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AI-Powered Rabies Prevention and Awareness Assistant

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Abstract

Having an almost 100 percent death rate after symptoms manifest, rabies is still one of the deadliest viral infections, thus prompt prevention and treatment are essential. Due to a lack of knowledge, a delayed medical response, and insufficient monitoring systems, rabies remains a significant public health concern in India even though it may be prevented with vaccination and appropriate wound care. The Rabies Alert India system was created as an intelligent, integrated platform that makes use of contemporary online technology and artificial intelligence in order to address these problems. The system offers AI-based threat detection, emergency bite protocol guidance, hospital and vaccination availability monitoring, and real-time incident tracking. To train Vision AI and Acoustic AI modules, multimodal inputs such as dog photos, audio patterns, and hospital location data are collected, tagged, and analyzed. The solution, which is implemented as a full-stack web application, guarantees scalability, user-friendly interaction, and quick emergency reaction. The evaluation results, which are backed by a simplified dashboard and WHO-standard first aid guidelines, show excellent accuracy in dog behavior identification, efficient sound-based threat analysis, and trustworthy hospital mapping. Rabies Alert India offers a comprehensive solution for rabies monitoring and prevention, assists healthcare authorities, and raises public awareness by fusing technology and healthcare, all of which contribute to a more intelligent and adaptable healthcare ecosystem.

Index Terms — Artificial Intelligence (AI), Real-time Incident Tracking, Vision AI, Acoustic AI, Web Application Architecture, Healthcare Data Management, Threat Detection Protocols.

I. Introduction

With an almost 100% fatality rate once symptoms manifest, rabies is one of the deadliest viral infections known to man. The main way that it is spread is by the bite or scratch of an infected animal, particularly a dog. Rabies is still a serious public health issue in many nations, including India, even though it can be avoided with prompt immunization and appropriate wound care. The lack of effective methods to track and handle rabies-related cases, delayed medical response, and public ignorance are the main obstacles to rabies control. Many people don't know what to do right away following an animal bite, which frequently results in potentially fatal circumstances. Additionally, it can be challenging to get to local hospitals that have immunizations available, particularly in rural and semi-urban locations. The Rabies Alert India system was created as a clever and comprehensive way to deal with these issues. This system offers real-time monitoring, emergency guidance, and healthcare accessibility by utilizing artificial intelligence and contemporary online technology. It serves as a central location for users to obtain essential information about rabies prevention and

treatment. The system has capabilities including supply

chain management, AI-based risk detection, hospital and

vaccine availability monitoring, and real-time incident

tracking. Together, these features guarantee that consumers can respond appropriately in an emergency and receive fast information. This project seeks to build a more knowledgeable and adaptable society by fusing technology and healthcare. In addition to helping individuals, it helps healthcare officials better monitor and manage rabies cases.

A. Problem Statement

- Due to a number of current issues with the healthcare system, rabies is still a serious public health concern. The

absence of real-time data on rabies incidents is one of the main issues. Analyzing patterns and taking preventative action becomes challenging without adequate tracking.

- Finding local hospitals that offer rabies vaccinations is another crucial problem. Patients frequently squander important time looking for healthcare facilities, delaying treatment and raising the risk of infection.
- The problem is made more difficult by the lack of a centralized system for tracking vaccination availability. Without adequate tracking, hospitals may run out of supplies, depriving patients of life-saving vaccinations.
- People are also unaware of the proper first aid procedures to take following an animal bite. Many people either overlook or use inappropriate cures, which might have serious repercussions.
- Current systems do not offer comprehensive solutions that include emergency guidance, AI-based analysis, and real-time tracking. This gap emphasizes the need for an all-encompassing system that can successfully handle all of these issues.

B. Objectives

- This project's main goal is to create an intelligent system that improves rabies prevention and surveillance. The system seeks to raise public awareness, enhance healthcare accessible, and deliver real-time information.
- Implementing a real-time event tracking system that enables users to view ongoing rabies cases and notifications is one of the main goals. This aids in comprehending the disease's severity and spread.
- Creating a hospital and vaccine locator module that makes it easy for users to find local medical facilities that have immunizations accessible is another goal. This feature guarantees prompt medical care.
- The device also has an emergency biting procedure feature that instructs users on how to administer first aid following an animal bite. This ensures appropriate therapy and lessens anxiety.
- Lastly, the project's goal is to develop a user-friendly, scalable platform that may be expanded in the future with more sophisticated features and integrations.

