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VetAId- Animal Disease Prediction and Prevention Using AI

[1] Aditi Gunapal, [2] Abhiram G J, [3] Divya Patil, [4] Prachi Singh, [5] Tejashree K

[1]*Aditi Gunapal, Dept. of Information Science Engineering, AMC Engineering College, Karnataka, India*
[2]*Abhiram G J, Dept. of Information Science Engineering, AMC Engineering College, Karnataka, India*
[3]*Divya Patil, Dept. of Information Science Engineering, AMC Engineering College, Karnataka, India*
[4]*Prachi Singh, Dept. of Information Science Engineering, AMC Engineering College, Karnataka, India*
[5]*Tejashree K, Dept. of Information Science Engineering, AMC Engineering College, Karnataka, India*

Abstract

Livestock health management is a major challenge in rural and semi-urban regions due to limited access to veterinary professionals, delayed diagnosis, and language barriers. Early identification of cattle diseases is critical to prevent productivity loss and economic damage to farmers. This paper presents VetAid, an AI-enabled veterinary decision support system designed to assist farmers in early disease awareness using symptom-based inputs. The system allows farmers to enter observed cattle symptoms in their preferred regional language and performs intelligent disease analysis using AI reasoning through the Groq API. A multilingual translation module ensures accessibility, while the AI engine predicts possible diseases and provides preventive measures and recommended actions. VetAid is implemented as a web-based platform and evaluated for functionality, performance, and usability. Experimental results demonstrate that the system delivers fast responses, handles multilingual inputs effectively, and presents farmer-friendly outputs. The proposed system acts as a supportive tool for early disease awareness and preventive livestock healthcare, contributing to sustainable agriculture and rural development..

***Key words*: Veterinary Artificial Intelligence, Livestock Disease Prediction, Symptom-Based Analysis, Multilingual System, AI Decision Support, Sustainable Agriculture.**

1. INTRODUCTION

1.1 Background

Livestock plays a crucial role in agricultural economies, particularly in developing regions where cattle farming is a primary source of income. Healthy livestock directly impacts milk production, meat supply, breeding efficiency, and farmer livelihood. However, livestock diseases remain a persistent challenge due to delayed diagnosis, lack of awareness, and limited access to veterinary services.

In rural areas, farmers often rely on experience-based judgment or delayed consultations to manage animal health. Many digital veterinary platforms are not accessible due to language barriers or complex interfaces. These limitations highlight the need for a simple, intelligent, and farmer-friendly veterinary assistance system.

The rapid advancement of digital technologies and artificial intelligence has opened new opportunities to improve livestock health management. AI-based decision support systems can analyze symptom patterns, reason over disease knowledge, and provide timely guidance without requiring physical presence of experts. However, most existing digital veterinary solutions are either complex, require structured clinical data, or lack support for regional languages, limiting their adoption by farmers.

Furthermore, language barriers remain a critical obstacle in the deployment of digital healthcare solutions. Many farmers are more comfortable describing animal symptoms in their native languages rather than in English. Systems that fail to support multilingual interaction often remain underutilized, regardless of their technical capabilities.

To address these challenges, there is a growing need for an intelligent, farmer-centric veterinary assistance system that combines symptom-based disease analysis, multilingual accessibility, and fast response generation. VetAid is designed in this context, leveraging AI inference through the Groq API to deliver real-time, accessible, and practical livestock disease guidance. The system aims to enhance early disease awareness, promote preventive care, and support sustainable livestock management.

1.2 Problem statement

Existing veterinary healthcare practices largely depend on manual observation, physical examinations, and expert consultations. While effective, these approaches are often time-consuming, expensive, and impractical for farmers in remote or underserved areas. In addition, many digital veterinary platforms provide only static information or require structured clinical data, which is difficult for farmers to supply during early stages of disease onset.

Another major challenge is the language barrier faced by farmers when using digital healthcare systems. Most existing solutions are not designed to support regional languages, forcing farmers to describe symptoms in English or technical terms. This limitation significantly reduces usability and adoption, especially among small-scale farmers with limited digital literacy.

