OPEN ACCESS JOURNALS
Indiana Journal of Multidisciplinary Research
Abbreviated Tittle- Ind J Multi Res
ISSN *(Online)*- 2583-3820
Journal Homepage Link- https://indianapublications.com/Journals/IJMR
DOI: https://doi.org/10.5281/zenodo.21609907

INDIANA PUBLICATIONS
PRODUCTIVE AND QUALITY RESEARCH

Research Articles

Volume-06|Issue-04|2026

Livestock Monitoring and Management System

Mrs. Manasa S[1], Dr. Swetha Manasa S [2], Raghavendra Tuller[3], Ritish S[4], Prashant P Walikar[5], Gagan[6]

[1,2]Assistant/Associate Professor, Department of Electronics and Communication, AMC Engineering College, Bangalore, India.
[3,4,5,6] UG Students, Department of Electronics and Communication, AMC Engineering College, Bangalore, India.

Article History
Received: 05.05.2026
Accepted: 22.06.2026
Published: 25.07.2026

Citation
Manasa, S., Manasa, S. S., Tuller, R., Ritish, S., Walikar, P. P., Gagan. (2026) Livestock Monitoring and Management System. *Indiana Journal of Multidisciplinary Research, 6*(4), 340-344.

Abstract: This paper presents an IoT-based livestock monitoring and management system designed to improve animal health, productivity, and agricultural sustainability. Key parameters like temperature are recorded by IoT sensors on livestock that send information about their location, movement, and grazing patterns to a central platform wirelessly. The system enables real-time tracking, geo-fencing, herd safety, and early disease detection, reducing operational inefficiencies and supporting timely interventions. Machine learning algorithms further analyze the collected data to detect irregularities, predict health risks, and enhance breeding and feeding practices. Examination of historical data aids in resource allocation and emission monitoring, which supports sustainable livestock practices. By integrating IoT with intelligent analytics, the proposed system transforms conventional livestock management into a smart, automated, and data-driven approach, enhancing animal welfare and ensuring long-term agricultural sustainability.

Keywords: IoT, Livestock Monitoring, Machine Learning, Data Analytics, Sustainable Farming.

INTRODUCTION

Global agriculture depends heavily on the production of livestock, which yields vital goods like meat, milk, and fiber. However, traditional livestock management methods are labor-intensive, prone to error, and often fail to provide timely insights into animal health, behavior, and surroundings. Particularly in large-scale farming, this results in inefficiencies, monetary losses, and difficulties guaranteeing animal welfare. The Internet of Things (IoT) offers a powerful solution by enabling real-time monitoring through interconnected sensors and wireless communication systems. IoT devices have the ability to monitor variables like temperature, humidity, location, and grazing behavior. Machine learning algorithms then use this data to identify abnormalities, forecast illnesses, and improve breeding and feeding procedures. By integrating IoT with intelligent analytics, livestock management becomes smarter, more automated and data-driven, improving efficiency, sustainability, and overall animal well-being.

LITERATURE REVIEW

To enhance efficiency and promote animal welfare, a number of research projects have focused on integrating sensor-based and Internet of Things technologies into livestock monitoring. Wireless IoT-based data loggers have been utilized to monitor environmental parameters such as temperature in real time [1]. Wireless Sensor Networks (WSN) have been widely used to track cattle and prevent rustling [2]. Radio Frequency Identification (RFID) has been employed for animal identification, disease detection, and wide-area tracking, providing accurate and low-maintenance monitoring solutions. Studies have also explored the use of Zigbee, LoRa, and Bluetooth Low Energy (BLE) modules for reliable, low-power data transmission in farm environments. Wearable technology, alongside sensor networks, has been employed to develop advanced health monitoring systems that document activity patterns, temperature, and pulse rate in order to identify anomalies early [3]. Computer vision and accelerometer-based methods have been applied to estrus detection, whereas machine learning methods like deep learning, regression, and clustering have proven useful in assessing animal behavior, forecasting health hazards, and enhancing breeding results [4]. Systems like Milking Point Controllers (MPC) and milk production IoT platforms have integrated recorders to provide insights into productivity and health [5]. Furthermore, predictive maintenance concepts, geo-fencing, and cloud-based decision-support systems have been implemented to improve herd safety, optimize resource utilization, and reduce inefficiencies. These studies collectively highlight the potential of combining IoT sensor networks, wireless communication, and intelligent analytics to transform traditional livestock management into a proactive, data-driven, and sustainable practice.

