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A Comparative Study on Real Time Cattle Health Care Monitoring and Tracking using IOT

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Abstract—

Good health and wellbeing of animals are essential to dairy cow farms and sustainable production of milk. Unfortunately, day-to-day monitoring of animal's condition is difficult, especially in large farms where employees do not have enough time to observe animals. This system continuously monitors the health status of cattle by collecting and analyzing physiological parameter such as body temperature, heart rate. This paper presents an automated, IoT based monitoring system designed to monitor the health of the dairy cow. A mobile application is also developed to provide farmers with the real time monitoring and alert in case of any abnormality in a cattle health. This system provides farmers with a cost effective and efficient solution for monitoring the help of their cattle which can lead to improvement in productivity and profitability in a livestock industry.

Keywords— Cattle Health Monitoring, Animals, Internet of Things, Livestock Tracking, Wearable Sensors, Health Alert System, Smart Agriculture.

INTRODUCTION

The livestock sector plays a vital role in agriculture and the rural economy by providing milk, meat, and other dairy products. Maintaining the health of cattle is essential for improving productivity, ensuring food quality, and reducing economic losses for farmers. Traditional cattle health monitoring methods mainly depend on manual observation, which is time-consuming, less accurate, and may fail to detect diseases at an early stage. Delayed identification of health issues such as fever, abnormal heart rate, reduced activity, and stress can lead to severe illness and decreased production.

I.

With the advancement of the Internet of Things (IoT), smart healthcare systems for livestock management have become more efficient and reliable. IoT enables real-time monitoring and tracking of cattle using sensors and wireless communication technologies. Parameters such as body temperature, heart rate, and location can be continuously monitored and transmitted to cloud platforms or mobile applications for analysis and alerts. This helps farmers and veterinarians take immediate action whenever abnormal conditions are detected.

The proposed Real-Time Cattle Healthcare Monitoring and Tracking System using IoT aims to improve cattle welfare and farm management by integrating sensors, microcontrollers, GPS modules, and cloud-based monitoring. The system provides continuous health tracking, location monitoring, and instant notifications to farmers, thereby reducing cattle mortality, improving productivity, and enabling smart livestock farming practices. This approach offers a cost-effective,

automated, and efficient solution for modern cattle healthcare management.

II. LITERATURE REVIEW

In [1], Shivaanivarsha N et al. (2026), proposed a Transformer-based Deep Learning Framework named "Kamadhenu" for intelligent cattle health prediction and disease diagnosis using IoT and computer vision technologies. The system was developed to improve livestock health management, reduce manual monitoring efforts, and support early disease detection in dairy farms. The framework combines wearable IoT sensors, image processing, YOLOv8 segmentation, Vision Transformer (ViT) feature extraction, and machine learning classifiers for accurate cattle disease identification. Physiological parameters such as heart rate, body temperature, feed intake, water consumption, and activity levels were continuously collected using IoT sensors connected through an ESP32 gateway. A Raspberry Pi camera module captured cattle images to monitor posture, gait, and visible skin abnormalities. The collected sensor and image data were refined using preprocessing techniques including noise filtering, normalization, contrast enhancement, resizing, and augmentation. YOLOv8 was used to segment disease-affected regions from cattle images for precise visual analysis. Vision Transformer (ViT) extracted deep visual features from segmented images, while classifiers such as SVM, Random Forest, and Regression models were used for disease classification and milk yield prediction. Experimental analysis showed that the Vanilla ViT with SVM classifier achieved the highest accuracy of 97.1% with excellent precision and sensitivity. The framework successfully identified cattle diseases such as Lumpy Skin Disease, Infectious Bovine Rhinotracheitis (IBR), Calf Scour, and Bovine Viral Diarrhea with high reliability. A mobile-based context.

