identify animals.
- Classification of animals as harmful or harmless.
- Real-time alerts (e.g., bee sound) activated if a harmful elephant is detected.
- Notifications sent to farmers, forestry, hospitals, and Krishibhavan.
- Role-based access system for different users (Admin, Farmer, Hospital, etc.).
- Claim registration by farmers for crop/property damage.

Technologies and Tools Used:

- YOLOv8: For Object detection
- CNN : For feature extraction and classification.
- OpenCV: Image processing and video analysis.
- XAMPP/WAMP: Local server for PHP and MySQL.
- Jupyter Notebook / VS Code: For code writing and testing.

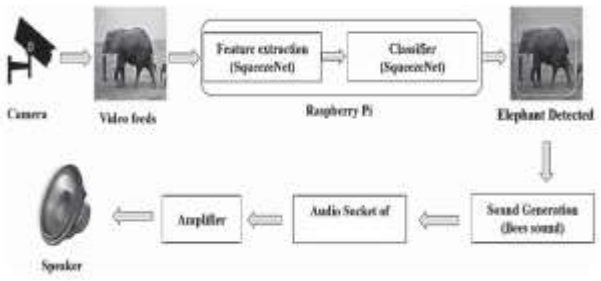

Fig – 1: System Design

3.1 Module Description :

1.Region Selection: As different animals may appear in any positions of the image and have different aspect ratios or sizes, it is a natural choice to scan the whole image with a multiscale sliding window. Although this exhaustive strategy can find out all possible positions of the animals.

2.Feature Extraction: To recognize different animals, we need to extract visual features which can provide a semantic and robust representation features are the representative ones. This is due to the fact that these features can produce representations features can produce representationsassociated with complex cells in human brain.

3.Adminstrator: Admin need to login with valid login credentials. They can view all the registered user details and their reports. They can also view the Forestry and Krishibhavan and their reports. Admin can view all the feedback given by the user, Hospital, krishibhavan , Farmer and Hospital.

4.Farmers: In this section, Farmers can register if they are a new Farmers else they can login with their credentials.They can search hospital . Search section will help the farmer to find the nearest hospital for their treatment. They can register complaint. They can see the claims that are pending that they have send to the forest department or krishibhavan. users can check complaint status .

5.User: In this section, user can register if they are a new user else they can login with their credentials. User can set the profile and edit it at any time. They can search hospital . Search section will help the user to find the nearest hospital for their treatment. They can see the claims that are pending that they have send to the forest department or krishibhavan. users can check complaint status .

6.Krishibhavan: Krishibhavan needs to register if they are new else they can login with their credentials. Login to the profile ,they can see the claims that are pending. Search it, update it can be done. They can send reports about the things that happened. They can send messages to the forestry and farmer regarding the claim that had been caused due to wild animals.

7.Hospital: Hospital need to register if they are new else they can login with their credentials. If the password is forgotten, they can reset it by the forgot password and they can log in to their profile. They can see the claims that are pending that they have send to the forest department or krishibhavan. Search the claims and update it and also reports can be send. They can send messages to the

forestry and users regarding the claims. They can search the user and forestry department.

8.Forestry: Forestry department need to register if they are new else they can login with their credentials. Both the people and farmer can register their complaints on it. It is reviewed by the Forestry Department. They can see pending claim, search the complaints and they give report on the basis of complaints.

4. METHODOLOGY:

1.Data Collection and Surveillance Setup
CCTV cameras or surveillance systems are placed in elephant-prone areas like forest borders, farms, and village outskirts. These cameras continuously capture video data for analysis.

2. Frame Extraction and Preprocessing
The video stream is divided into frames using **OpenCV**. Each frame is resized and preprocessed (noise removal, normalization) to prepare it for accurate detection by the AI model.

3. Object Detection with YOLOv8
Each frame is passed through the **YOLOv8 (You Only Look Once version 8)** model, which is pre-trained to detect animals, especially elephants. YOLOv8 can detect elephants in real-time with high speed and accuracy by generating bounding boxes and confidence scores.

4. Deep Feature Extraction
To identify elephants clearly, deep features like shape, contour, and texture are extracted using **Convolutional Neural Networks (CNN)**. Lightweight models like **SqueezeNet** may also be used for faster detection with less computational power.

5. Classification and Risk Detection
If an animal is detected, the system classifies it as an elephant or not. Upon identifying an elephant, the system evaluates whether the situation poses a risk (e.g., approaching farmlands, houses, or roads).

6. Alert Generation
Once an elephant is confirmed, the system:

- Triggers a **local alert** (e.g., bee sound or siren) using a speaker connected to a device like **Raspberry Pi** to try to scare away the elephant.
- Sends **real-time alerts and notifications** to the concerned departments (Forestry, Krishibhavan, Farmers, and Hospitals).