PROPOSED SYSTEM

The proposed system is an IoT-enabled livestock monitoring and management platform that combines sensor networks, wireless communication, cloud computing, and machine learning to increase farm efficiency, productivity, and animal health. Each animal is equipped with a wearable device containing sensors (temperature, pulse, accelerometer, magnetometer), GPS, and RFID modules to continuously capture vital signs, activity, location, and grazing behavior. Data is transmitted via Bluetooth Low Energy (BLE), LoRa, or Wi-Fi to a hub device like Raspberry Pi, which transmits it to a secure cloud server for analysis and storage. On the cloud platform, machine learning algorithms including classification, clustering, regression, and anomaly detection are applied to identify abnormal conditions, predict disease risks, and optimize feeding, breeding, and resource allocation. Geo-fencing is employed to track herd movement and ensure safety, while predictive alerts based on weather data enhance climate adaptability. Additional modules such as Milking Point Controllers (MPC) record milk yield and health metadata, enabling early detection of issues that could affect production. A mobile and web-based dashboard provides farmers with real-time insights, alerts, and reports, allowing them to take timely actions such as preventive treatments, feed adjustments, or breeding decisions. By integrating IoT with intelligent analytics, the proposed system transforms conventional livestock management into a smart, automated, and data-driven process, reducing costs and improving return on investment. System Architecture: The proposed system consists of two main integrated components: 1. Sensor and Wearable Device Module 2. Cloud Analytics and Dashboard Module These two modules communicate through wireless protocols (BLE, LoRa, Wi-Fi) and cloud-based data synchronization. The whole architecture guarantees synchronized health tracking, geo-fencing alerts, and real-time herd management using sensor data, GPS coordinates, and machine learning analytics

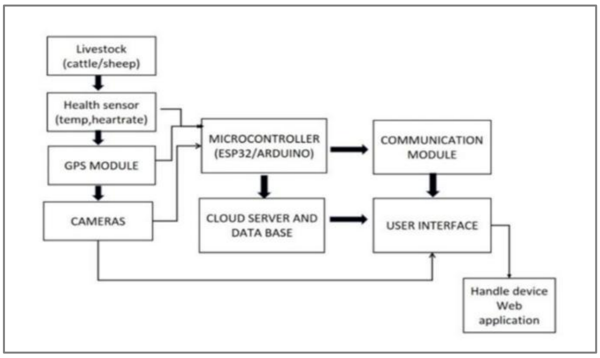

Figure 1: Block Diagram for Livestock Monitoring and Management System

Figure 1 integrates health and environmental monitoring for livestock (cattle/sheep) using IoT-enabled sensors. Health sensors (temperature, heart rate) and environmental sensors continuously acquire data, while a GPS module and cameras provide location tracking and visual monitoring. These inputs are processed by a microcontroller (ESP32/Arduino) and transmitted through a communication module to a cloud server and database. The stored data is accessed via a user interface and a web application, enabling real-time monitoring and decision-making.

