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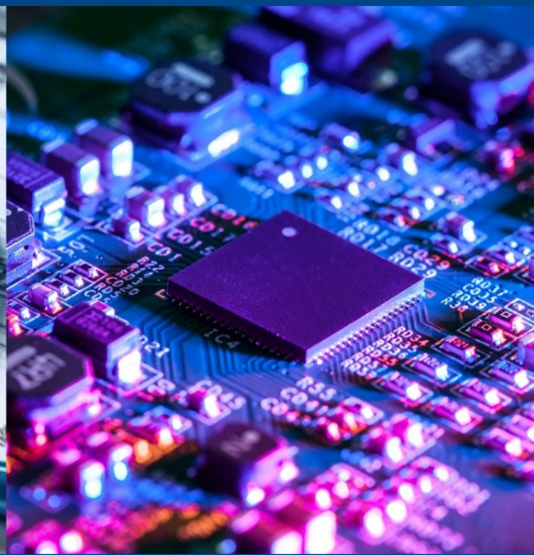

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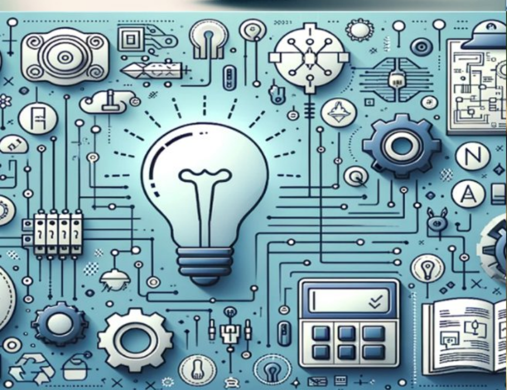

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AI-Based Livestock Health Monitoring for Cattle Disease and Decision Support

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ABSTRACT: Livestock diseases significantly impact agricultural productivity and rural economies, particularly in regions where cattle farming is a primary source of livelihood. Traditional livestock health monitoring relies heavily on manual inspection and delayed veterinary intervention, leading to late diagnosis and increased economic loss. This paper presents the design and implementation of an AI-Based Livestock Health Monitoring System for Cattle Disease Detection and Decision Support. The proposed system integrates a weighted rule-based risk assessment algorithm with an optional Convolutional Neural Network (CNN) module for image-based disease recognition. Structured livestock attributes such as age, breed, vaccination status, cattle type, and previous disease history are analyzed to compute a risk score that classifies animals into Healthy, At Risk, or Critical categories. The system also provides veterinary recommendations including vaccination advice and preventive control measures. A web-based dashboard is implemented to store historical health records and visualize disease trends

KEYWORDS: Artiﬁcial Intelligence, Livestock Monitoring, Risk Scoring Algorithm, CNN, Disease Detection, Decision Support System, Smart Agriculture.

I. INTRODUCTION

Livestock farming is a vital component of the agricultural economy, contributing significantly to food production, dairy supply, and rural income generation. However, cattle diseases such as Foot-and-Mouth Disease and Lumpy Skin Disease pose serious threats to livestock

health and farm productivity. Early disease detection remains a major challenge due to thelack of structured monitoring systems and limited access to veterinary services in rural areas. Traditional methods primarily depend on manual observation and farmer experience, which may result in delayed diagnosis and ineffective disease management. With advancements in Artificial Intelligence, intelligent monitoring systems can assist in proactive livestock health management. AI techniques enable automated analysis of structured and visual data to identify risk patterns and support decision-making. This research proposes an AI-Based Livestock Health Monitoring System that integrates structured risk scoring with optional deep learning- based image recognition to provide early detection and veterinary decision support.

II. LITERATURE SURVEY

Artificial Intelligence has been increasingly applied in smart agriculture and livestock disease detection. Previous research has utilized machine learning algorithms such as Naïve Bayes, Support Vector Machines (SVM), K-Nearest Neighbors (KNN), Decision Trees, and Random Forest models to classify cattle diseases based on structured datasets. These approaches aim to improve prediction accuracy by training supervised models on historical data Additionally, deep learning techniques, particularly Convolutional Neural Networks (CNN), have been employed for image- based disease recognition, enabling automated detection of visible symptoms. IoT-based monitoring systems have also been introduced to collect real-time physiological parameters usingwearable sensors. However, most existing systems focus solely on prediction accuracy and lack integrated risk assessment mechanisms, decision-support modules, and continuous monitoring dashboards. The proposed system addresses these limitations by developing a hybrid AI

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architecture combining rule-based reasoning and deep learning validation within a unified livestock monitoring framework.

