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Vanrakshak AI: AI Driven Wildlife Sanctuary Monitoring System

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Abstract: ***Monitoring wildlife in forest areas is difficult and requires continuous observation. Traditional monitoring methods depend on manual patrol or basic camera systems which cannot detect animals automatically. This project proposes a smart monitoring system called Vanrakshak AI that detects animals using computer vision techniques. The system captures video from surveillance cameras and processes each frame to identify animal movement. Motion detection is used to reduce unnecessary processing and improve efficiency. The YOLO object detection model is used to detect animals, while DeepSORT tracking helps track animals across frames. When an animal is detected, the system stores the image, updates the database, and sends alerts to the monitoring dashboard. In some cases, notifications can also be sent through Telegram to inform forest authorities. The system helps in real-time monitoring and can assist forest departments in protecting wildlife and preventing human-animal conflicts.***

Keywords: Animal Detection, Computer Vision, Deep Learning, Object Detection, Real-Time Surveillance, Wildlife Monitoring, Yolo.

I. INTRODUCTION

The monitoring of wildlife is an important task for maintaining ecological balance and ensuring the safety of both animals and humans. In forest areas, tracking animal movement is difficult due to large geographical regions and limited human resources. Forest officials often depend on manual monitoring or basic camera systems, which are not efficient for real-time observation [2,5].
Traditional methods of wildlife monitoring require continuous human effort and are time-consuming [6]. These systems also fail to provide instant alerts when animals move into sensitive areas, which can lead to human–animal conflicts [3,7]. In addition, monitoring wildlife during nighttime or in low-light conditions becomes more challenging [8].
To overcome these problems, this project introduces Vanrakshak AI, an intelligent wildlife monitoring system. Recent academic trends show a significant shift toward using improved YOLO architectures, such as YOLOv8 and YOLO-SAG, to handle complex forest backgrounds and real-time constraints [1, 4]. These studies demonstrate that integrating deep learning with automated notification systems significantly reduces the response time for forest authorities [2, 5].

II. PROBLEM STATEMENT

In many forest areas, monitoring wildlife activity is difficult due to the lack of automated systems. Forest officials often depend on manual patrols or basic camera systems, which require continuous observation. These methods are time-consuming and do not provide real-time information about animal movement [6]. Existing systems are not capable of detecting animals automatically or generating instant alerts when animals enter sensitive areas [5]. This delay in detection increases the risk of human–animal conflicts and reduces the effectiveness of wildlife monitoring [3]. Therefore, there is a need for a system that can automatically detect animals, track their movement, and provide real-time alerts to improve monitoring and safety.

III. PROPOSED SYSTEM

The proposed system Vanrakshak AI is designed to automatically detect animals from live camera feeds. The system processes video frames and applies motion detection to identify activity. When motion is detected, the yolo object detection model is used to detect animals present in the frame [1,4]. Deepsort tracking is used to track detected animals across multiple frames to maintain identity and analyze behavior patterns [7]. The system draws bounding boxes around detected animals and saves cropped images for record purposes. Detection information is stored in a database along with timestamps. The processed frames and detection results are displayed on a monitoring dashboard. In critical cases, alerts can also be sent through telegram to notify forest authorities.

IV. FLOW CHART

The flowchart of the Vanrakshak AI system describes the sequence of operations performed by the system. The process starts with capturing frames from a live camera feed. The frames are preprocessed and checked for brightness. Motion detection is applied to identify movement in the frame.