Therefore, there is a clear need for an intelligent, accessible, and multilingual veterinary decision support system that can analyze unstructured symptom descriptions and provide timely disease-related guidance. The absence of such a system motivates the development of VetAid, which aims to support early disease awareness through AI-based reasoning, reduce dependency on immediate veterinary availability, and improve livestock health management in rural environments.

1.3 Research Gap and Motivation

Recent advancements in digital technologies and artificial intelligence have led to increased research interest in livestock health monitoring and veterinary decision support systems. Several studies have explored the use of information and communication technologies (ICT), machine learning models, and rule-based systems for animal disease identification and management. While these approaches have contributed valuable insights, significant gaps remain in terms of accessibility, usability, and real-world adoption, particularly in rural and resource-constrained environments.

Most existing livestock disease prediction systems rely on structured datasets such as clinical measurements, laboratory test results, or sensor-based data. Although these systems demonstrate high accuracy under controlled conditions, they are impractical for early-stage disease detection where such data is unavailable. Farmers often identify disease onset based on observable symptoms such as changes in appetite, behavior, or physical appearance. However, very few systems are designed to process unstructured, symptom-based inputs provided directly by farmers.

Another major limitation observed in existing research is the lack of multilingual support. Many digital veterinary platforms and decision-support tools are developed primarily in English, assuming a certain level of technical literacy among users. This assumption significantly restricts adoption in rural regions where farmers prefer communicating in regional languages. The absence of language-adaptive systems creates a critical gap between technological advancements and real-world usability.

Furthermore, several AI-based livestock health systems focus heavily on predictive modeling using traditional machine learning algorithms or deep learning architectures that require large, labeled datasets and extensive computational resources. These systems often lack real-time inference capability and are difficult to deploy in low-infrastructure environments. There is limited research exploring lightweight, low-latency AI inference mechanisms that can deliver fast responses without requiring specialized hardware.

Another gap lies in the integration of disease prediction with actionable guidance. Many existing studies emphasize disease classification accuracy but fail to translate predictions into practical recommendations for farmers. Early disease awareness is most effective when accompanied by preventive measures and suggested actions that farmers can immediately implement. The lack of integrated decision support reduces the practical impact of many research solutions.

The motivation behind this work arises from the need to bridge these identified gaps by developing a farmer-centric veterinary assistance system that emphasizes accessibility, intelligence, and practicality. VetAid is motivated by the objective of enabling early disease awareness using symptom-based inputs, removing language barriers through multilingual interaction, and delivering fast AI-powered reasoning using the Groq API. By focusing on usability and real-world deployment rather than purely theoretical performance, this work aims to create a practical veterinary decision support system that can improve livestock health management, reduce economic losses, and support sustainable agriculture in rural communities.

1.4 Objectives

The primary objective of this research is to design and develop an AI-enabled veterinary decision support system that assists farmers in early identification and prevention of cattle diseases using symptom-based analysis. The proposed system aims to address the limitations of existing livestock healthcare solutions by focusing on accessibility, multilingual interaction, and real-time AI reasoning.

The specific objectives of this study are outlined as follows:

1. *To analyze the challenges associated with traditional livestock disease diagnosis systems*, particularly in rural and semi-urban regions where access to veterinary professionals and diagnostic facilities is limited. This includes understanding delays in diagnosis, language barriers, and lack of timely disease awareness among farmers.

2.*To design a farmer-centric veterinary assistance platform* that allows users to describe observed cattle symptoms in a natural and intuitive manner without requiring technical or clinical knowledge. The system is intended to be simple, easy to use, and suitable for farmers with limited digital literacy.

3.*To incorporate multilingual support for symptom input,* enabling farmers to interact with the system using regional languages. This objective focuses on reducing language barriers and increasing adoption of digital veterinary solutions in rural communities.