In [2], Mrs. M. Gayathri et al. (2026), proposed an AI-powered smart surveillance system for real-time human and pet monitoring with health, emotion, and behavior analysis. The system was developed to improve intelligent surveillance by integrating object detection, facial emotion recognition, and behavioral analysis within a unified framework. The proposed model utilized deep learning techniques such as YOLOv8 for real-time detection of humans and animals including dogs, cats, horses, sheep, cattle, and birds from live video streams. A Convolutional Neural Network (CNN) was employed to classify facial emotions such as happiness, sadness, anger, fear, surprise, disgust, and contempt with an accuracy of nearly 98–99%. The collected datasets were preprocessed using grayscale conversion, normalization, noise removal, and image augmentation techniques to improve model efficiency and robustness. The system analyzed emotional transitions over time to identify stress-related and subconscious behavioral conditions. Real-time dashboards were designed to display live counts of humans and animals along with emotional statistics and alert notifications. Automated alerts were generated whenever prolonged high-risk emotions such as anger or sadness were detected. The framework also ensured ethical surveillance by avoiding identity recognition and personal data storage. Experimental evaluation demonstrated improved accuracy, reliability, and robustness compared to conventional surveillance systems. The authors concluded that the proposed AI-based surveillance system enhances public safety, crowd monitoring, emotional intelligence, and real-time behavioral analysis in smart environments.

In [3], Tanvir Ahmed et al. (2025) proposed an advanced IoT-based animal health farming framework designed to improve livestock monitoring, disease prediction, and farm management efficiency through smart sensing and intelligent data analysis. The system integrates wearable sensors, edge devices, fog computing, cloud platforms, and machine learning techniques to provide real-time monitoring of animal health and behavior. Various sensors such as temperature sensors, heart rate sensors, GPS modules, RFID tags, accelerometers, gyroscopes, and vision sensors were used to collect physiological and behavioral data from livestock. The collected data included body temperature, heart rate, feeding activity, rumination, posture, movement, stress levels, and environmental conditions. The architecture consisted of multiple layers including physical, edge, fog, and cloud layers, where data processing was performed at different stages to reduce latency and improve response time. Communication technologies such as NB-IoT Wi-Fi, Bluetooth Low

Energy (BLE), and cloud-base services were utilized for efficient data

transmission and remote monitoring. Machine learning algorithms including decision trees, logistic regression, convolutional neural networks (CNNs), and anomaly detection models were applied to classify animal behaviors and detect diseases at early stages. The system enabled automatic health alerts and smart decision-making for farmers through mobile and cloud applications. Experimental studies demonstrated accurate monitoring of cattle activities, estrus detection, lameness prediction, feeding behavior analysis, and stress assessment with high reliability. The integration of edge and fog computing significantly reduced bandwidth consumption and improved real-time processing performance. Cloud computing provided large-scale data storage, analytics, and remote accessibility for veterinarians and farm managers. The authors concluded that IoT integrated with AI and ML technologies can greatly enhance animal welfare, reduce labor costs, improve disease management, and support sustainable precision livestock farming practices.

In [4], Shankar K et al. (2025) proposed a Smart IoT-based Framework for Livestock Mobility Monitoring and Support in Livestock. The system was designed to monitor the health and mobility of downer and pregnant cattle in real time. It used IoT technology along with physiological and behavioral sensors for continuous monitoring. Sensors such as temperature sensors, heart rate sensors, SpO2 sensors, and accelerometers were utilized. The sensors collected data related to body temperature, posture, movement, and activity levels of cattle. An Arduino Uno, ESP32, and Raspberry Pi were used for processing and analyzing sensor data. Threshold-based intelligent algorithms were implemented to detect abnormal conditions in animals. The collected information was transmitted through Wi-Fi, Bluetooth, and MQTT communication protocols. The system also provided remote monitoring support through mobile and cloud-based applications. Relay-controlled automated actuation mechanisms were integrated for mobility assistance. Inflatable airbags and support devices were activated automatically during abnormal conditions.

The proposed framework was tested on 10 cattle over a monitoring period of 30 days. Experimental results showed accurate detection of abnormal posture, low activity, and temperature variations. The automated intervention system achieved 100% successful recovery during detected abnormal events. The authors concluded that the proposed IoT framework improves animal welfare, reduces manual monitoring, and enhances smart livestock management efficiency.