7. Report and Complaint Handling
The detection is logged into the system's web portal. Concerned stakeholders (Forest officials, farmers, hospitals) can:

- View incident reports
- Submit or verify claims
- Communicate with each other
- Monitor elephant activity history

8. Role-Based Web Access
The project includes a web-based system developed in **PHP and MySQL** where users can:

- Admin: View all system activity and manage users
- Farmers: Register complaints, view detection alerts, and claim status
- Forestry: Respond to incidents and complaints
- Hospital/Krishibhavan: Verify injury/crop damage claims.

5. REQUIREMENT SPECFICATION

Requirement Specification is the part of the project which gives the details about the hardware and software requirements of our project. It also details the features of the programming language used.

5.1 Hardware Requirements

Table 1: Hardware Requirements

Component	Specfication
Processor	Intel
RAM	4GB
Main Memory	8GB RAM
Processing Speed	600 MHZ
Hard Disk Drive	1 TB
Keyboard	104 Keys
Camera	Standard HD Resolution

5.2 Software Requirement

Table 2: Software Requirement

Component	Specification
Front-end	HTML,CSS,JavaScript
Back-end	Python,PHP
Database	MySQL
Server Environment	XAMPP(Apache,MySQL. PHP,phpMyAdmin)
Dataset Format	CSV
Development IDE	Anaconda
Operating System	Windows 11

6. SYSTEM IMPLEMENTATION

System implementation is the final phase that is putting the utility into action. Implementation is the state in the project where theoretical design turned into a working system. The most crucial stage is achieving anew successful system and giving confidence in the new system that it will work efficiently and effectively. The system is implemented only after thorough checking is done and it is found working according to the specifications. System implementation is in the final phase. i.e., integrating all modules into live action. Implementation is the state in the project where

theoretical design is turned into a working system. The implementation stage is a system project in its own right. It involves careful planning, design, investigation of the current system and constraints on implementation, design of methods to achieve change over, and evolution method. Once the planning has been completed the major effort is to ensure that the programs in the system are working properly. At the same time concentrate on training user staff.

The major implementation procedures are:-

- Build Application
- User Signing
- Configuring Server(Apache Tomcat)
- Load Modules using the JSON
- Finally Record/Test any web-based application

6.1 Equipment Installation

Anaconda is the free and open-source Python and R programming language distribution that is simple to set up. Anaconda is a software environment for mathematical computation, computer science, predictive analysis, and deep learning. Anaconda 5.3 is the most recent distribution, which was launched in October of 2019. It contains the module, an environmental manager, and the library at over 1000 open-source packagers, all of which come with free community support.users' interface (GUI) for desktop that comes with the Anaconda distribution. It helps us to use the Anaconda distribution's software and control conda packagers, environmental, and networks withheld having to use the commanded line command. It is most compatible for the system, Mac OS X, Linux.

The Anaconda distribution with the following application with the usage of the Anaconda navigator.

1. Jupyter Notebook
2. Jupyter Lab
3. Qt Console
4. Glueviz
5. Spyder
6. RStudio
7. Orange3
8. Visual Studio Code

- JupyterLab: This is based on Jupyter Notebook, Structure, this is and expandable worker platform of the collaborative, reproducible computing.
- Jupyter Notebook: This is an immersive programming notebook that runs on the internet. When explaining the data processing, we can be able to edit and run human readable docs.
- Qt Console: In line figure are, clear multilevel editors with the syntax highlighting, graphics call tip, more are all supported by the PyQt GUI.
- Spyder: This is the Python Programming Environmental for scientists. It is the robust Python with functionality such as advancement editing, dynamic checking, debugging concept, introspection.

VS Code: This is a streamline coded editor that includes features for debugging process**,**

- mission execution, version control.
- Glueviz: This was mostly used to visualize multi-dimensional dataset spanning several directories. The searches for links between and beyond similar data set.
- Orange 3: It is the data mining platform built on components. This will be used for data processing and visualization.Orange 3's workflows are much collaborative, having the largest toolbox.
- Rstudio: This is a set of the resource that work together to help you get things done with R. It comprises R basics as well as notebooks

XAMPP

XAMPP is a free and open-source cross-platform web server package that includes **Apache**, **MySQL/MariaDB**, **PHP**, and **Perl**. It allows developers to set up a local server environment on their own machine for testing and development purposes.

1. **Purpose of Installation**
   The installation of XAMPP provides a ready-to-use development environment by bundling essential software components in one package. It eliminates the need for individually downloading and configuring Apache, PHP, and MySQL.
2. **Pre-Installation Requirements**
   - Operating System: Windows, Linux, or macOS
   - Administrator privileges to install and configure system services
   - Disk space for storing XAMPP files and web projects
3. **Installation Steps (Theory)**
   - **Download**: The installer package is downloaded from the official Apache Friends website.
   - **Execution**: Upon execution, the setup wizard guides the user through the installation.
   - **Component Selection**: Users select which components they want to install (e.g., Apache, MySQL, phpMyAdmin).
   - **Installation Directory**: The user chooses where the software should be installed (typically C:\xampp on Windows).
   - **Service Configuration**: Apache and MySQL can be set to run as system services (optional).
   - **Completion**: Once installed, the XAMPP Control Panel is used to manage services.
4. **Post-Installation**
   - Users can launch **Apache** and **MySQL** using the XAMPP Control Panel.
   - Web applications can be stored in the htdocs folder.