4.*To develop a symptom-based disease analysis approach* that can process unstructured textual inputs and map them to possible cattle diseases. The system emphasizes early disease awareness rather than clinical diagnosis, supporting preventive decision-making.

5.*To integrate artificial intelligence reasoning* through the Groq API for fast, reliable, and low-latency inference. This objective aims to evaluate the effectiveness of lightweight AI inference mechanisms that can operate efficiently without requiring high computational resources.

6.*To provide actionable outputs in the form of disease information, preventive measures, and recommended actions*, ensuring that AI predictions are translated into practical guidance that farmers can immediately understand and apply.

7.*To evaluate the system* based on functionality, performance, and usability, assessing factors such as response time, accuracy of disease guidance, multilingual input handling, and overall user experience.

8.*To demonstrate the applicability of AI-based decision support systems* in livestock healthcare, highlighting how such systems can improve early disease awareness, reduce economic losses, and contribute to sustainable agriculture.

Through these objectives, the study aims to bridge the gap between advanced AI technologies and real-world livestock healthcare needs. The successful achievement of these

objectives establishes VetAid as a practical, scalable, and farmer-friendly veterinary decision support system.

2. RELATED WORK

Several studies have explored digital solutions for livestock health monitoring. ICT-based livestock management systems have improved data accessibility for farmers but often lack intelligent disease reasoning. Traditional machine learning models such as decision trees and SVMs have been applied for disease prediction but require structured datasets and expert input.

Recent research highlights the potential of AI-based decision support systems in agriculture. However, most systems focus on data-driven prediction models without addressing language barriers or real-time farmer usability. Unlike existing approaches, VetAid combines AI reasoning, multilingual input support, and farmer-friendly interaction into a unified system.

In recent studies, researchers have also explored the use of natural language processing and AI-driven reasoning for agricultural and veterinary decision support systems. These approaches focus on interpreting user-described symptoms and contextual information to provide advisory outputs. However, many such systems are either domain-restricted, lack real-time inference capability, or are developed as conceptual frameworks without practical deployment. Additionally, limited attention has been given to optimizing inference latency and usability for non-technical users. Unlike these approaches, VetAid emphasizes practical implementation by integrating low-latency AI inference through the Groq API, multilingual symptom processing, and actionable disease guidance, thereby addressing both technical efficiency and real-world farmer usability.

3. METHODOLOGY

The methodology is a structured pipeline represented through Data Flow Diagrams (DFD-0 and DFD-1) which shows the whole process and the interaction between them.

3.1 Overview (DFD-0)

Figure 3.1 The VetAid system allows farmers to enter animal symptoms through a user-friendly interface.

The input is processed using multilingual language support and AI-based disease analysis.

Based on the analysis, the system retrieves relevant disease information and provides health advice and results.

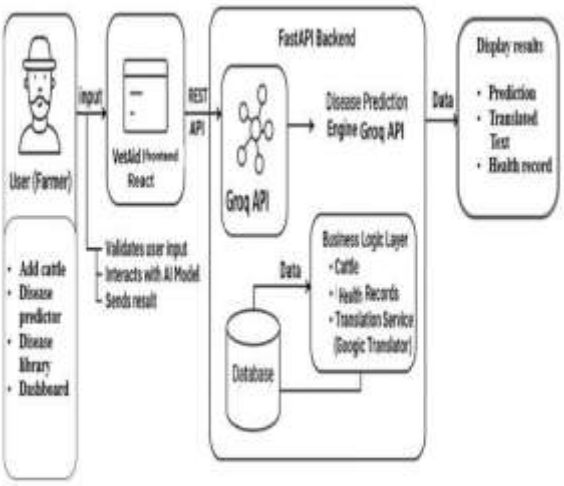

Figure 3.1. *Level-0 Data Flow Diagram (DFD-0)*

The Level-2 Data Workflow Diagram illustrates the internal processing of data within the VetAid system in a more detailed manner. It explains how user-provided symptom data is transformed into meaningful disease guidance through multiple processing stages.