In [5], Babitha Hemanth et al. (2025) proposed a real-time animal health and geolocation monitoring system using an IoT-based wearable collar. The system is designed for wildlife conservation and livestock management by continuously monitoring animals like elephants and cattle . It uses sensors such as MLX90614 for body temperature, MAX30100 for heart rate and SpO_2, and MPU6050 for motion detection. A GPS module is included for real-time location tracking of animals. All sensors are connected to an ESP32 microcontroller for data processing and communication. The collected data is transmitted wirelessly to a cloud platform using Wi-Fi or related protocols. A remote monitoring dashboard allows farmers and forest officials to observe animal health and movement in real time. The system can generate alerts for abnormal health conditions or boundary violations. The study highlights the importance of sensor fusion and edge processing for efficient monitoring in remote areas. The wearable collar is lightweight, durable, weather-resistant, and energy-efficient for long-term use. Experimental results showed accurate real-time monitoring and reliable data transmission. The authors concluded that the system improves early disease detection, livestock safety, and wildlife protection.

However, battery consumption during continuous transmission remains a limitation. Future improvements suggested include solar-powered operation, better energy optimization, additional health sensors, and machine learning for predictive analysis.

In [6], MD. Azahar Ali (2024), presented a study on the use of 3-D printed wearable biosensors for real-time livestock health monitoring and precision farming. The research focused on improving animal healthcare through continuous physiological monitoring, early disease

detection, and enhanced animal welfare. The study explained that electrochemical biosensors are capable of monitoring important biomarkers such as glucose, calcium levels, stress indicators, and metabolic disorders in livestock. Unlike conventional 2-D sensors, 3-D printed biosensors provide higher sensitivity, larger surface area, improved tissue integration, and better detection accuracy. The authors discussed the use of additive manufacturing and 3-D printing technologies for developing low-cost, flexible, and customized wearable sensors suitable for harsh farm environments. Wearable devices such as ear tags, collars, and skin patches were used for continuous monitoring of livestock behavior and health conditions. The collected data was integrated with Artificial Intelligence (AI) and Machine Learning (ML) algorithms for anomaly detection, predictive analysis, and intelligent decision-making in precision livestock farming.

The system successfully enabled early detection of diseases such as subclinical ketosis and hypocalcemia in dairy cows. Advanced materials including graphene, nanomaterials, and microelectrode arrays were utilized to improve sensor performance, reliability, and rapid diagnostics using biological samples such as milk, sweat, saliva, urine, and interstitial fluid. The study concluded that wearable biosensors combined with AI technologies can significantly improve livestock productivity, animal welfare, food safety, and sustainable agriculture, although challenges such as biofouling, battery limitations, calibration drift, and connectivity issues still need further improvement.

In [7], Shruti Nikrad et al. (2024), proposed an integrated cattle health monitoring system using a smart neck belt and mobile application for continuous livestock monitoring and disease detection. The system employed multiple sensors such as temperature, pulse rate, GPS, and accelerometer sensors to collect real-time health and activity data from cattle. An ESP32 NodeMCU controller was used to process the sensor data and transmit it to Google Firebase through Wi-Fi for cloud storage and analysis. The developed Android application enabled farmers to monitor real-time health conditions, access historical health records, and receive alerts whenever abnormal conditions were detected. The proposed system aimed to support early disease detection, remote monitoring, improved animal welfare, and efficient farm management. The authors concluded that the system was cost-effective, user-friendly, and capable of improving livestock productivity while reducing economic losses through timely monitoring and intervention.