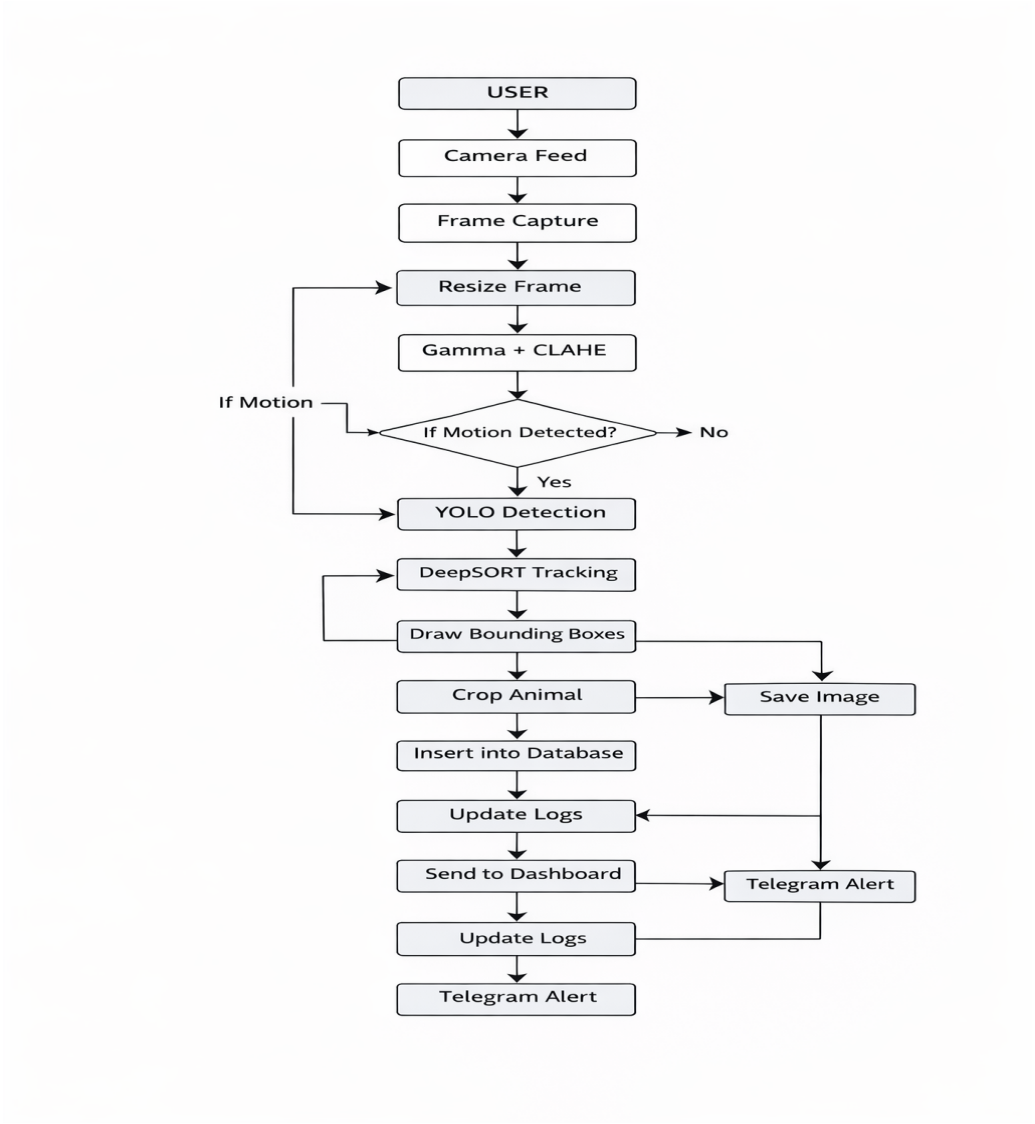

Fig .1: Flowchart of proposed system

When motion is detected, the YOLO model performs animal detection. DeepSORT tracking is used to track detected animals across frames. The detected animals are highlighted with bounding boxes, cropped, and stored in the database. The system also updates logs and sends information to the monitoring dashboard. In certain situations, alert notifications are sent through .

V. METHODOLOGY

The methodology of the proposed Vanrakshak AI system is designed to monitor wildlife activity using computer vision techniques and deep learning models. The system processes video streams from forest surveillance cameras and detects animals automatically. The architecture consists of multiple modules including input acquisition, frame processing, animal detection, tracking, database management, and notification services. Each module performs a specific task to ensure efficient and accurate monitoring of wildlife.

The overall architecture of the system consists of multiple modules including input acquisition, frame processing, animal detection, tracking, database management, and notification services. The animal detection module uses the YOLO deep learning algorithm to identify animals in real time, while the DeepSORT tracking algorithm is used to track detected animals across consecutive frames. Detection results are stored in a database along with detection logs and captured images for future reference and analysis & also we can add, delete & edit the camera name and link through frontend.

