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Smart Vet Assistant for Pets

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Abstract
Animal health is really important. We need to check on animals all the time. It is hard to find out if they are sick early because we have to watch them manually. This project is about making a system to monitor animal health. We will use the internet and special computer programs to keep an eye on animals continuously and detect illness before it is too late. The system uses tools to collect information about animals, such as their body temperature and heart rate. It also checks the air they breathe and its acidity or basicity. All this information is stored safely and analyzed by computer programs to identify patterns or signs of poor health. There is also a website where users can monitor real-time data, review past records, and receive alerts if something is wrong. This system is beneficial because it helps in better animal care, prevents serious illness, and supports pet owners and farmers in managing their work efficiently using technology. Animal health monitoring is very important, and this smart system makes it possible.
Keywords: *Big Data Analytics, Diabetes Prediction*

1. Introduction
Animals play a vital role in human life, whether as companion pets or as livestock supporting agriculture and the food industry. Their health and well-being directly influence emotional connections as well as economic stability in farming sectors. However, traditional animal healthcare methods mainly rely on manual observation and periodic veterinary check-ups, which make continuous monitoring difficult and often result in delayed disease detection. Many illnesses develop gradually and do not show visible symptoms in their early stages, leading to late diagnosis and increased treatment complexity. With the rapid advancement of technologies such as the Internet of Things (IoT) and Machine Learning (ML), new possibilities have emerged for improving animal health monitoring systems. IoT enables the use of smart sensors to continuously collect physiological parameters such as temperature, heart rate, oxygen level, gas concentration, and pH values. These sensors facilitate real-time monitoring without disturbing the natural behavior of animals. At the same time, Machine Learning techniques allow intelligent analysis of large volumes of sensor data to identify hidden patterns and predict potential health issues [3], [5]. Several researchers have proposed IoT-based monitoring systems integrated with machine learning for livestock and pet health management. These systems demonstrate improved disease detection and decision-making capabilities; however, they often face challenges such as limited adaptability, dependency on large datasets, lack of personalization, and insufficient real-time alert mechanisms [1], [2], [4]. To address these limitations, this project proposes a Smart Animal Health Monitoring System that integrates IoT-based sensing with machine learning-driven analysis to provide continuous health tracking, early disease detection, and intelligent alert generation. The system collects real-time data from multiple sensors, processes it through an intelligent backend, and presents meaningful insights via a user-friendly interface.

The main objectives of this work are as follows:
- To design a real-time animal health monitoring system using IoT sensors.
- To apply machine learning techniques for early disease prediction.
- To provide intelligent alerts and decision support for users.
- To improve overall animal care through a

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technology-driven approach.

The originality of this work lies in combining multi-parameter sensing, machine learning-based prediction, and real-time alerting into a unified and scalable system that supports both livestock and pet healthcare.

1.1. Importance of Smart Animal Monitoring

Animal health monitoring is essential for ensuring productivity, disease prevention, and overall well-being. Traditional monitoring approaches are inefficient for large-scale or continuous observation. Smart systems provide automated, real-time tracking of health conditions, reducing human effort and improving accuracy. The integration of IoT and machine learning enables predictive healthcare, allowing early intervention before diseases become severe.

1.2. Challenges in Existing Systems

Despite advancements, existing animal monitoring systems face several challenges. Many systems rely on limited datasets or predefined threshold values, which reduce prediction accuracy. Lack of scalability, poor adaptability across different animal types, and insufficient real-time alert mechanisms are also major issues. Additionally, integration of multiple sensor data and providing user-friendly interfaces remain significant challenges. These limitations highlight the need for a more comprehensive and intelligent monitoring solution.

2. Method (12 Pt)

The methodology of the Smart Animal Health Monitoring System is designed to enable continuous health monitoring, intelligent data analysis, and real-time alert generation. The system integrates IoT-based sensing, wireless communication, and machine learning techniques. The experimental setup consists of multiple sensors, including temperature, heart rate (ECG), gas, oxygen level, and pH sensors connected to an ESP32 microcontroller. The microcontroller collects real-time physiological data and transmits it to the backend server using Wi-Fi and HTTP protocols. The received data is preprocessed to remove noise, normalize values, and handle missing data. Machine learning algorithms are applied to analyze the processed data for classification and anomaly detection. Based on the analysis, the system generates alerts and displays the results through a web-based dashboard. Previously established IoT communication protocols and machine learning techniques are adopted from existing studies [1], [5]. The novelty of this work lies in integrating multi-parameter sensing with real-time intelligent alert generation.