In [8], Galande Sonali A, Koyate Aishwarya N, More Bhagyashri S, and Prof. Gajaphode P K presented a paper titled “Cattle Health Monitoring System Using Arduino and IoT,” published in the International Journal of Scientific Research in Science, Engineering and Technology and associated with the IEEE 11th International Conference on Consumer Electronics (ICCE-Berlin), Volume 11, Issue 3, May–June 2024. The paper proposes an IoT-based cattle health monitoring system developed using Arduino UNO and wireless sensor technology to improve livestock healthcare and farm management efficiency. The proposed system continuously monitors important physiological parameters of cattle such as body temperature, heartbeat, and environmental humidity using different sensors interfaced with the Arduino controller. The collected sensor data is transmitted through the ESP8266 Wi-Fi module to an online cloud platform for real-time monitoring, storage, and graphical analysis. The study emphasizes that traditional manual monitoring methods are time-consuming, labor-intensive, and less accurate, especially in large-scale dairy farms. In contrast, the proposed automated monitoring system enables farmers and veterinarians to continuously observe cattle health conditions remotely and quickly identify abnormal physiological changes. This helps in providing timely medical treatment and preventive care for cattle. The paper also highlights that continuous health monitoring reduces the risk of disease outbreaks, improves milk production, enhances animal safety, and supports better livestock management practices. Furthermore, the implementation of IoT technology minimizes manual efforts, improves operational efficiency, and promotes smart farming techniques for modern dairy farm applications.

In [9], Dr. C. Rangaswamy, Rakshitha B. A, Monisha K, and Rajini H. S (2024) proposed an “Automation of Cattle Livestock” system for efficient cattle health

monitoring and management using IoT and deep learning techniques. The system uses Convolutional Neural Networks (CNN) and image processing for early detection of Lumpy Skin Disease (LSD) in cattle. A dataset containing cattle skin images was used to train the CNN model for accurate disease classification. RFID technology was implemented to uniquely identify and track cattle movement within the farm. ZigBee wireless communication was used for transmitting cattle monitoring data to a central system. The proposed system also employed load cells to measure cattle feed quantity in real time for better nutrition management. LCD displays were used to show cattle entry, exit, and food quantity information. The image preprocessing and feature extraction techniques improved disease detection accuracy. Experimental results showed high performance with an accuracy of 92.53% in disease identification. The system helps farmers in early disease detection, efficient cattle tracking, and optimized feeding management. The authors concluded that the proposed automated livestock monitoring system improves farm productivity, reduces disease spread, and enhances overall cattle healthcare management.

In [10], S. Salik Nihal, Santhosh Kumar C F, Shafiq Mohammed, and A R Kalaiarasi (2023), presented a review on an "IoT-Based Cattle Health Monitoring System for Real-Time Detection and Alerting for Improved Farm Management." The study discusses the application of IoT technology in enhancing cattle healthcare and improving dairy farm management practices. The proposed system is developed using an Arduino Uno microcontroller integrated with sensors such as the DHT11 temperature sensor, pulse sensor, and accelerometer to continuously monitor important cattle health parameters including body temperature, heart rate, movement, and rumination activity. The collected sensor data is transmitted wirelessly to a centralized monitoring system for real-time observation, storage, and analysis. The system is mainly designed for large-scale dairy farms where manual monitoring of cattle becomes difficult and time-consuming. By continuously tracking the physiological and behavioral conditions of cattle, the system supports early disease detection and enables timely medical treatment. In addition, the monitoring system generates alerts through smartphone notifications and buzzer alarms whenever abnormal health conditions are identified. This automated monitoring approach reduces the need for frequent physical inspections by farmers and minimizes long-term healthcare and labour costs. The study highlights that IoT-based monitoring systems significantly improve animal welfare, increase farm productivity, and enhance operational efficiency in dairy farming. Overall, the paper demonstrates that smart IoT-enabled cattle health monitoring systems provide an effective and sustainable solution for modern livestock and dairy farm management.

In [11], Bhatla AB, Kikani YB, Joshi DG, Jain R, and Patel K (2023) proposed a system titled "Real Time Cattle Health Monitoring Using IoT, ThingSpeak, and a Mobile Application" for continuous monitoring of cattle health using IoT and cloud computing technologies. The proposed system, named My Herd, is designed to monitor important physiological parameters of cattle such as body temperature, heart rate, and activity level using various sensors integrated with IoT devices. The collected sensor data is transmitted through IoT nodes to the ThingSpeak cloud platform for real-time storage and monitoring. MATLAB algorithms integrated with the cloud platform are used for analyzing the collected data and predicting possible health abnormalities in cattle. The system also includes a mobile application that allows farmers to monitor cattle health conditions remotely and receive instant alerts whenever abnormal physiological conditions are detected. The study mainly focuses on the importance of early disease detection to improve livestock health, farm productivity, and overall farm management efficiency. Experimental testing was conducted on a group of cattle, and the obtained results demonstrated accurate detection and diagnosis of different health conditions. The proposed system reduces the dependency on continuous manual inspections and enables farmers to take timely preventive and medical actions. Furthermore, the paper highlights that the monitoring system can help reduce the excessive use of antibiotics and medications, thereby lowering the risk of antibiotic resistance in livestock farming. Overall, the study concludes that IoT-based cattle health monitoring systems improve animal welfare, increase productivity, minimize operational costs, and support the implementation of smart and sustainable livestock farming practices.