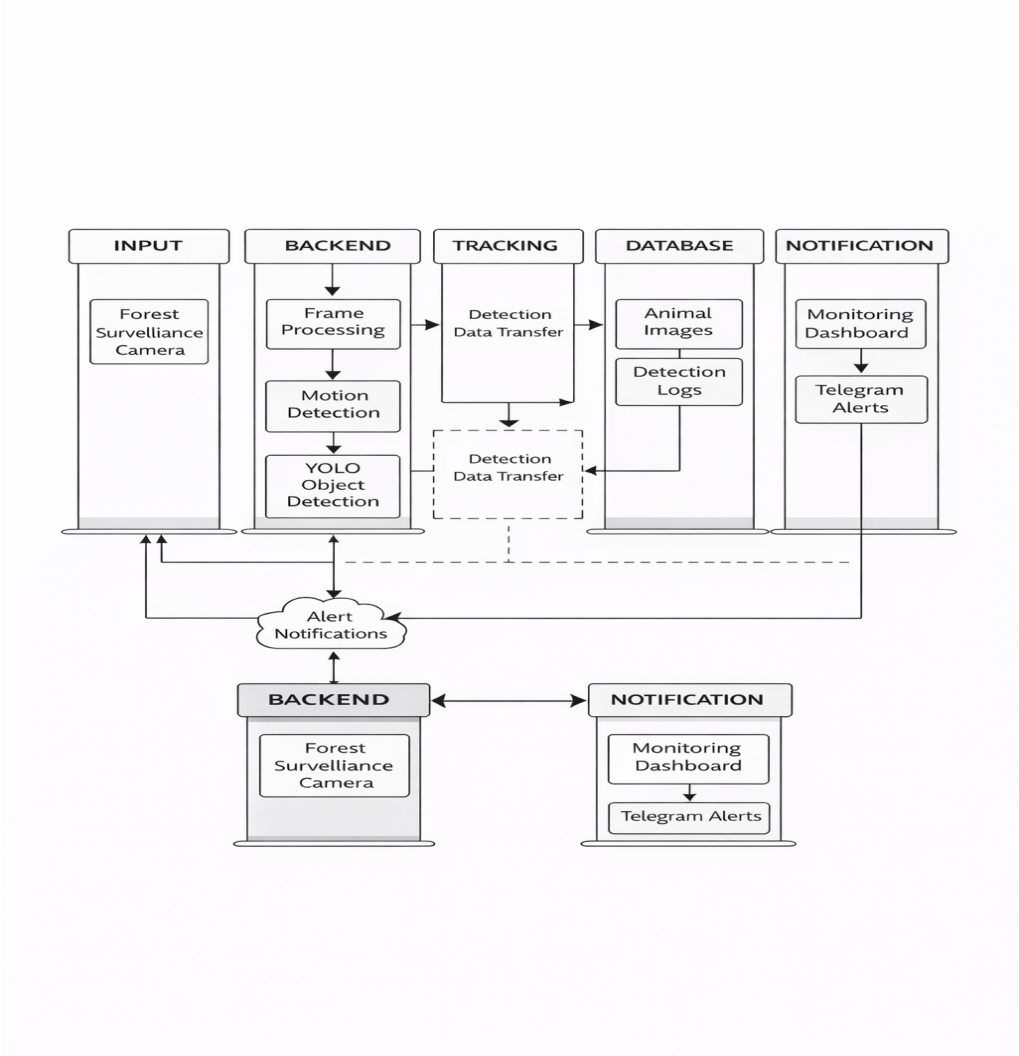

Fig .2: Blockdiagram of methodology

A. Input Acquisition

High-definition video streams are captured from forest surveillance cameras. These video streams are divided into individual frames to facilitate real-time analysis. This continuous acquisition is vital for integrating AI into existing camera trap infrastructures [5, 6].

B. Backend Processing Module

Each frame undergoes resizing and preprocessing to optimize detection accuracy. A motion detection filter is applied first to identify activity. The system only activates heavy deep learning models if movement is identified, which saves computational resources. This lightweight approach ensures the system remains efficient in complex forest scenes [2].

Animal detection is performed using the YOLO algorithm, which provides high-accuracy identification even in nighttime conditions [1, 8]. Once detected, the DeepSORT module tracks animals across multiple frames to maintain identity and prevent duplicate counts. This tracking is essential for long-term behavioral analysis and automated monitoring [4, 7].

C. Database Module

The database module stores detection results generated by the system. It saves cropped animal images and detection logs along with timestamps. Maintaining this database allows authorities to review past detections and analyze wildlife activity patterns [7].

D. Notification Module

The notification module provides real-time alerts to monitoring authorities. Detection results are displayed on the monitoring dashboard where users can observe wildlife activity [1]. In addition, the system sends alerts through Telegram notifications whenever animal activity is detected.

This helps forest officials respond quickly when necessary [3,5]. The super admin panel allows us to add, delete, and edit users' chat IDs, which are used for sending Telegram alerts.