II. Literature Survey

[1] We introduce YOLO, a novel method for object detection. Previous work on object detection uses classifiers for detection. Rather, we formulate object detection as a regression issue to bounding boxes that are geographically separated and the corresponding class probabilities. In a single evaluation, a single neural network directly predicts class probabilities and bounding boxes from whole images. The entire detection pipeline may be adjusted end-to-end directly on detection performance because it is a single network. Our unified architecture is incredibly quick. At 45 frames per second, our fundamental YOLO model processes images in real time. Fast YOLO, a scaled-down version of the network, achieves double the mAP of other real-time detectors while processing an incredible 155 frames per second. YOLO is less likely to forecast false positives on background, but it makes more localization errors than cutting-edge detection methods. Lastly, YOLO picks up extremely broad object representations. When generalizing from natural images to other domains, such as artwork, it performs better than other detection techniques, such as DPM and R-CNN.

[2] To categorize the 1.3 million high-resolution photos in the LSVRC-2010 ImageNet training set into 1000 distinct classes, we trained a sizable, deep convolutional neural network. Our top-1 and top-5 error rates on the test data were 39.7\% and 18.9\%, respectively, which is significantly better than the prior state-of-the-art outcomes. Five convolutional layers, some of which are followed by max-pooling layers, and two globally linked layers with a final 1000-way softmax make up the neural network, which has 500,000 neurons and 60 million parameters. We employed non-saturating neurons and a highly effective GPU implementation of convolutional nets to speed up training. We used a novel regularization technique that worked incredibly well to decrease overfitting in the globally connected layers.

[3] In this work, we examine how the depth of the convolutional network affects its accuracy in the context of large-scale picture recognition. Our primary contribution is a comprehensive analysis of networks with increasing depth utilizing an architecture with relatively small (3x3) convolution filters, which demonstrates that raising the depth to 16–19 weight layers can significantly outperform the state-of-the-art configurations. These results served as the foundation for our ImageNet Challenge 2014 submission, in which our team placed first in the localization track and second in the classification track. Additionally, we demonstrate that our representations obtain state-of-the-art outcomes when applied to different datasets. To encourage more study on the application of deep visual representations in computer vision, we have made our two top-performing ConvNet models publicly accessible.

[4] Recent years have seen the rapid advancement of AI technology, which has resulted in its extensive application and growing significance in daily life. AI has been incorporated into the healthcare industry to create the new sector of "smart healthcare." Opportunities and difficulties coexist in smart healthcare. An extensive summary of previous advancements and current breakthroughs in this field is given in this article. First, we provide an overview of smart healthcare's definition and features. Second, we examine the macro-level prospects that AI technology offers to the smart healthcare industry. Third, we classify certain AI applications in smart healthcare into ten areas and go over each one's technical underpinnings separately. Lastly, we list 10 major problems that these programs encounter and go over the current fixes for each.

[5] The outcome of a case involving Sassy, a Border Collie, illustrates the potential advantages of artificial intelligence in veterinary care. In this scenario, ChatGPT was crucial in recommending a diagnosis that resulted in a successful course of therapy, demonstrating the potential of AI chatbots as useful instruments in challenging situations. However, there are

worries about pet owners depending just on AI chatbots for medical guidance, which could lead to incorrect diagnosis, ineffective treatment, and a delay in seeking professional assistance. We stress the importance of taking a balanced approach, presenting AI chatbots as additional resources rather than as a replacement for certified vets. The study suggests ways to reduce hazards, including educating pet owners about the limitations of AI chatbots, putting laws in place to direct AI chatbot firms, and encouraging cooperation between AI chatbots and vets. The complex web of duties in this ever-changing environment highlights the significance of laws, the instructional function of AI chatbots, and the mutually beneficial link between AI technology and veterinary knowledge.