In [12], K. Darvesh, N. Khande, S. Avhad, and M. Khemchandani presented a paper titled "IoT and AI Based Smart Cattle Health Monitoring," published in the Journal of Livestock Science (ISSN Online 2277-6214),

Volume 14, Pages 211–218, 2023, DOI: 10.33259/JLivestSci.2023.211-218. The paper proposes an advanced IoT and Artificial Intelligence (AI) based smart cattle health monitoring system designed to improve dairy cattle healthcare, productivity, and farm management efficiency. The proposed system utilizes various IoT sensors such as heart rate sensors, temperature sensors, and motion sensors to continuously monitor important physiological and behavioral parameters including heart rate, activity level, surrounding temperature, heat stress, and sleep tracking of cattle. The collected real-time sensor data is transmitted to a cloud platform for storage, monitoring, and analysis. Machine Learning algorithms such as Random Forest and Boost are used to analyze the collected data and predict the overall health condition of cattle with improved accuracy. The system also includes a mobile application that allows farmers to visualize real-time cattle health data and receive instant alerts whenever abnormal conditions or potential diseases are detected. The proposed smart collar-based monitoring system was successfully tested on dairy cattle and demonstrated reliable and efficient performance in continuous livestock monitoring. The study highlights that the system is cost-effective, user-friendly, and highly useful for early disease detection, reducing manual monitoring efforts, and improving cattle management in large-scale dairy farms. Furthermore, the integration of IoT and AI technologies enhances decision-making capabilities, improves animal welfare, increases dairy farm productivity, and supports smart and sustainable livestock farming practices.

In [13], Saravanan et al. (2023) proposed a Smart Big Data Expert System Framework for monitoring and identifying diseases in cattle and poultry using IoT and big data technologies. The system was mainly developed to support tribal communities living in remote hill areas where veterinary healthcare facilities are limited. The framework integrates System on Chip (SoC)-based IoT devices, Apache Kafka, Apache Storm, and MongoDB for real-time data collection, processing, and storage. Sensors and smart cameras installed in Smart Health Care Centers continuously collect animal health parameters such as temperature, heartbeat, symptoms, and disease images. The collected data are transmitted to cloud servers through wireless communication networks for further analysis. Apache Kafka acts as a high-performance messaging system, while Apache Storm processes large volumes of streaming sensor data in real time. MongoDB is used to store historical disease records and monitoring information efficiently. The proposed system employs a hybrid machine learning approach combining DBSCAN clustering and Random Forest classification algorithms to improve disease identification accuracy. DBSCAN is mainly used for detecting outliers and grouping similar disease symptoms, whereas Random Forest performs accurate disease classification. The framework also supports automatic medicine prescription generation and remote healthcare assistance through video conferencing facilities. Smart medicine dispensing machines installed in healthcare cabins provide medicines automatically after disease identification. The system was experimentally tested under different client-server environments to analyze latency, throughput, and scalability performance. Experimental results showed that the framework improved disease prediction accuracy and enabled reliable real-time monitoring of livestock health conditions. The authors concluded that the proposed smart healthcare framework significantly enhances animal welfare, reduces manual monitoring efforts, and provides an efficient healthcare solution for remote tribal regions.