VI. RESULT

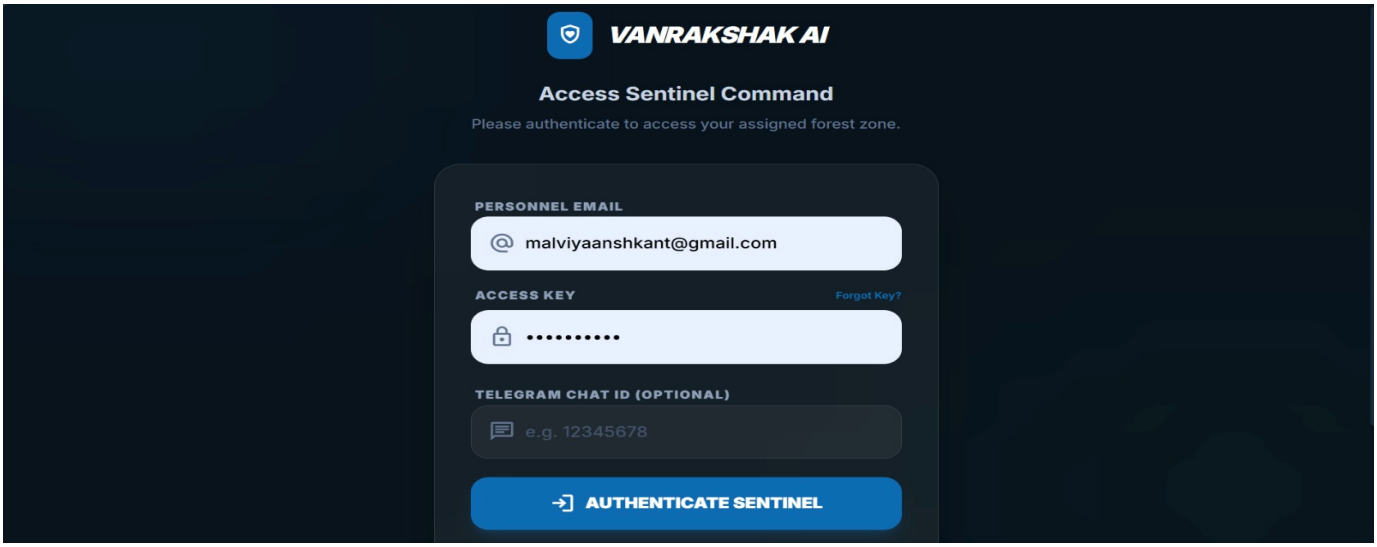

Fig. 1.1 Login Page

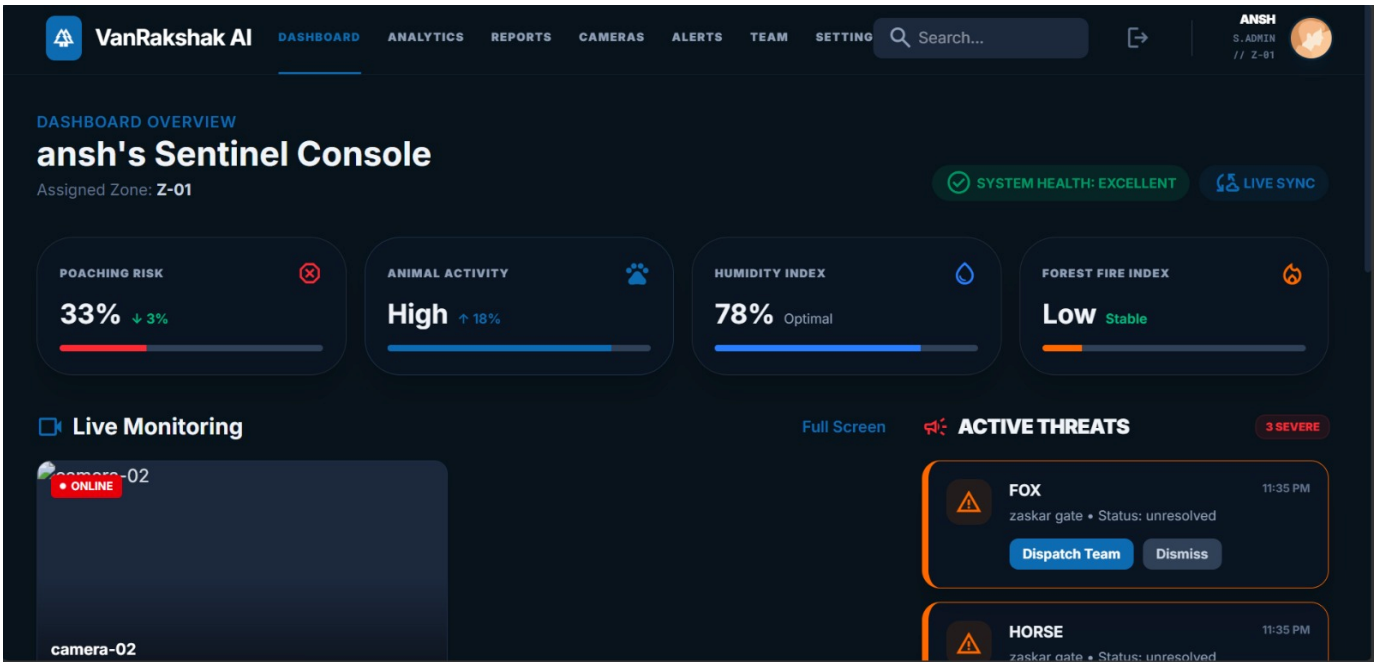

Fig. 1.2 Dashboard

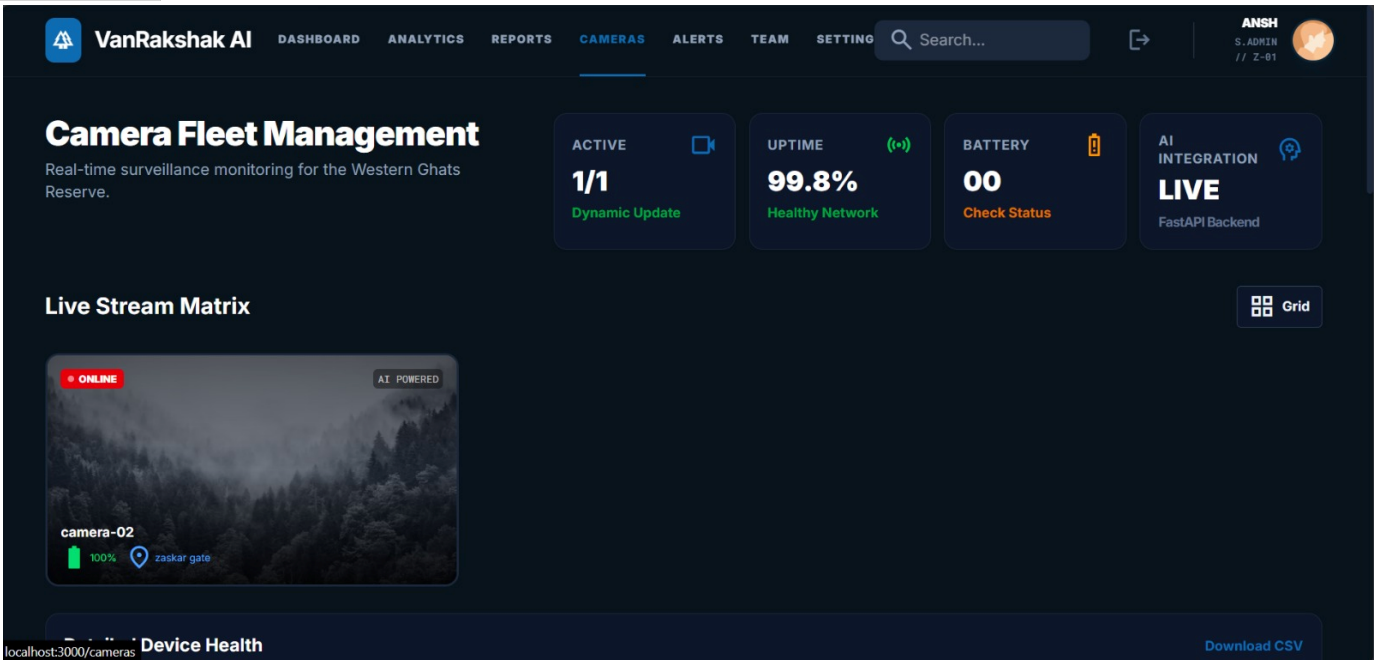

Fig.1.3 Camera Monitoring Section