[6] Over the past few years, there has been a significant upsurge in many animal diseases. Many of these illnesses have the potential to develop into zoonotic illnesses, which can become highly contagious and affect both humans and animals. The study of machine learning focuses on teaching computers and machines to learn on their own so that more predictions can be produced for a variety of applications. While machine learning techniques have been used for a long time to detect human diseases, very little progress has been achieved for animal diseases. By using machine learning approaches to categorize specific animal diseases and forecast the disease's progress, we make a novel addition to the previously stated field through this research study. Animal diseases that develop into zoonosis can have a significant influence on both human and animal species. Therefore, we applied specific methodologies in this experiment to determine if the disease is zoonotic or not.

[7] As a branch of artificial intelligence (AI), deep learning (DL) focuses on creating models and algorithms that mimic how the human mind solves problems. In the field of veterinary care, advanced AI technology has attracted a lot of attention lately. This study offers a thorough summary of the studies devoted to using DL in veterinary medicine for diagnostic reasons. Focusing on the relationship between DL and veterinary medicine, our systematic review methodology adhered to PRISMA criteria and found 422 pertinent research papers. We eliminated non-primary research, reviews, and irrelevant AI studies before reducing our selection to 39 primary research publications that directly used DL to animal disease diagnosis or management after exporting titles and abstracts for screening. A number of diagnostic fields, including radiography (33% of the studies), cytology (33%), health record analysis (8%), MRI (8%), environmental data analysis (5%), photo/video imaging (5%), and ultrasound (5%), saw an increase in the use of DL models between 2013 and 2024. Radiographic imaging has become the most influential during the last ten years. Comparing DL models to professional veterinarian benchmarks, several studies have shown significant success in classifying main thoracic lesions and cardiac illness using radiographs.

Additionally, the system has demonstrated its adaptability across many veterinary diagnostic modalities by successfully identifying, counting, and classifying cell types in microscope slide images. Deep learning has potential for veterinary diagnostics, but there are still a number of obstacles to overcome. These difficulties include the requirement for sizable and varied datasets, the possibility of interpretability problems, and the significance of expert consultation during model construction to guarantee validity. In order to guide future research and development initiatives in the sector, a comprehensive grasp of these factors for the design and application of DL in veterinary medicine is essential. Additionally, the possible future effects of DL on veterinary diagnostics are examined in order to identify opportunities for additional development and growth of DL applications in veterinary medicine, which will ultimately lead to higher standards of care and better animal health outcomes as this technology advances.

[8] In animal healthcare, predictive analysis use data-driven methods to improve animal welfare, identify early disease indicators, and predict health outcomes. Predictive models can detect possible health hazards before they become serious by examining data from sources like genetic information, environmental sensors, veterinarian records, and behavioral observations. These methods are very helpful in stopping the transmission of infectious diseases, streamlining treatment procedures, and lowering the total cost of animal care in a variety of environments, such as zoos, farms, and companion animal practices. Tracking important health indicators including vital signs, activity levels, and environmental conditions—all of which might offer early indications of health problems—is part of the use of predictive analytics. For example, early detection of infections like avian influenza or bovine tuberculosis helps prevent their spread. In a similar vein, these instruments can forecast the development of long-term ailments, such as mastitis in dairy calves or arthritis in pets, allowing for improved long-term care and prompt remedies. In the end, predictive analysis helps farmers, veterinarians, and caregivers make better decisions by giving them insightful information that improves treatment results and animal health management in general. Predictive analytics is expected to play a bigger part in animal healthcare as data collection methods develop, providing more efficient, preventative, and individualized care.

III. EXISTING AND PROPOSED SYSTEM

A. Existing Systems

1. Static Health Information Websites: These resources offer broad details on rabies symptoms, ways to prevent the disease, and available treatments. They are helpful for raising awareness, but they don't provide immediate help or tailored advice.
2. Hospital Directory Systems: These systems provide a list of medical facilities. However, they don't offer emergency advice and don't have up-to-date information on vaccine availability.
3. Government Health Portals: Although they offer official data and reports, government portals frequently lack interactive elements and are difficult to use.

4. Manual Reporting Systems: Data processing and analysis are delayed in many areas because rabies cases are reported manually.