Initially, the farmer/user enters observed cattle symptoms through the User Interface module. The input may be provided in a regional language or English. This data is first passed to the Input Validation module, where the system checks for completeness, invalid characters, and empty fields to ensure reliable processing.

After validation, the symptom data is forwarded to the Language Support module, which performs multilingual translation and localization. This module converts regional language inputs into a standardized language format suitable for AI processing while preserving the original meaning of the symptoms.

The translated symptom data is then sent to the AI-Based Disease Analysis module. This module communicates with the Groq API, where AI reasoning is applied to analyze symptom patterns and infer possible cattle diseases. The AI engine processes the input and generates structured prediction results.

Next, the predicted disease information is matched with the Disease Knowledge Base, which stores details such as disease descriptions, symptoms, preventive measures, and recommended actions. Relevant information is retrieved and combined with the AI prediction output.

Finally, the processed results are sent to the Health Advice & Results module, where the information is formatted into a user-friendly response. The system displays disease insights, prevention tips, and suggested actions back to the farmer, completing the data workflow.

3.2 Detailed Workflow (DFD-1)

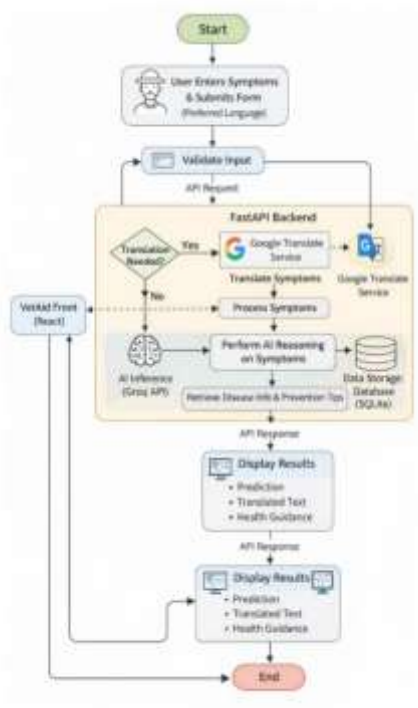

Figure 3.2. Level-1 Data Flow Diagram (DFD-1)

4. SYSTEM DESIGN

The VetAid system is designed as a lightweight, modular, and farmer-centric veterinary decision support platform. The system architecture focuses on simplicity, scalability, and real-time response generation while ensuring accessibility for users with minimal technical expertise. The design integrates multilingual interaction, AI-based reasoning, and a structured disease knowledge base to support early livestock disease awareness.

4.1 System Design

VetAid follows a client–server architecture in which users interact with the system through a web-based interface. Farmers enter observed cattle symptoms using natural language in their preferred regional language. The design ensures that users are not required to provide structured medical data or clinical measurements, making the system suitable for early-stage disease identification.

The system design consists of the following core components:

User Interface Module:
Provides a simple and intuitive interface for farmers to input symptoms and view results.

Input Validation Module:
Ensures that the entered symptom data is complete and free from invalid or empty inputs before further processing.

Language Support Module:
Handles multilingual translation and localization by converting regional language inputs into a standardized format suitable for AI processing.

AI-Based Disease Analysis Module:
Performs intelligent reasoning on the processed symptom input using the Groq API to infer possible cattle diseases.

Disease Knowledge Base:
Stores structured information about cattle diseases, symptoms, preventive measures, and recommended actions.

Result Presentation Module:
Formats and displays disease insights and health advice in a farmer-friendly manner.

The modular design allows each component to function independently while maintaining smooth data flow across the system. This approach improves maintainability and enables future enhancements such as image-based diagnosis or mobile application support.

5. IMPLEMENTATION

The VetAid system is implemented as a web-based application using widely supported technologies to ensure ease of deployment and scalability. Python is used as the primary backend language due to its strong support for AI integration and web development. The frontend is developed using standard web technologies to provide a responsive and accessible user experience.