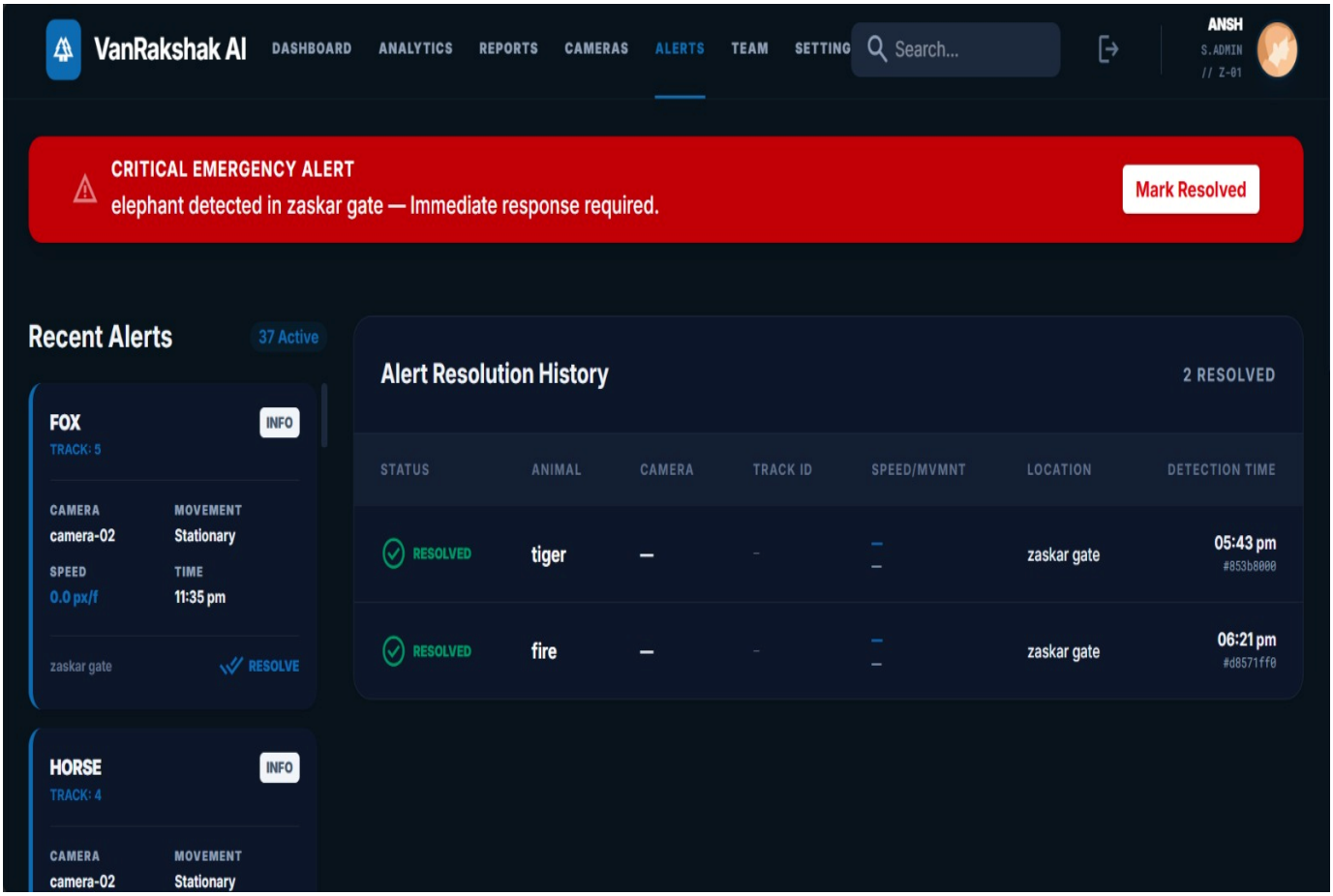

Fig.1.4 Alert Section

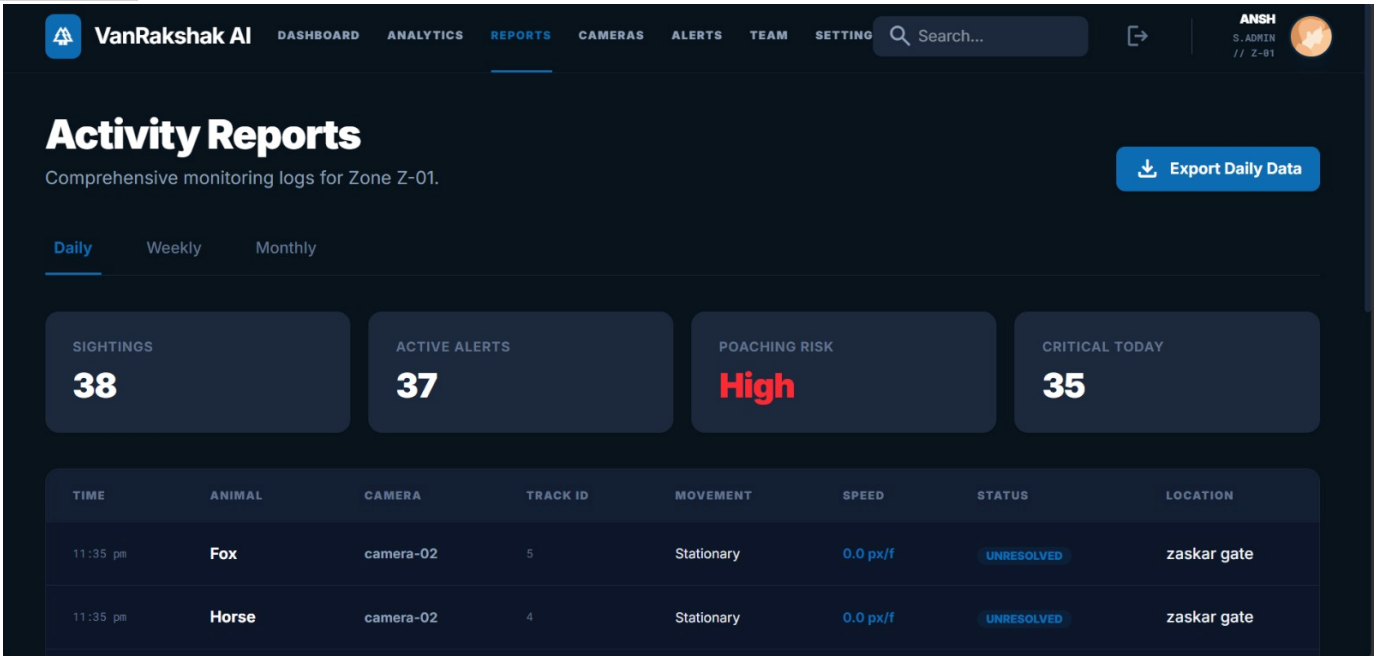

Fig.1.5 Report Section

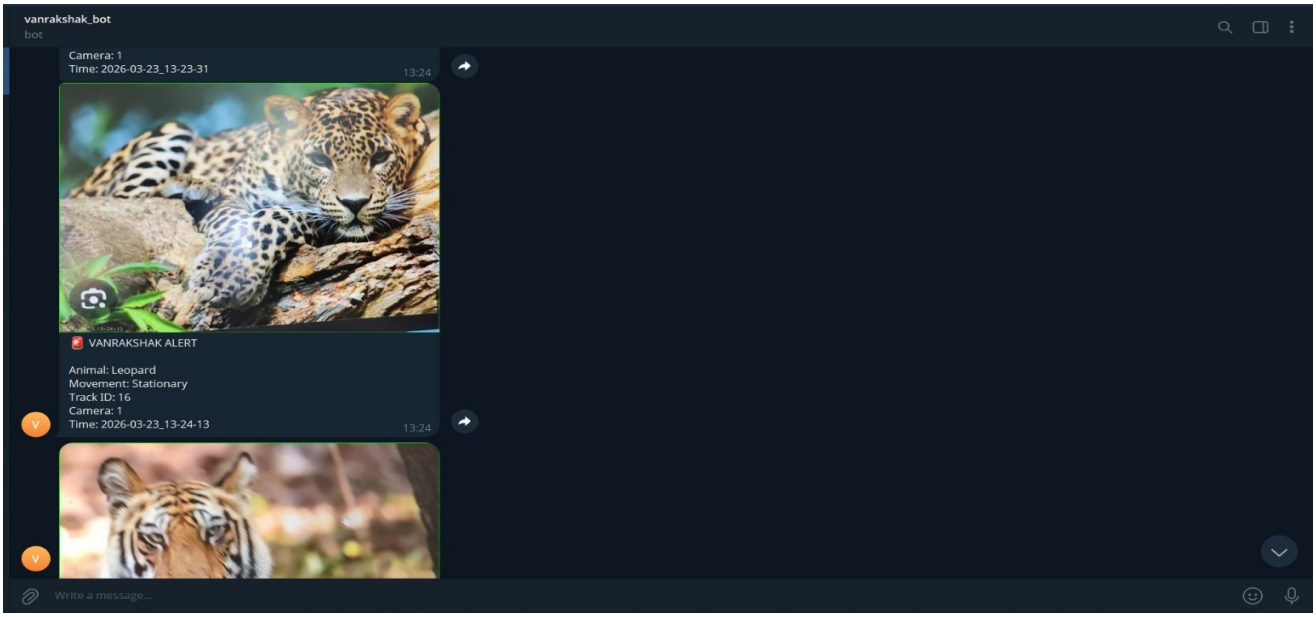

Fig 1.6 Telegram Alert

VII. CONCLUSION

The proposed work aims to improve forest monitoring, which is generally slow and depends a lot on manual observation. In real situations, it is difficult for forest guards to continuously keep track of animal movement, and some important activities may get missed. To solve this problem, the proposed system uses YOLOv11 along with DeepSORT tracking to detect and follow animals automatically.