B. Limitations

Even if there are numerous systems available, there are a number of important restrictions:

- Insufficient real-time data updates
- Artificial intelligence is not integrated
- Lack of instructions for emergency reaction
- Inadequate accessibility and user engagement
- There isn't a single platform that combines every characteristic
- Ineffective supply chain tracking for vaccines
- A delay in locating high-risk locations

C. Proposed System

By offering a thorough and clever solution, the suggested system, Rabies Alert India, is intended to solve the shortcomings of current methods. It incorporates several features, including:

- Tracking incidents in real time
- Monitoring hospital and vaccination availability
- Animal detection with AI
- Guidelines for emergency biting protocol
- Monitoring the supply chain

The solution gives users accurate and timely information by utilizing AI modules and contemporary web technology.

IV. METHODOLOGY

Frontend, backend, database, and AI modules are all integrated into the system's scalable and modular architecture. Each part is in charge of particular duties, guaranteeing effective operation and simple upkeep.

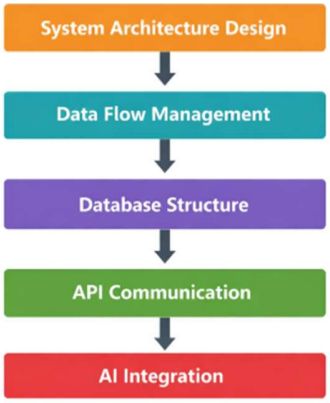

Fig 1: Methodology Flow Diagram

The architecture of the Rabies Alert system is three-tiered:

- Front-end Presentation Layer
- Application (Backend) Layer
- Data Layer (DB)

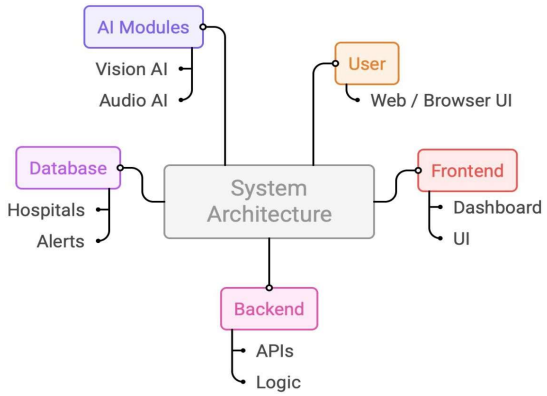

Fig 2: System Architecture

A. Working Principle

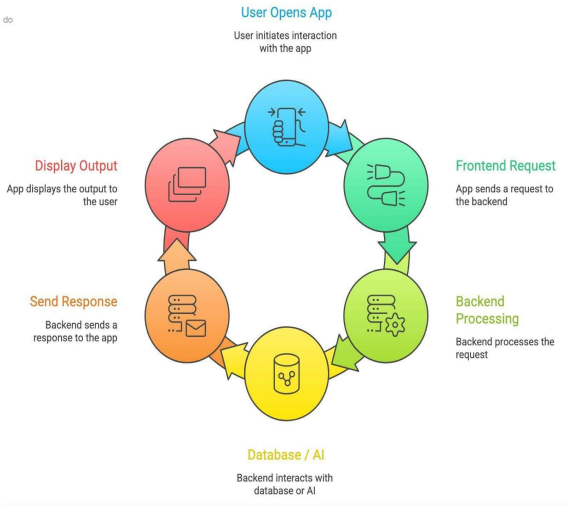

Fig 3: Block Diagram

The Rabies Alert India system architecture's end-to-end data communication cycle is shown in the figure 4.3. In order to provide real-time results, it simulates how the application moves through each operational layer.

- The user opens the application, which starts the client-side process and launches the React or comparable framework-built frontend interface.
- Frontend Request: The client encapsulates user actions or sensor inputs in structured HTTP requests (usually RESTful or via WebSocket) that are sent to the backend API.
- Backend Processing: Logic execution, authentication, and routing are handled by the server, which is built with Express or Node.js. It serves as an intermediary between data sources and the user interface.
- Database/AI Layer: The backend communicates with AI modules (Vision AI and Acoustic AI) for inference tasks and with PostgreSQL for structured data retrieval. Data queries, model loading, and prediction creation are all carried out by this layer.