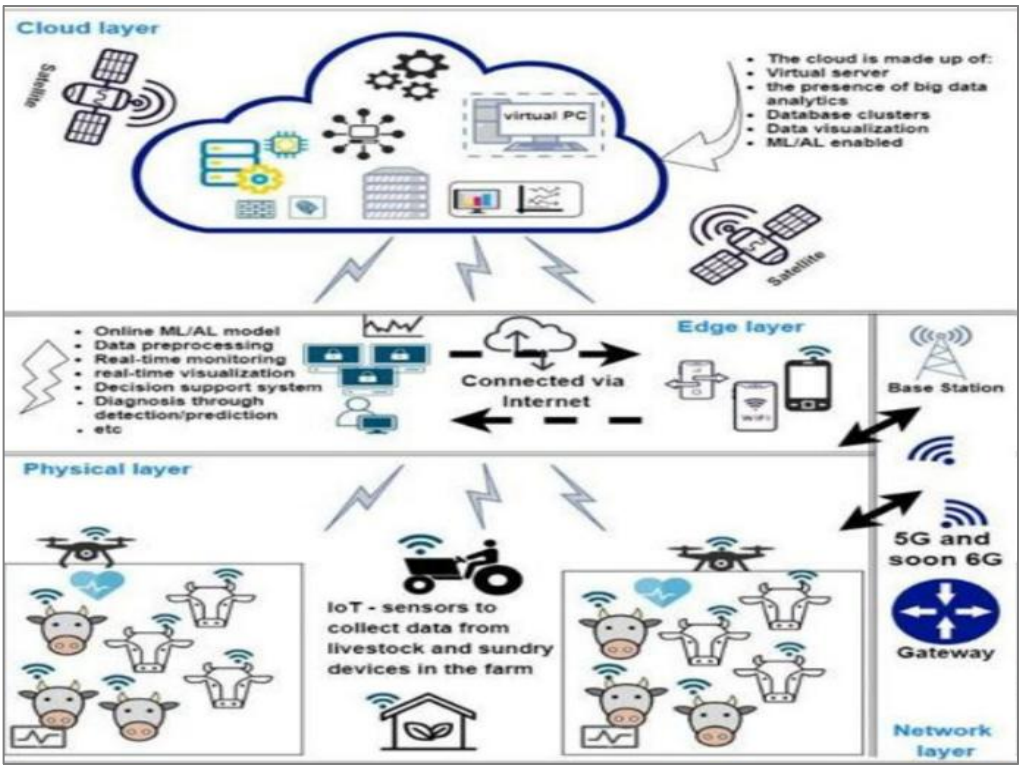

Figure 2: Multi-layer Smart IoT Architecture for Livestock Management

***Corresponding Author:** Mrs. Manasa S

Figure 2 illustrates the multi-layer smart IoT architecture comprising sensing devices, communication networks, data processing, and decision-making modules. The sensor layer collects physiological and environmental data, while the network layer ensures seamless data transmission. At the processing layer, cloud and edge computing techniques analyze the gathered information. The application layer provides actionable insights to farmers through intelligent dashboards and alert systems, enhancing sustainability, animal welfare, and overall efficiency.

Deployment View

The IoT tracking unit is mounted on the cow's collar, while a beacon receiver is positioned inside the barn. The device captures geo-location data via GPS and transmits it directly to a cloud-hosted API. Information such as milk yield and behavioral parameters is also forwarded to the cloud service platform. Web and mobile applications display analytical insights in the form of graphs and charts.

Sensors

Wireless Sensor Networks (WSNs) are implemented to monitor livestock location, body temperature variations, grazing patterns, and pasture conditions, thereby reducing risks such as theft through geo-location tracking. These sensors also capture real-time environmental data, including weather conditions, to support behavioral analysis. Heat-maps are generated to minimize interference caused by physical obstacles, while the large volume of collected data enables anomaly detection and predictive analysis for improved livestock management.

Security, Privacy, and Trust Analysis

Data forms the backbone of the system, making application security a critical aspect when operating in a cloud environment. Since the cloud platform supports multiple tenants, livestock-related information from various clients must be handled with strong privacy and security measures. Ensuring data protection is not optional but a fundamental requirement of the application. Therefore, security mechanisms should be integrated at the early stages of system design and development, rather than being treated as an afterthought.

Abbreviations and Acronyms

BLE – Bluetooth Low Energy, DB – Database LoRaWAN – Long Range Wide Area Network, RTLS – Real-Time Location System WSN – Wireless Sensor Network GPS – Global Positioning System IoT – Internet of Things ML – Machine Learning UI – User Interface

METHODOLOGY

Each livestock unit is fitted with a collar-mounted IoT device housing the following sensors and modules that continuously collect vital parameters:

Table 1: Sensor Types and Applications

Sensor Type	Measured Data	Application in Livestock Monitoring
Ultrasonic Sensor	Distance Measurement	Detecting Intruders
IR Sensor	Feed/Food Availability Level	Monitoring Cattle Feed Levels
Temperature Sensor (Body)	Animal Body Temperature	Detecting Stress, Illness
Pulse Sensor	Heart Rate (Beats Per Minute)	Detecting Stress

