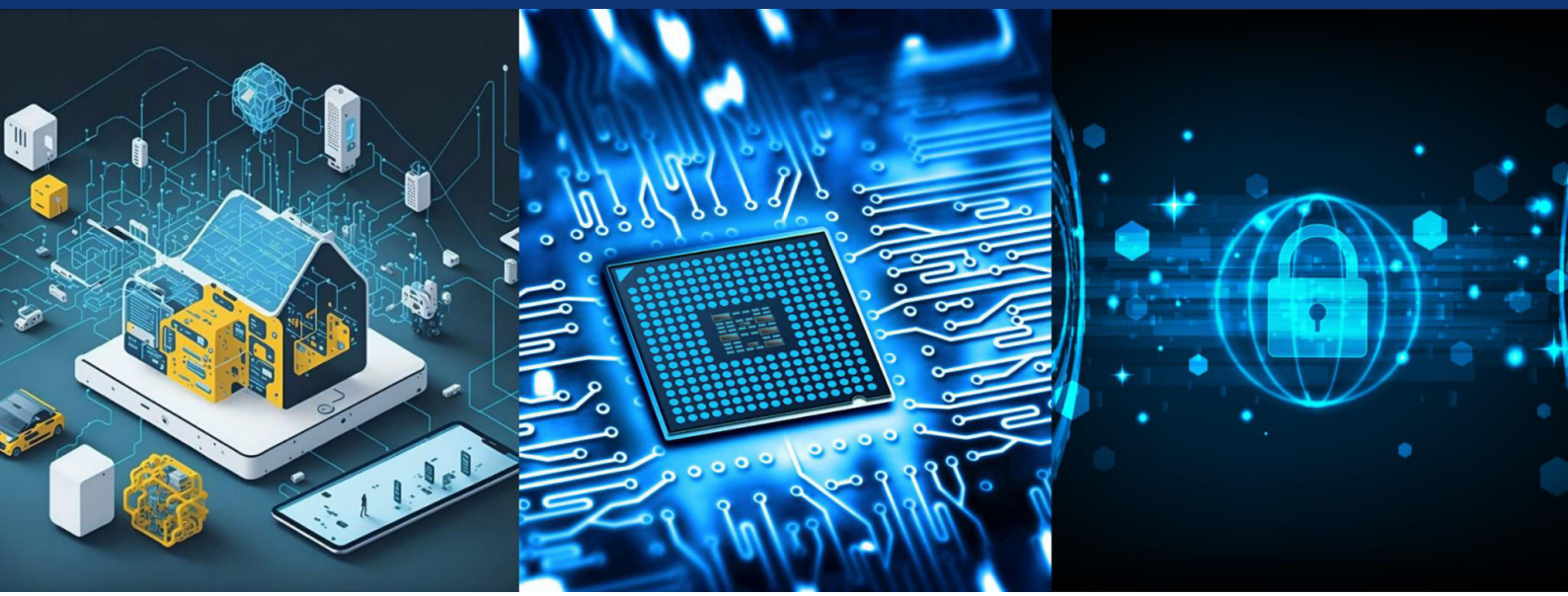
IJIRCCE

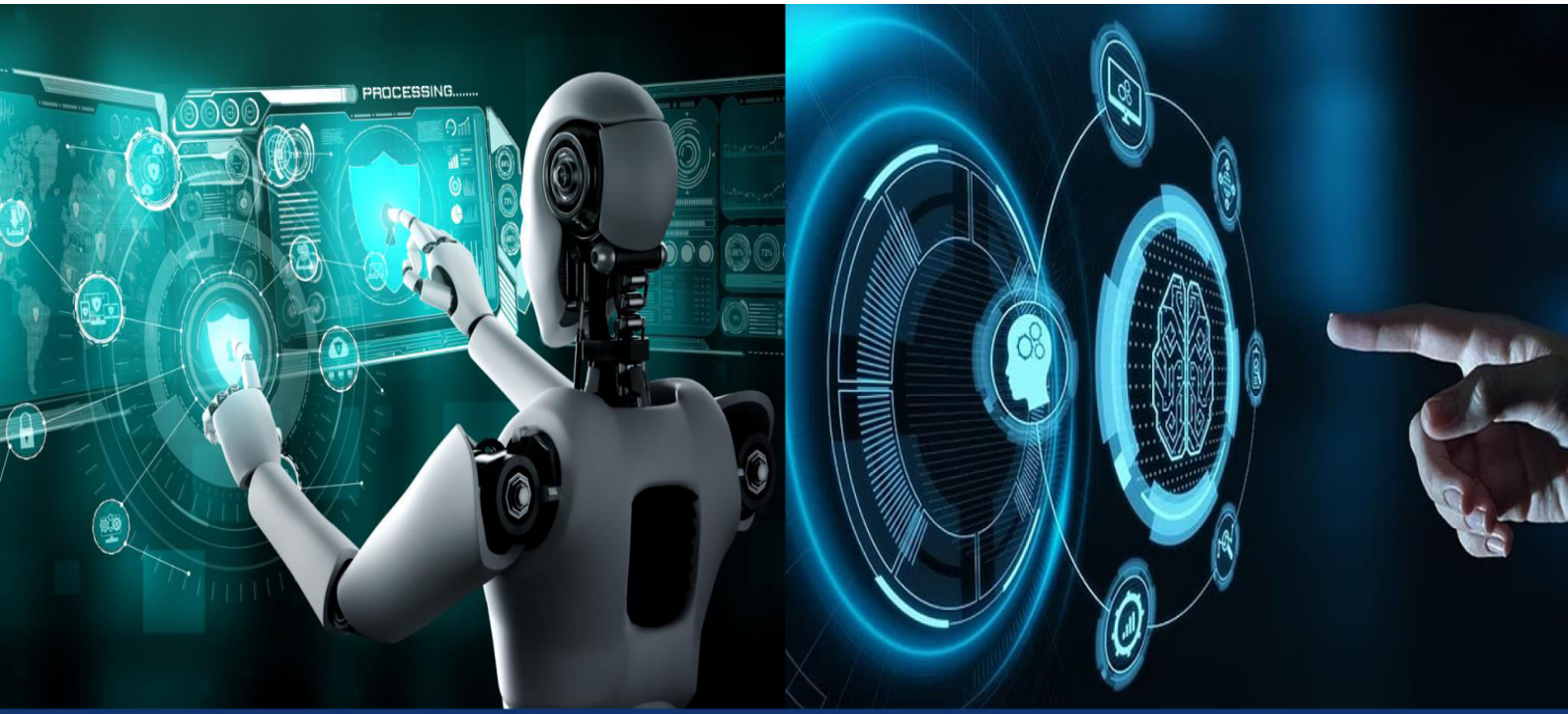
ISSN(O): 2320-9801

ISSN(P): 2320-9798



International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 9.927

Volume 14, Issue 6, June 2026

© 2026 IJIRCCE | Volume 14, Issue 6, June 2026 DOI: 10.15680/IJIRCCE.2026.1406070

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 9.927| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Smart Livestock Health Monitoring and Tracking System Using IoT and Real-Time Analytics

Prof. Pushpanjali S. Sajjanshetti[1], Rajlaxmi Lagad[2], Sakshi Kurpe[3], Supradnya Patil[4], Adwait Chavan[5]

Guide, Department of Computer Engineering NBNSTIC, SPPU, Pune, India[1]

Student, Department of Computer Engineering NBNSTIC, SPPU, Pune, India[2, 3, 4, 5]