- Send Response: The processed results are sent back to the front end via secure API endpoints after being serialized into JSON.
- Display Output: For user interpretation, the frontend dynamically renders the received data, updating dashboards, alerts, or visual indicators.

V. IMPLEMENTATION AND RESULTS

The implementation's main goals are to offer sophisticated analysis features, user-friendly interaction, and real-time data display. After being built independently, each module is combined to create a whole system. To guarantee scalability, performance, and dependability, contemporary technologies like React, Express, and PostgreSQL are employed. The system is built to effectively manage numerous users and massive volumes of data.

The analysis's main goal is to confirm whether the system effectively achieves its objectives of improving user awareness, facilitating prompt medical action, and offering rapid decision support. To guarantee robustness and practical application, the evaluation is carried out utilizing both simulated and real-world test situations.

A. Dashboard

The dashboard serves as the system's main center and offers a summary of all crucial data pertaining to rabies surveillance. Dashboard's characteristics:

- Shows the number of cases, hospitalizations, and fatalities.
- Displays incident updates in real time
- Offers data in a graphical format
- Periodically automatically refreshes data

Fig 4: Dashboard Panel

TABLE I
DASHBOARD EVALUATION METRICS

Parameter	Description	Result
Load Time	Time to display UI	<2 Seconds
Accessibility	Ease of use	Very High
Navigation	User movement	Smooth
User Satisfaction	Feedback	High

B. Hospital & Vaccine Finder

This module assists users in finding local hospitals and verifying the availability of vaccines. Features

- Look up hospitals by location
- Shows contact information
- Displays the status of vaccine availability
- Offers guidance

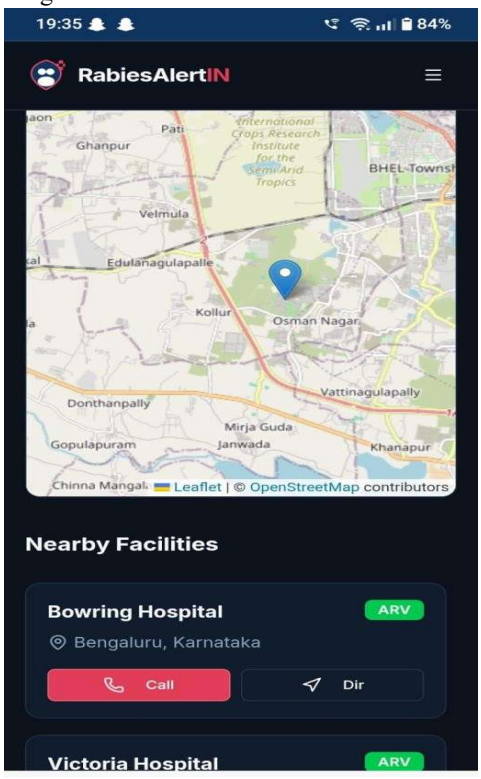

Fig 5: Hospital and Vaccine Finder Interface

C. Vision AI Module: Detection of Dog Threats

The Rabies Alert INDIA system's key intelligence component is the Vision AI module. It allows users to take or submit a picture of a dog and get an immediate threat evaluation.

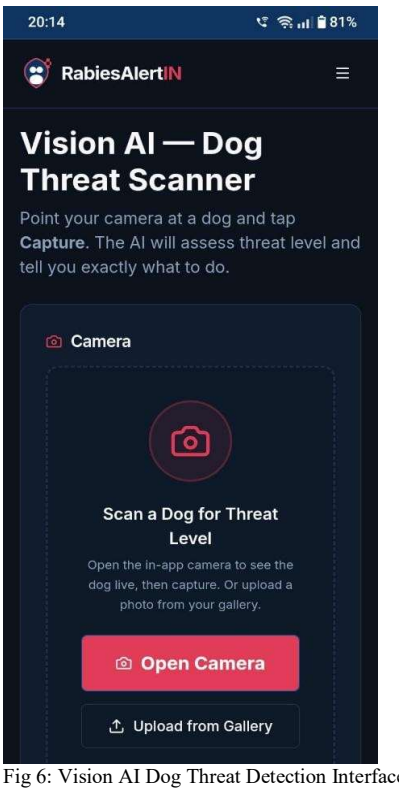

Fig 6: Vision AI Dog Threat Detection Interface

Table II
THREAT CLASSIFICATION LEVELS

Level	Description	Action
Low	Calm dog	Safe to pass
Medium	Alert dog	Maintain distance
High	Aggressive behaviour	Move away slowly
Critical	Immediate danger	Seek shelter immediately

D. Sound-Based Threat Analysis in the Acoustic AI Module

Using sound patterns or user descriptions, the Acoustic AI module offers a different approach to threat detection.