It also sends alerts through Telegram and provides a live dashboard, helping authorities respond faster when required. This reduces manual effort and makes monitoring more efficient. In future, the system can be further improved to run on low-power devices so that it can be used in remote forest areas. Overall, the proposed work provides a simple and practical solution for real-time wildlife monitoring.

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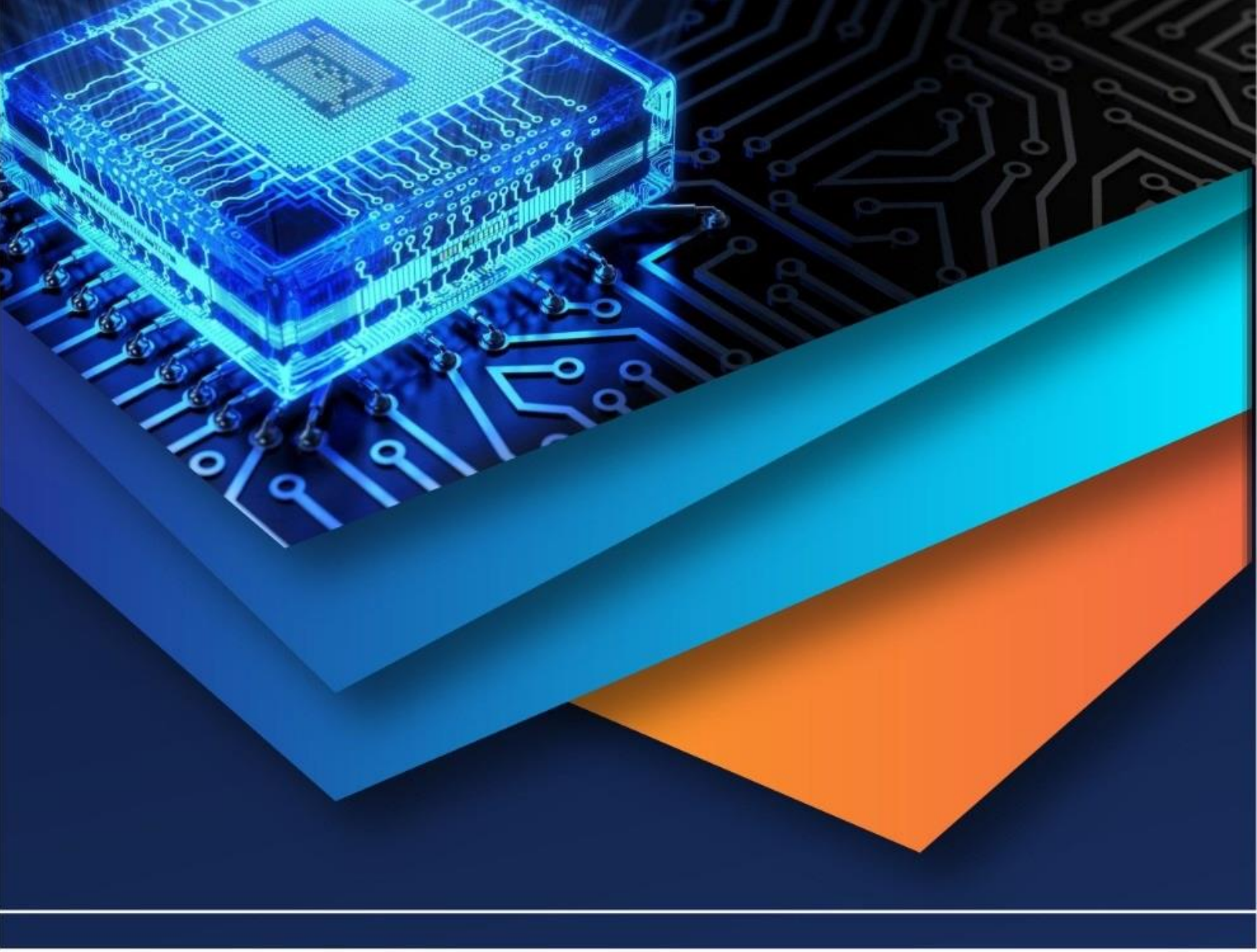

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