IMPLEMENTATION AND RESULTS

IoT-based livestock monitoring systems provide a reliable and efficient means of managing animal health and farm security. Continuous tracking of body temperature ensures early identification of abnormal physiological conditions, while monitoring food and water levels supports proper nutrition management and reduces the risk of shortages. In addition, integrated intruder detection mechanisms enhance the safety of livestock against external threats. The data obtained from these sensors undergoes processing through machine learning algorithms to detect anomalies, produce predictive insights, and initiate timely alerts. Through cloud platforms and mobile dashboards, farmers gain real-time access to visual analytics and decision-support tools, enabling prompt responses to emerging issues. Overall, the integration of IoT sensing, anomaly detection, and intelligent analytics improves animal well-being, reduces operational costs, enhances security, and contributes to more sustainable livestock management practices. The scalability of IoT-based cattle tracking systems enables easy integration of more sensors and analytics modules when farm needs change.

This adaptability ensures long-term consistency, facilitates data-driven decision-making, and remains in harmony with precision agriculture practices for sustainable agriculture.

***Corresponding Author:** Mrs. Manasa S

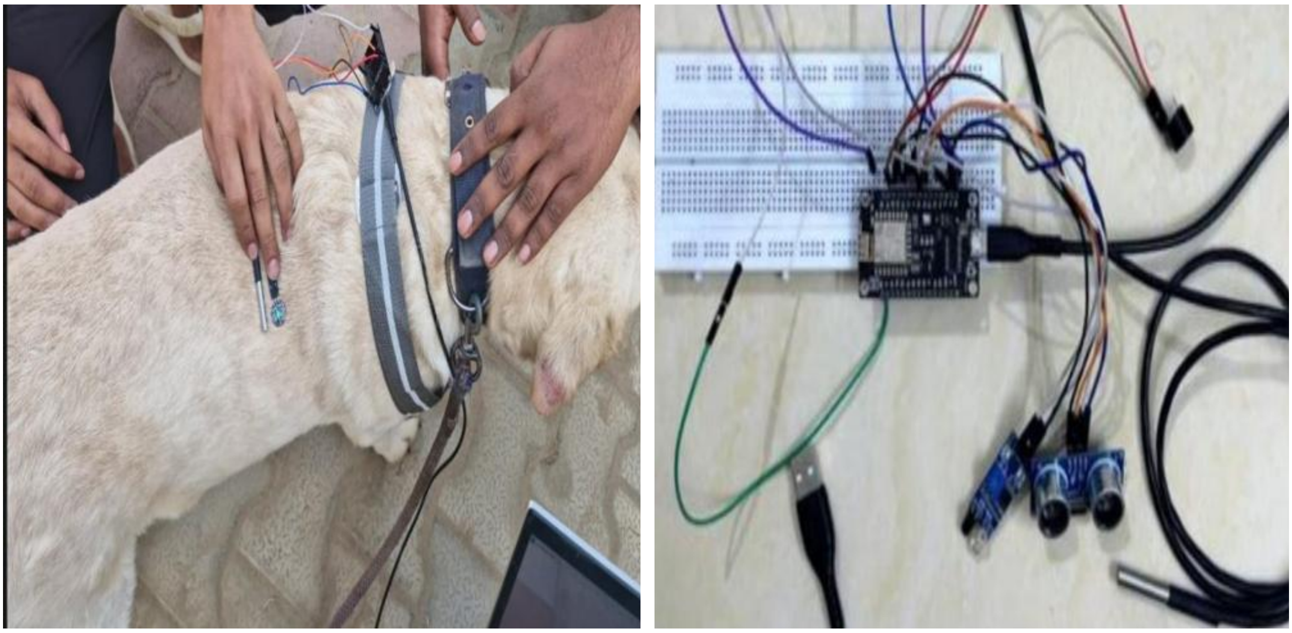

Figure 3: Assembling of Components

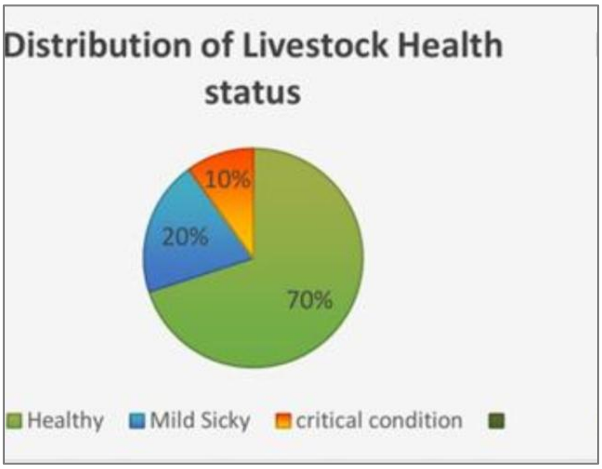

Figure 4: Distribution of Livestock Health Status

Figure 4 illustrates the distribution of health status among a herd of 20 livestock. The analysis indicates that 70% of the animals were classified as healthy, whereas 20% displayed minor health issues that necessitated attention. Only 10% were classified as being in critical condition. This demonstrates the proposed system's ability to monitor herd health and facilitate timely decision-making for preventive management.

CONCLUSION

This paper has outlined the key system requirements and proposed an IoT-based architectural framework for effective livestock monitoring and remote management. The presented use case has been structured in a clear and systematic manner, with comprehensive analysis conducted to identify potential challenges and existing research gaps. The system enables farmers to monitor herd health using IoT sensors, in contrast to outdated techniques that