- Recognizes patterns of barking
- Determines the degree of hostility
- Offers safety advice

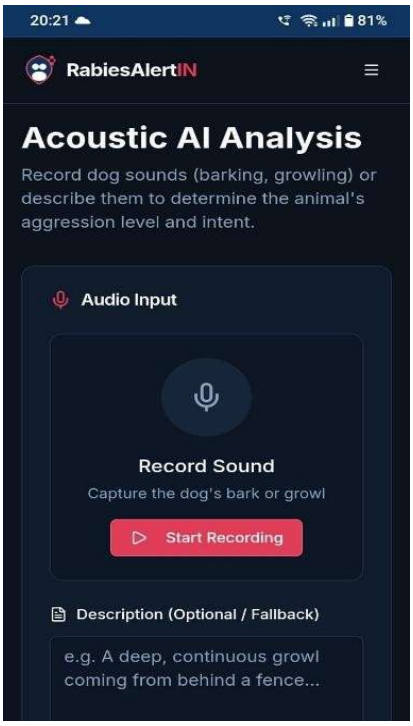

Fig 7: Acoustic AI Interface

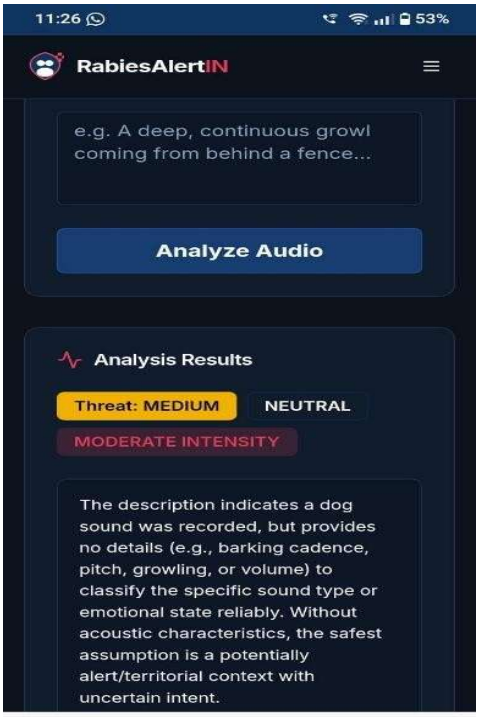

Fig 8: Acoustic AI result screen: threat level

Table III
ACOUSTIC AI RESULTS

Input	Interpretation	Output
Loud Barking	Aggressive	High treat
Growling	Dangerous	Critical
Soft barking	Calm	Low threat

E. Module for First Aid Protocol

The WHO-recommended emergency procedures for dog bite cases are provided in this module. Crucial Steps:

- Spend fifteen minutes cleaning the wound.
- Steer clear of bandaging
- Get medical assistance
- A comprehensive immunization schedule

(a)

(b)

Fig 9: (a) and (b) First Aid Interface

F. Accuracy Analysis of Vision AI

A number of variables, including lighting, angle of capture, and image quality, affect the Vision AI module's accuracy. While low-quality photos may have a minor impact on performance, high-resolution images yield more accurate findings. The system exhibits a high degree of consistency and dependability in spite of these difficulties. Important behavioral characteristics including posture, movement, and facial expressions can be recognized by the model.