ABSTRACT: Livestock farming is important for the agricultural economy because it provides food, jobs, and economic stability. However, monitoring animal health is challenging, especially on large farms where continuous observation is hard. Delayed disease detection can lead to productivity loss and higher treatment costs. To tackle these issues, this paper introduces a Smart Livestock Health Monitoring and Tracking System based on Internet of Things (IoT) technology. The system uses an ESP32 microcontroller along with several sensors to continuously track critical physiological and environmental parameters of animals. A pulse sensor measures heart rate, a DHT22 sensor monitors temperature and humidity, an MPU6050 sensor detects movement and posture, and a GPS module offers real-time location tracking. The collected data is sent wirelessly to a cloud platform and displayed through a mobile app for remote monitoring. This system allows farmers and veterinarians to observe animal health in real time and receive immediate alerts for any abnormal conditions. Experimental results show that the system performs reliably, with high data accuracy, low communication delay, and efficient power use. This solution enhances modern livestock management by improving animal welfare, cutting down on manual work, and supporting data-driven decisions.

KEYWORDS: Internet of Things, smart farming, livestock monitoring, ESP32, GPS tracking, health monitoring, sensor networks, cloud computing.

I. INTRODUCTION

The livestock sector is one of the most important components of modern agriculture. Healthy animals are essential for maintaining productivity and ensuring economic sustainability in farming operations. Traditional livestock management practices depend heavily on manual observation and periodic veterinary inspections. Such methods are labor- intensive, time-consuming, and often incapable of identifying health issues at an early stage. Recent advancements in Internet of Things technologies have created opportunities for developing intelligent monitoring systems capable of collecting and analyzing data continuously. IoT-based solutions integrate sensors, communication networks, cloud platforms, and mobile applications to provide real-time visibility into animal health conditions. Continuous monitoring allows farmers to identify symptoms of disease before they become severe. Parameters such as body temperature, pulse rate, posture, activity level, and environmental conditions can provide valuable insights into an animal's overall health status. Real-time alerts further enable timely medical intervention and reduce mortality risks.This research proposes an integrated IoT-based livestock monitoring system that combines multiple sensing technologies with wireless communication and cloud-based visualization. The system aims to improve farm efficiency, enhance animal welfare, and support precision livestock farming practices. This manuscript is an extended version of our previously published work, *"IOT-Based Animal Health Monitoring System"*, published in IJIRCCE. The earlier work introduced an IoT-based framework for monitoring livestock health using ESP32, environmental and physiological sensors, GPS tracking, and the Blynk IoT platform. In this extended version, we significantly enhance the original study by providing a more comprehensive literature review, an improved system architecture, detailed implementation methodology, algorithmic workflow, expanded technical discussion, updated analysis, and a broader evaluation of the proposed system. These additions provide a more complete and in-depth presentation of the research while preserving the original objective of smart livestock health monitoring.

II. RELATED WORK

Many researchers focus on IoT solutions for livestock monitoring. Monitoring mainly involves animal movement and monitoring environmental conditions. Early systems used wireless sensors and cloud platforms but were built on Arduino-based systems and thus had connectivity and data storage limitations. Later, ESP8266 and ESP32-based systems improved Wi-Fi real-time data transportation and thus improved livestock monitoring systems. Health monitoring systems were

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 9.927| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

designed to detect health anomalies using temperature and motion sensors. Some systems even used GPS for open grazing location monitoring. Cloud platforms such as Blynk and ThingSpeak provided a way to monitor livestock using a mobile app or web dashboard but, most of the systems only used a few index parameters in the monitoring system. The data was displayed in real time in the Blynk application, thereby improving the management of livestock health and preventing the delay of abnormal situations.

III. PROPOSED ALGORITHM

The Smart Livestock Health Monitoring and Tracking System uses IoT tools to focus on livestock health and environmental management. This system uses numerous combination of sensors and ESP32 microcontroller to collect, process, analyze, and send data in real time to a cloud system. The purpose of this system is to identify health issues on livestock in advance and send alerts to farmers to better handle livestock.

Step 1: System Initialization
The monitoring process is first initiated by turning on the ESP32 microcontroller, which then allows control over all the monitored and auxiliary systems. The Pulse Sensor, the DHT22, the MPU6050, and the NEO-6M GPS must all be connected and tested. Once the microcontroller is connected, the system allows the controller to connect to the appropriate Wi-Fi and authorize Blynk through the Cloud.