depend on manual observation or periodic veterinary visits. The system continuously monitors each animal's vital signs when data is uploaded to the cloud. To reduce the need for constant human supervision, farmers receive periodic health alerts when any animal approaches abnormal parameter thresholds. The findings provide a foundation for developing a scalable and efficient livestock management solution leveraging IoT technologies. The integration of IoT with intelligent analytics, cloud computing, and machine learning proves to be an effective approach for transforming traditional livestock management into a smart, automated, and data-driven system, enhancing animal welfare and contributing to long-term agricultural sustainability.

REFERENCES

1. Yick, J., Mukherjee, B., & Ghosal, D. (2008). Wireless sensor network survey. *Computer Networks, 52*(12), 2292–2330. https://doi.org/10.1016/j.comnet.2008.04.002
2. Mashoko, P. K., Wari, N. K., Rimer, S., & Paul, B. S. (2008). *Cattle monitoring system using wireless sensor networks in order to prevent cattle rustling*. In *Proceedings of the International Conference*.
3. Kondaka, L. S., Thenmozhi, M., Vijayakumar, K., et al. (2021). An intensive healthcare monitoring paradigm by using IoT-based machine learning strategies. *Multimedia Tools and Applications*. https://doi.org/10.1007/s11042-021-11111-8
4. Hebri, D., Nuthakki, R., Digal, A. K., Venkatesan, K. G. S., Chawla, S., & Reddy, C. R. R. (2024). Effective facial expression recognition system using machine learning. *EAI Endorsed Transactions on Internet of Things, 10*.
5. Govindaraj, et al. (2023). IoT-based patient monitoring system for predicting heart disease using deep learning. *Measurement, 218*, Article 113235.

***Corresponding Author:** Mrs. Manasa S

https://doi.org/10.1016/j.measurement.2023.113235
6. Kumar, P. M., Gandhi, U., Varatharajan, R., Manogaran, G., Jidhesh, R., & Vadivel, T. (2017). Intelligent face recognition and navigation system using neural learning for intelligent security in Internet of Things. *Cluster Computing, 22*(4), 7733–7744.
7. Lv, Z. (2021). Security of Internet of Things edge devices. *Software: Practice and Experience, 51*(12), 2446–2456.
8. Alshehri, M. D., Hussain, F. K., & Hussain, O. K. (2018). Clustering-driven intelligent trust management methodology for the Internet of Things (CITM-IoT). *Mobile Networks and Applications, 23*(3), 419–431.

***Corresponding Author:** Mrs. Manasa S