In [14], Akash Trivedi, Pinaki Sankar Chatterjee, (2022) CARE is an IoT enabled smart cow health monitoring system developed to monitor the health condition of dairy cows in real time. The main aim of this project is to detect different diseases in cows at an early stage using sensors and machine learning techniques. Different sensors such as temperature sensors, heartbeat sensors, respiration sensors, SCC sensors, and accelerometers are attached to the cow's body to collect important health data. The collected data is sent to the cloud through IoT technology for storage and analysis. The system helps farmers monitor cows easily, especially in remote areas and large dairy farms where regular checkups are difficult. CARE can detect diseases like fever, mastitis, milk fever, foot and mouth disease, leptospirosis, and anthrax based on symptoms and behavioural changes. Machine learning algorithms such as SVM, Random Forest, Logistic Regression, and Decision Tree are used for disease prediction. Among these algorithms, Random Forest provided the highest accuracy. This system helps farmers take quick action by informing them about health problems at the early stage. It also helps to improve milk production, reduce animal deaths, and minimize economic loss. Overall, the project

supports smart and modern farming using IoT and artificial intelligence technologies.

In [15], Olgierd Unold et al. (2020) proposed an IoT-based cow health monitoring system designed to improve livestock health management and dairy farm productivity through continuous monitoring. The system consisted of wearable sensor devices attached to cow collars, cloud-based servers, communication hubs, and an Android application for farmers. Sensors such as accelerometers and motion detectors were used to collect real-time data related to cow activities including feeding, rumination, resting, walking, and estrus behavior. The collected data were transmitted using Bluetooth Low Energy (BLE) technology and stored in cloud servers for further processing and analysis. A multi-level architecture was implemented to analyze cow behavior and identify abnormalities in health conditions. Machine learning and classification tree algorithms were applied to detect behavioral changes and predict possible diseases in cattle. The proposed system was tested on dairy farms in Poland and achieved accurate detection of estrus cycles and early symptoms of diseases such as mastitis. The Android application provided farmers with real-time monitoring and health status updates of individual cows. The authors concluded that the IoT-based monitoring system improves animal welfare, reduces manual monitoring efforts, enables timely disease detection, and enhances overall dairy farm management efficiency.

III. COMPARISON OF THE TECHNIQUES

Table I: Comparison Table

Paper No.	Methodology	Results	Gaps
[1]	IoT, YOLOv8, ViT, and ML-based cattle disease prediction.	Achieved 97.1% disease prediction accuracy.	Needs better low-light performance and scalability.
[2]	YOLOv8 and CNN-based real-time surveillance and emotion analysis.	Achieved 98–99% emotion recognition accuracy.	Requires better scalability and lower computational cost.
[14]	IoT sensors and ML algorithms for real-time cow health monitoring.	Random Forest achieved highest disease prediction accuracy.	Requires improved accuracy and real-time scalability.
[9]	CNN, IoT, RFID, and ZigBee-based cattle monitoring system.	Achieved 92.53% accuracy in disease detection.	Needs higher accuracy and large-scale farm validation.
[3]	IoT, edge-fog computing, and ML-based livestock monitoring system.	Achieved reliable real-time health and behavior monitoring.	Requires improved security and cost-effective deployment.
[4]	IoT sensors and intelligent algorithms for cattle mobility monitoring	Achieved accurate abnormal condition detection with 100% recovery support.	Needs large-scale testing and improved automation reliability.
[6]	3D-printed wearable biosensors with AI/ML-based livestock health monitoring.	Enabled early disease detection with improved sensing accuracy and reliability.	Issues with biofouling, battery life, calibration, and connectivity remain.

V. CONCLUSION

Real-Time Cattle Health Care Monitoring Using IoT, provides an efficient and smart solution for continuous monitoring of cattle health and location. By integrating sensors such as temperature, heart rate, motion, and GPS modules with an IoT-enabled microcontroller, the system enables real-time data collection and remote monitoring. The collected information can help farmers detect abnormal health conditions at an early stage, reducing the risk of disease spread and cattle loss. The system also improves livestock management by providing timely alerts and accurate tracking of cattle movement. Its lightweight, low-cost, and energy-efficient design makes it suitable for practical farm deployment. Overall, the project enhances animal welfare, increases farm productivity, and reduces manual monitoring efforts. Future improvements can include solar-powered operation, cloud-based analytics, and machine learning techniques for predictive health monitoring and disease detection.

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