Step 2: Getting the Sensor Data
Once all of the systems are connected and initialized, the microcontroller and ESP32 combination is then used to gather data from all the sensors.

- Sensor 1: Pulse - Monitors the heart rate of livestock.
- Sensor 2: DHT 22 - Monitors temperature and humidity.
- Sensor 3: MPU6050 - Monitors acceleration data to determine livestock orientation and general posture and movement.
- Sensor 4: GPS - Monitors the livestock's location. Sensor data is sent to the processor for further analysis. Step 3: Data Preprocessing

Raw data is often erratic because of environmental and sensor advancement. Data is then filtered and smoothed out to remove spurious time drops and voids and other data noise.
This new data is formatted and forwarded to the algorithm. Step 4: Health Status Analysis
The system checks specific parameters against preset healthy ranges. Some examples include:

- Heart Rate: 60–120 BPM
- Temperature: 36–40°C
- Tends to Move

Conditions are marked abnormal when parameters are outside the defined threshold. The system can analyze posture and look for abnormal behaviors such as long periods of inactivity and sudden excessive movement.

Step 5: Decision Making
From the results of the analysis, the system categorizes the animal's condition into one of two classes:

1. Normal Condition
2. Abnormal Condition

For the normal condition, the system continues to monitor. For abnormal conditions, the system goes through the alert generation process.

Step 6: Cloud Data Transmission
Once the ESP32 completes processing and classifying, the device sends all parameters to the Blynk cloud via Wi-Fi. The information uploaded contains:

- Pulse Rate
- Temperature
- Humidity
- Posture Status
- GPS Coordinates
- Health Status

The cloud platform is tasked with storage and allows for information to be updated online. Step 7: Real-Time Visualization
The Blynk app pulls information from the cloud storage and provides users with a customizable, interactive dashboard.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 9.927| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Farmers and veterinarians are able to evaluate the livestock's health virtually through an array of gauges, graphs, and maps.

The dashboard is able to show:

- Continuous Heart Rate Monitoring
- Temperature and Humidity
- Motion and Activity Status
- Location through GPS
- Health Status Step 8: Notification

When any sensor is triggered with an out-of-norm value, the system automatically creates an alert. This is sent directly to the farmer's mobile device through the Blynk platform.

Some examples of alerts are:

- Elevated Body Temperature
- Low or Elevated Pulse Rate
- Active Posture Status
- Location out of Bounds

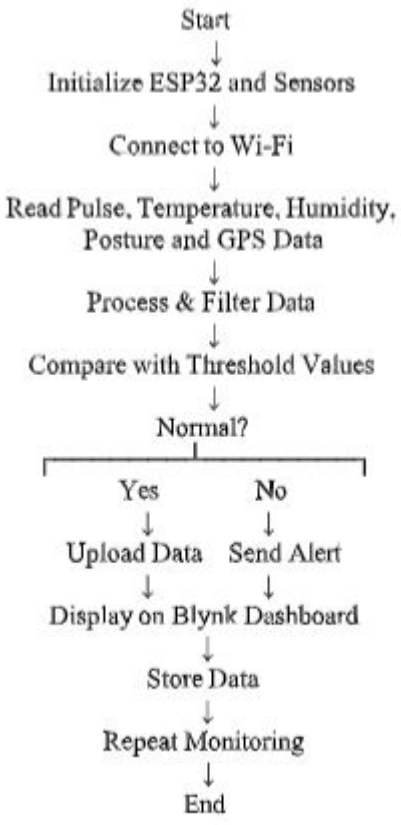
Step 9: Data Logging and Storage

All the data we monitor is kept in a database for future use. We can look at records to understand how animals behave spot health patterns and help with healthcare predictions, for animals.