Problem Statement

Conventional livestock monitoring practices face several limitations, including reliance on manual observation, absence of structured health record management, delayed disease identification, and lack of integrated decision- support mechanisms. Farmers often lack access to intelligent systems that provide early warning signals and preventive guidance. There is a need for an affordable, explainable, and scalable AI- based solution capable of assessing livestock health risk, detecting potential diseases, and providing actionableveterinary recommendations.

Proposed System

The proposed AI-Based Livestock Health Monitoring System consists of multiple interconnected modules designed to provide intelligent health analysis and monitoring. The system collects structured livestock data through a web interface, processes it using a weighted rule-based risk assessment algorithm, and classifies livestock health conditions. An optional CNN-based image recognition module analyzes livestock images to validate visible symptoms. The system also incorporates a veterinary decision-support module that recommends vaccination schedules and preventive measures. All results are stored in a centralized database and visualized through an interactive dashboard.

III. METHODOLOGY

The system follows a structured AI-based processing pipeline to provide intelligent cattledisease detection and decision support for farmers and veterinarians.

1. DataCollection:

Data is collected from cattle skin images, eye and mouth images, wearable health sensors (temperature, heart rate, rumination activity), environmental conditions, and manually entered symptoms by farmers. Captured images and sensor readings are stored in the database and prepared for processing.

2. Preprocessing:

Data is cleaned and structured before analysis. Images are resized, normalized, and enhanced to remove noise. Sensor data is checked for missing values and outliers, and feature scaling is applied to ensure consistency. This step ensures high-quality input for the AI models.

3. FeatureExtraction:

Image data is processed using a Convolutional Neural Network (CNN) to extract spatial and texture features related to cattle diseases. Sensor data is converted into statistical features such as temperature deviation, heart rate variation, and activity index to enable accurate disease pattern recognition.

4. DiseaseClassification&Processing:

The system identifies the disease by applying deep learning and machine learning models. The CNN model classifies diseases from image data, while a Random Forest classifier analyzes sensor-based health patterns. The predictions are combined using an ensemble approach to improve accuracy and reliability.

5. DecisionSupportMechanism:

The predicted disease results are evaluated to determine severity level (Mild, Moderate, Severe). The system retrieves relevant treatment recommendations, medication guidance, and preventive measures from the knowledge base to assist farmers in decision- making.

6. ResponseDelivery:

The final diagnosis, confidence score, severity level, and treatment recommendations are displayed on the farmer's mobile application and veterinary dashboard

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IV. SYSTEM ARCHITECTURE

The system is designed using a layered architecture to ensure modularity, scalability, and real-time disease monitoring. Each layer performs a specific role in processing cattle health data and delivering intelligent disease detection and decision support.

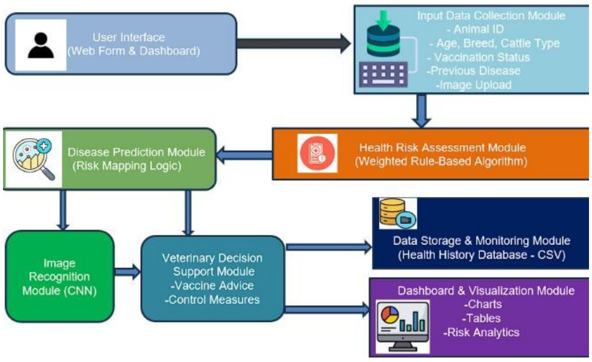

Fig 1 . ARCHITECTURE DIAGRAM

1. ClientLayer:
The Client Layer is the web and mobile application used by Farmers and Veterinarians. It is built using React (for web) and supports a simple, user-friendly interface. Farmers can log in, capture cattle images, enter symptoms, and view health reports. They can submit data through image upload, text input, or voice input. The system sends these requests securely to the backend using authentication tokens.

2. API/ServiceLayer:
The API Layer is developed using FastAPI. It receives requests from the frontend and processes them. It validates user authentication, analyzes the type of input (image, sensor data, or symptoms), and forwards the request to the appropriate AI model. This layer connects the frontend with the database and machine learning modules.