Multilingual symptom processing is implemented through a language translation module that converts user inputs into a standardized language format while preserving semantic meaning. This translated data is forwarded to the AI inference module.

AI-based disease analysis is carried out using the Groq API, which performs low-latency inference on symptom descriptions. The API analyzes the input text, identifies relevant disease patterns, and generates structured outputs such as possible disease names, brief descriptions, preventive measures, and recommended actions.

The disease knowledge base is queried to enrich AI predictions with contextual information that is easily understandable by farmers. The final output is then displayed through the user interface, completing the workflow.

The implementation emphasizes efficiency and real-time performance. By offloading AI inference to the Groq platform, the system avoids dependency on high-end local hardware while maintaining fast response times. This makes VetAid suitable for deployment in rural and low-infrastructure environments.

6. RESULTS AND DISCUSSION

The performance of the proposed VetAid system was evaluated to assess its effectiveness in providing early livestock disease awareness through symptom-based analysis. The evaluation focused on functional correctness, response time, multilingual input handling, and overall usability.

6.1 Functional Evaluation

The system was tested using multiple symptom scenarios representing commonly observed cattle diseases. For each valid symptom input, VetAid successfully generated possible disease identification along with relevant preventive measures and recommended actions. The system demonstrated consistent behavior across repeated trials, indicating reliable functional performance.

The multilingual input feature was evaluated by providing symptom descriptions in regional languages. The translation module accurately processed the inputs and preserved semantic meaning, enabling effective AI-based disease analysis. This confirms that the system meets its objective of improving accessibility for rural farmers.

6.2 Performance Analysis

Response time was evaluated as a key performance metric due to the system's real-time decision support objective. The use of the Groq API for AI inference resulted in low-latency response generation. In most test cases, the system produced outputs within a short time span after symptom submission, even when handling multilingual inputs.

The system maintained stable performance during consecutive user requests, indicating that the lightweight architecture and external AI inference mechanism are suitable for practical deployment without significant performance degradation.

6.3 Usability Discussion

Usability testing was conducted to evaluate the farmer-centric design of the system. Test users were able to enter symptoms easily without requiring technical or medical knowledge. The output presentation was clear and concise, providing disease-related insights in an understandable manner.

Multilingual support significantly enhanced usability, allowing users to interact with the system in their preferred language. This feature addresses a major limitation of existing digital veterinary platforms and improves adoption potential in rural environments.

6.4 Discussion

The results demonstrate that VetAid effectively addresses the research gaps identified in existing livestock healthcare systems. By focusing on symptom-based input, multilingual accessibility, and low-latency AI inference, the system provides a practical solution for early disease awareness.

Unlike traditional veterinary diagnosis systems, VetAid does not rely on structured clinical data or physical examinations. Instead, it supports preventive decision-making by offering timely guidance based on observable symptoms. While the system does not replace professional veterinary consultation, it acts as a supportive tool that can reduce delays in treatment and minimize economic losses.

CONCLUSION

This paper presented VetAid, an AI-enabled multilingual veterinary decision support system designed to assist farmers in early livestock disease awareness through symptom-based analysis. The system addresses key challenges in livestock healthcare, including delayed diagnosis, limited access to veterinary services, and language barriers faced by rural farmers.

VetAid integrates multilingual symptom processing with AI-based reasoning using the Groq API to generate fast and reliable disease-related guidance. The system was implemented as a lightweight web-based platform and evaluated for functionality, performance, and usability. Experimental results demonstrated that the system provides timely responses, handles multilingual inputs effectively, and delivers clear, farmer-friendly outputs.

By focusing on accessibility and practical usability rather than clinical diagnosis, VetAid serves as a supportive tool for early disease awareness and preventive decision-making. The proposed approach demonstrates the potential of AI-driven decision support systems in livestock healthcare and highlights their role in improving rural agricultural sustainability.

Future work will focus on extending the system to support additional livestock species, incorporating image-based disease analysis, and integrating tele-veterinary services to enhance decision support capabilities further.

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