2.1. Tables

Table 1. Hardware Components Used in the System

Component	Description	Purpose
ESP32 Microcontroller	Wi-Fi enabled microcontroller	Data collection & transmission
Temperature Sensor	Measures body temperature	Detect fever condition
ECG/Heart Rate Sensor	Monitors heart activity	Track heart rate abnormalities
Gas Sensor	Detect harmful gases in surroundings	Monitor breathing environment
Oxygen Sensor (SpO_2)	Measure oxygen level	Detect respiratory issues
pH Sensor	Measures acidity/basicity	Monitor internal health changes

Table 2. Software and Technologies Used in the system

Technology	Description	Purpose
Arduino IDE	Embedded programming platform	Programming ESP32
Python (Flask/Django)	Backend framework	Data processing & API handling
Machine Learning	Algorithms (Scikit-	Health prediction

	learn/TensorFlow)	& analysis
Firebase	Cloud database	Data storage & retrieval
HTML/CSS/Bootstrap	Frontend technologies	User dashboard interface
Wi-Fi/HTTP	Communication protocol	Data transmission

Table 3 **Sensor Parameters Monitored**

Parameter	**Unit**	**Normal Range (Approx.)**	**Purpose**
Temperature	°C	37 – 39	Detect fever
Heart Rate	BPM	60 – 160	Monitor cardiac health
Oxygen Level	% (SpO_2)	95 – 100	Detect breathing issues
Gas Level	ppm	Safe range varies	Detect harmful gases
pH Level	pH scale	6.5 – 7.5	Monitor metabolic condition

Figures are presented separately from the main text and are numbered using Arabic numerals (e.g., Fig. 1, Fig. 2) according to their sequence of appearance in the manuscript. Each figure is centered, and the figure number is placed clearly outside the boundaries of the image. The caption is provided below the figure in a clear and concise manner shown in table 1 and 2.

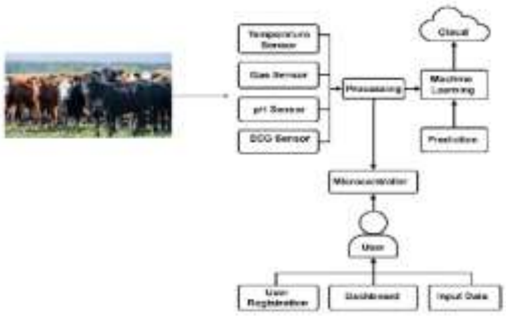

Figure 1 **System Architecture of Smart Animal Health Monitoring System**

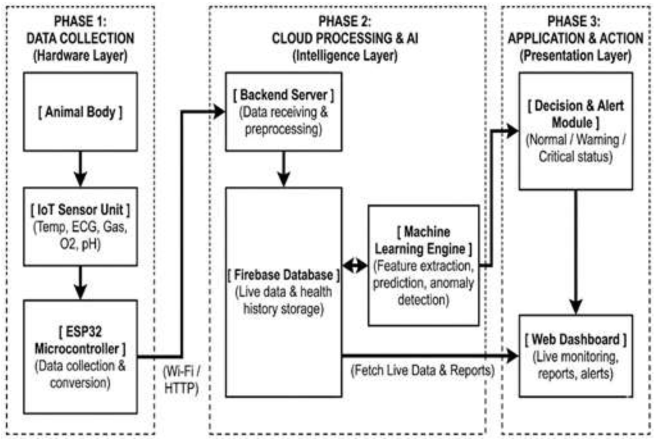

Figure 2. **Methodology Flow Diagram**

3. Results And Discussion

3.1. Results

The experimental setup of the Smart Animal Health Monitoring System was designed to evaluate the effectiveness of real-time data collection, processing, and health prediction using IoT sensors and machine learning techniques. The system collected physiological parameters such as temperature, heart rate (ECG), oxygen level, gas concentration, and pH values from animals using multiple sensors connected to the ESP32 microcontroller. The data was transmitted to the cloud server through Wi-Fi and stored in the Firebase database for further analysis. To ensure data reliability, preprocessing techniques such as noise removal, normalization, and missing value handling were applied. Machine learning models were then used to classify the health condition of animals into three categories: Normal, Warning, and Critical.