3. Data & Machine Learning Layer: This layer stores and processes livestock health data. The database stores cattle records, disease history, sensor readings, and treatment information. The AI models process images using a Convolutional Neural Network (CNN)

4 Background Monitoring Layer: This layer handles automatic health monitoring tasks such as continuous sensor data tracking, abnormal health pattern detection, and alert generation. It runs in the background without farmer involvement, ensuring real-time updates and timely disease warnings.

I. Technical Stack
The AI-Based Livestock Health Monitoring System for Cattle Disease Detection and Decision Support is developed using the following technologies:

1. Frontend:
The frontend is developed using React.js with Vite to create a fast and responsive Single Page Application (SPA). Tailwind CSS is used for designing a clean and farmer-friendly user interface. Axios is used to send API requests securely from the frontend to the backend. The interface allows farmers to upload cattle images, enter symptoms, and view disease predictions and treatment recommendations.

2. Backend:
The backend is built using FastAPI, a high- performance Python framework for developing REST APIs. Uvicorn is used as the ASGI server to run the application efficiently. JWT-based authentication is implemented to ensure secure access control for farmers and veterinarians. The backend handles image processing, sensor data analysis, and communication with AI models.

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3. Database:

MongoDB is used as the primary database to store cattle records, disease history, sensor readings, treatment recommendations, and prediction logs. PyMongo is used to connect and interact with the MongoDB database from the FastAPI backend.

4. AI & Machine Learning:

The system uses a Convolutional Neural Network (CNN) model built with TensorFlow/Keras for cattle image- based disease detection. A Random Forest classifier from Scikit-learn is used to analyze physiological sensor data. NumPy is used for numerical computations, and an ensemble learning approach is implemented to combine predictions from multiple models for improved accuracy and reliability.

5. Image&DataProcessing:

OpenCV is used for image preprocessing tasks such as resizing, normalization, and noise reduction. Pandas is used for handling sensor datasets and structured health records. Data augmentation techniques are applied to improve model robustness. The processed features are passed to the machine learning models for accurate disease classification.

V. IMPLEMENTATION

The AI-Based Livestock Health Monitoring System for Cattle Disease Detection and Decision Support is implemented using a layered and modular approach. The frontend is developed using React, where farmers and veterinarians can log in, upload cattle images, enter symptoms, and view disease predictions and health reports through a simple and user-friendly interface. The backend is built using FastAPI, which handles authentication, role- based access control, image and sensor data processing, disease prediction requests, and API routing. MongoDB is used to store cattle records, sensor readings, disease history, treatment information, and prediction results. All components are connected through REST APIs, allowing smooth communication between the frontend, backend, database, and machine learning models to provide accurate, real-time cattle disease detection and decision support.

VI. EXPERIMENTAL RESULTS

The proposed AI-Based Livestock Health Monitoring System was tested to evaluate its performance, accuracy, and real-time disease detection capability. The system was evaluated using different types of inputs,including cattle skin images, physiological sensor data (temperature and heart rate), and manually entered symptoms. For image-based disease detection, the Convolutional Neural Network (CNN) model successfully classified common cattle diseases with high accuracy and consistent prediction performance. The model effectively identified visible symptoms such as skin lesions and infections under normal lighting conditions. Minor variations in image quality and angle had limited impact on classification accuracy due to preprocessing and data augmentation technique

Fig.2. Home Page

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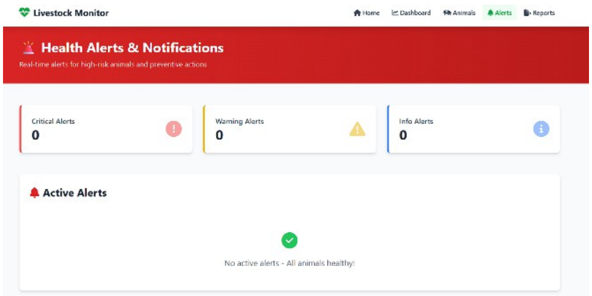

Fig.3. Health Alert Page

VII. DISCUSSION

The proposed AI-Based Livestock Health Monitoring System demonstrates an effective integration of deep learning, sensor data analysis, and decision support mechanisms for cattle disease detection. The layered architecture ensures modularity, making the system scalable and easy to maintain. The use of Convolutional Neural Networks (CNN) significantly improves the system's ability to detect visual disease symptoms beyond traditional manual inspection methods. By implementing an ensemble learning approach combining image-based and sensor-based predictions, the system provides more reliable and accurate results compared to single-model systems. This enhances early disease detection and reduces false negatives. Overall, the system successfully

achieves its objective of providing intelligent, real-time cattle disease detection and decision support, particularly suitable for rural farming environments.