- phpMyAdmin can be accessed through a browser via http://localhost/phpmyadmin to manage databases.

Benefits of XAMPP Installation

- Simplifies the local development setup
- All-in-one package for web development
- Open-source and free
- Supports PHP-based CMS like WordPress, Joomla, and Drupal

7. SAMPLE OUTPUTS

Fig-2: Screenshot live camera tracking of elephant

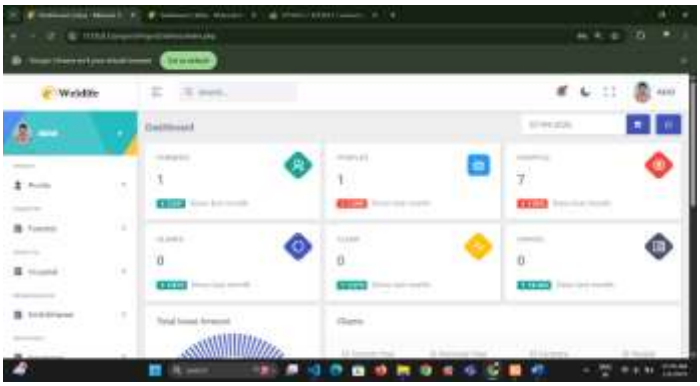

Fig-3: Screenshot of admin page

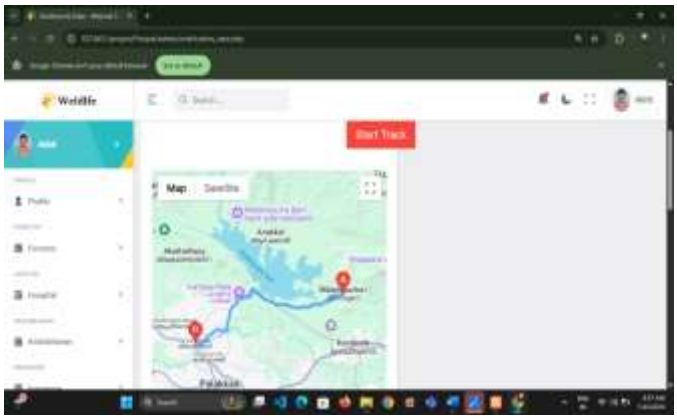

Fig-4: Screenshot of elephant live location tracking

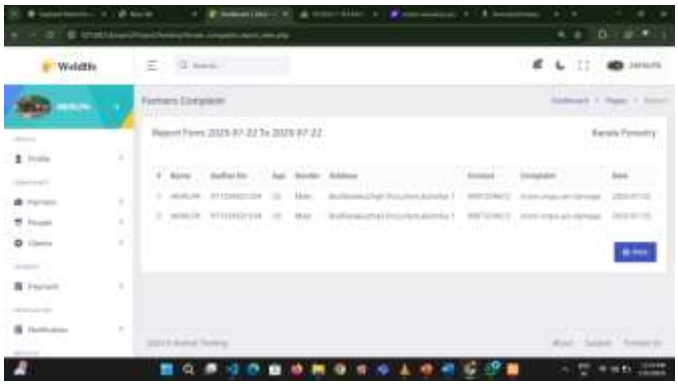

Fig-5:Screenshot of Farmers Complaint

8.CONCLUSIONS

This project presented a comprehensive real-time object detection and alert system aimed at identifying elephant and classifying them as either harmful or harmless using OpenCV and deep learning techniques. The system was designed with a specific focus on addressing ecological challenges, such as biodiversity loss and human-elephant conflict, by integrating object detection technology into a user-accessible multi-role platform.
The implementation successfully achieved real-time detection, recognition, and classification of both domestic and elephant through a trained neural network, with efficient handling of features like shape, color, and texture. A role-based user management system enabled seamless interaction between farmers, forestry departments, hospitals, Krishibhavan, and administrators.Real-time alerts ensured timely warnings for approaching dangerous elephants, reducing risks to human lives and property.

This system not only proved technically feasible but also offered valuable insights for researchers and students entering the field of artificial intelligence and machine learning. The project deepened the team's understanding of object detection pipelines, from region selection to feature extraction, classification, and bounding box localization. The structured alert mechanism and integration with claim management, messaging, and feedback systems provide a robust base for future use in environmental conservation and community support.

In conclusion, the project objectives were met successfully, and the system demonstrated strong performance across various test

scenarios. The experience also reinforced the significance of teamwork, planning, and the vast potential of technology in solving real-world problems related to ecology and agriculture.

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