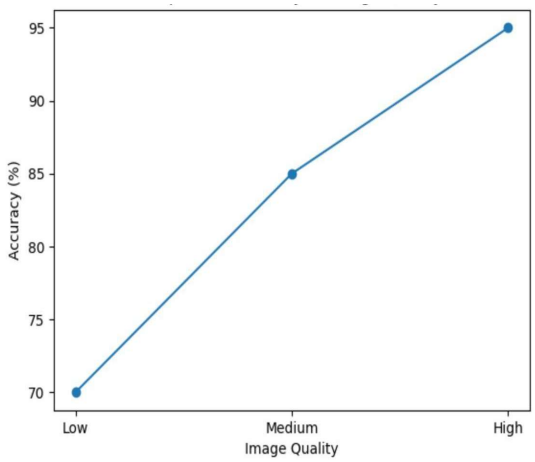

Fig 10: Accuracy vs Image Quality

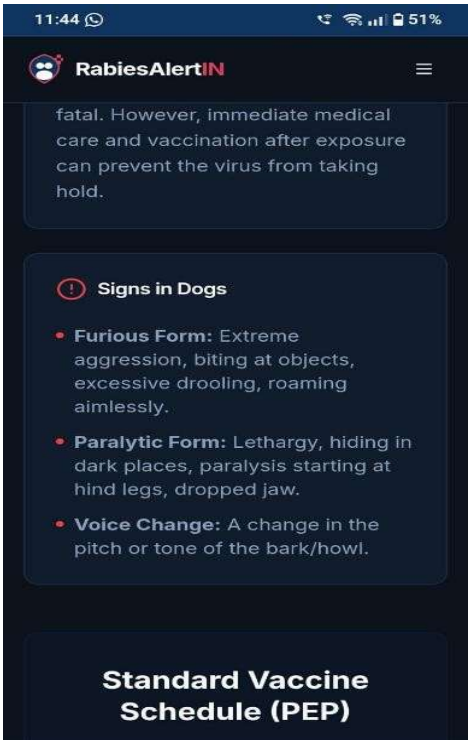

Fig 11: Rabies Information Screen

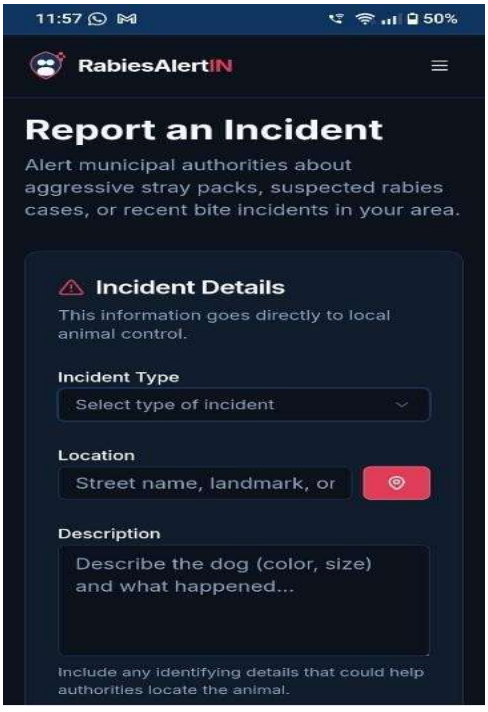

Fig 12: Reporting an Incident

VI. CONCLUSION AND FUTURE WORK

The Rabies Alert India system successfully demonstrates how Artificial Intelligence and modern web technologies can be integrated to address critical gaps in rabies prevention and monitoring. By combining real-time incident tracking, hospital and vaccine availability, AI-based threat detection, and emergency guidance, the system provides a comprehensive solution that enhances public awareness, supports healthcare authorities, and ensures timely medical intervention. The evaluation results confirm that the system is efficient, user-friendly, and reliable in emergency scenarios, thereby contributing to improved public health outcomes.

FUTURE SCOPE

- Mobile App Integration: Extending the system to mobile platforms for wider accessibility in rural and semi-urban areas.
- Advanced AI Models: Incorporating deep learning for more accurate behavioral and acoustic analysis of animals.
- Multi-language Support: Adding regional language interfaces to improve usability across diverse populations.
- Predictive Analytics: Using AI to forecast rabies outbreak hotspots and guide preventive measures.
- Government Collaboration: Integrating with national health portals for centralized reporting and resource allocation.
- Scalability to Other Diseases: Expanding the framework to monitor and manage other zoonotic diseases beyond rabies.

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