A. Advantages

The proposed AI-Based Livestock Health Monitoring System offers several important advantages:

1. AI-based early disease detection
2. Multi-modal analysis using image and sensor data
3. Ensemble learning for improved accuracy
4. Development of a dedicated mobile application
5. Real-time health monitoring and alerts
6. Severity level prediction for better decision-making
7. Support for multi-language voice assistance for farmers
8. Secure role-based access control
9. Farmer-friendly interface with simple interaction
10. Reduces economic losses due to late disease detection
11. Scalable and modular system architecture

B. Limitations

Despite its effectiveness, the proposed system has certain limitations:

1. Dependence on stable internet connectivity for real-time updates
2. Prediction accuracy may vary with poor image quality or lighting conditions
3. Sensor inaccuracies may affect physiological analysis
4. Limited detection capability for rare or unseen diseases
5. Performance may decrease with very large- scale farm data
6. Requires computational resources for model inference

C. Future Enhancement

Several future enhancements are planned to improve system functionality:

1. Integration of advanced deep learning models for improved disease classification
2. Implementation of lightweight edge AI models for offline rural deployment

3. Integration with veterinary hospital management systems
4. Real-time analytics dashboard for livestock health trends
5. Cloud deployment for better scalability and performance
6. Continuous model training using new disease datasets

VIII. CONCLUSION

The proposed AI-Based Livestock Health Monitoring System for Cattle Disease Detection and Decision Support provides an intelligent and efficient solution for early disease identification and farm-level health management. By integrating deep learning, sensor data analysis, and decision support mechanisms, the system enables accurate disease detection and real- time health monitoring. The use of a Convolutional Neural Network (CNN) for image-based analysis combined with a Random Forest classifier for physiological data improves prediction accuracy compared to traditional manual inspection methods.

The ensemble learning approach further enhances reliability by reducing false negatives and improving overall diagnostic performance. The layered architecture ensures modularity, security, and scalability, while role-based access control protects sensitive livestock health data.

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REFERENCES

[1] D. Kaur, V. K. S. Virk, “Smart neck collar: IoT-based disease detection and health monitoring for dairy cows,” Journal of Ambient Intelligence and Humanized Computing, 2023,
pp. 1–14
[2] M. Adam, “Deep Learning Approaches for Automatic Livestock Monitoring,” Future Internet, vol. 17, no. 9, 2025.
[3] U. Nawaz, M. Z. Zaheer, F. S. Khan et al., “AI in Agriculture: A Survey of Deep Learning Techniques for Crops, Fisheries and Livestock,” arXiv:2507.22101, 2025.
[4] V. M. Araújo, I. Rili, T. Gisiger et al., “AI- Powered Cow Detection in Complex Farm Environments,” arXiv:2501.02080, 2024.
[5] R. Patil, A. Pati, A. Raj, “AI and IoT Based Algorithm for Cattle Lumpy Disease Detection,” 2025 IEEE Int. Conf. Comput Robot. Test. Eng. Eval. (ICCRTEE), 2025.
[6] Md. Prakash Kumar, P. Abinaya, D. Ashokkumar et al., “Advanced Livestock Disease Detection and Health Forecasting using Machine Learning,” Int. J. Innovative Research in Science, Eng. and Tech., vol. 14, no. 4, Apr. 2025.
[7] H. Mohapatra, “A LoRa IoT Framework with Machine Learning for Remote Livestock Monitoring in Smart Agriculture,” arXiv:2510.07322, 2024.
[8] K. Ahmed, M. Ahmed and A. Hussain, “Cattle Disease Prediction Using Machine Learning: A Comprehensive Study,” Animals, vol. 13, no. 1, p. 85, 2025. This paper evaluates machine learning approaches for cattle disease diagnosis using real- world case datasets.
[9] M. Nadeem et al., “Improving Bovine Disease Detection through Multilabel Machine Learning Models,” Scientific Reports, 2025. This study highlights advanced ML techniques for disease prediction by integrating behavioral and physiological inputs from sensor and image data.
[10] T. Li et al., “Advancements in Intelligent Monitoring Technologies for Smart Livestock Farming,” Agriculture, vol. 16, no. 1, 2025.

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