Table 4. Sample Sensor Readings and Predicted Health Status

Temp (°C)	Heart Rate (BPM)	Oxygen (%)	Gas Level (ppm)	pH Value	Predicted Status
38.2	120	97	10	7.0	Normal
39.5	140	92	25	6.5	Warning
40.8	165	88	40	6.2	Critical
37.8	110	98	8	7.2	Normal

The results demonstrate that the system successfully identifies abnormal health conditions based on variations in multiple parameters. When sensor values exceed normal thresholds, the system generates alerts and displays them on the web dashboard in table 3 and 4. Additionally, the system provides:

- Real-time monitoring through a dashboard
- Historical data visualization
- Automatic alert generation for abnormal conditions

These results confirm that the system performs efficient real-time monitoring and early disease detection.

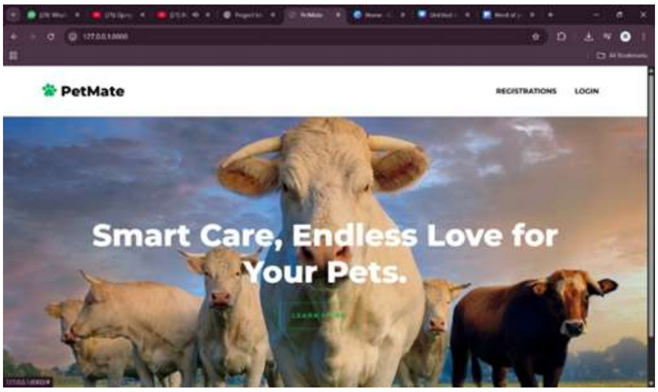

Figure 3 Home Page of Smart Animal Health Monitoring System

Description:
The home page provides an overview of the system, including features, purpose, and navigation options. It acts as the entry point for users to access different functionalities of the application.

Figure 4 Dashboard Interface of Smart Animal Health Monitoring System

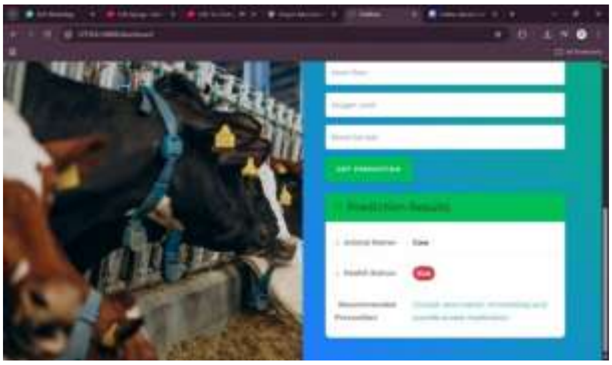

Figure 4 Prediction Result

3.2. Discussion

The results clearly indicate that integrating IoT sensors with machine learning significantly improves the efficiency and accuracy of animal health monitoring systems. Unlike traditional methods that rely on manual observation, the proposed system enables continuous and automated tracking of health parameters. The use of multiple sensors allows the system to analyze different physiological conditions simultaneously, which enhances the reliability of health predictions. For example, a combination of increased temperature and decreased oxygen level provides stronger evidence of a critical condition compared to analyzing a single parameter. Machine learning models further improve the system by identifying hidden patterns in the data and enabling early detection of diseases. This predictive capability is particularly useful in preventing severe health issues and reducing economic losses in livestock management. However, the performance of the system depends on the quality and quantity of training data. Limited datasets or sensor inaccuracies may affect prediction accuracy. Environmental factors and variations among different animal species may also require model customization. Despite these challenges, the system demonstrates strong potential as a scalable and practical solution for modern animal healthcare. It provides real-time insights, reduces human effort, and supports timely decision-making, making it highly beneficial for both farmers and pet owners.

Conclusion

The problem addressed in this study was the difficulty in continuously monitoring animal health and detecting diseases at an early stage using traditional manual methods. As discussed in the results and analysis, the proposed Smart Animal Health Monitoring System successfully overcomes these limitations by integrating IoT sensors, cloud-based processing, and machine learning techniques.

The results confirm that the system is capable of collecting real-time physiological data, processing it efficiently, and accurately predicting animal health conditions. The dashboard interface further enhances usability by providing clear visualization of sensor readings and health status, enabling users to take timely actions. The discussion highlights that the use of multi-parameter monitoring and intelligent analysis improves the reliability and effectiveness of disease detection compared to conventional approaches. Thus, the study confirms that the proposed system provides a practical, efficient, and scalable solution for modern animal healthcare, reducing manual effort and supporting early diagnosis and better decision-making.

Future Work

In future, the system can be enhanced by incorporating additional advanced sensors to monitor more health parameters. The accuracy of prediction models can be improved by using deep learning techniques and larger datasets. Furthermore, integration with mobile applications, GPS-based animal tracking, and veterinary consultation systems can extend the functionality and make the system more comprehensive and accessible.

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