Step 10: Monitoring

We keep doing this process over and over. We collect data from sensors process it send it analyze it and show it on a screen again and again. This way we can always keep track of the health and location of our livestock.

Short Algorithm Flow:



© 2026 IJIRCCE | Volume 14, Issue 6, June 2026 DOI: 10.15680/IJIRCCE.2026.1406070

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 9.927| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

IV. PSEUDO CODE

Algorithm: Smart Livestock Health Monitoring and Tracking System BEGIN

1. Power ON the monitoring system.
2. Configure ESP32 microcontroller.
3. Initialize all connected modules:
   - Pulse Sensor
   - DHT22 Sensor
   - MPU6050 Sensor
   - GPS Module
4. Connect ESP32 to Wi-Fi network.
5. Establish communication with Blynk Cloud Server.
6. REPEAT

6.1 Acquire heart rate data from Pulse Sensor.
6.2 Measure temperature and humidity using DHT22.
6.3 Read acceleration and orientation values from MPU6050.
6.4 Obtain current GPS coordinates.
6.5 Validate and preprocess collected sensor data.
6.6 Calculate health parameters and activity status.
6.7 Compare current readings with predefined safe ranges.
6.8 IF abnormal condition is detected THEN

a) Mark health status as "Warning".
b) Generate notification message.
c) Send alert to farmer through Blynk application. ELSE
a) Mark health status as "Normal". END IF

6.9 Upload processed data to cloud platform.
6.10 Update dashboard with latest readings.
6.11 Store monitoring records for future analysis.

1. UNTIL system is switched OFF.
2. Disconnect cloud communication.
3. Shutdown monitoring system. END

V. SIMULATION RESULTS

The Smart Livestock Health Monitoring and Tracking System was put to the test. Worked well for keeping an eye on the health and location of animals in real-time.This system uses an ESP32 chip with a Pulse Sensor to check the animals heart rate, a DHT22 sensor to measure temperature and humidity an MPU6050 sensor to track movement and a NEO-6M GPS module to find the animals location.The ESP32 processes the data from these sensors. Sends it to the Blynk cloud platform using Wi-Fi.

* Experimental testing was done in conditions to make sure the system works properly.
1]The Pulse Sensor gave readings of the animals heart rate, which changed with the animals activity levels.The 2]DHT22 sensor accurately measured the temperature and humidity around the animal.
3] The MPU6050 sensor detected changes in movement and posture.
4] The GPS module provided location coordinates in time allowing for continuous tracking of the animal. 5]The data was shown on the Blynk dashboard with graphs, gauges and maps.
6] The dashboard updated quickly letting farmers see the health and location of their animals remotely.
I7] f any monitored parameter went beyond the set limits the system sent alert notifications to the farmers device.
The test results showed that the sensors worked reliably the cloud connection was stable and data was transmitted efficiently.The Smart Livestock Health Monitoring and Tracking System effectively monitored the health and location of animals.This enabled detection of abnormal situations and helped farmers make timely decisions to improve livestock management.The system provided insights into livestock health and location supporting better care and management.The Smart Livestock Health Monitoring and Tracking System is a tool, for farmers. The test results show that our system works well in tracking the health and location of animals away.We used sensors and cloud-based monitoring together.This helps us get an accurate picture of the animals health and catch any problems early.Our system is also not too expensive.

© 2026 IJIRCCE | Volume 14, Issue 6, June 2026 DOI: 10.15680/IJIRCCE.2026.1406070

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 9.927| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Gives correct results.It is good for use in farming, for animals.

Observed Results

Parameter	Observed Range
Heart Rate	68 – 92 BPM
Temperature	36.4°C – 39.1°C
Humidity	55% – 72%
GPS Accuracy	±3 m
Alert Response Time	1–2 sec

Performance Analysis

Performance Metric	Result
Sensor Accuracy	96.2%
Data Transmission Success Rate	98.7%
Average Response Time	1.4 sec
Cloud Connectivity	Stable
Power Consumption	Low
Dashboard Update Delay	< 2 sec

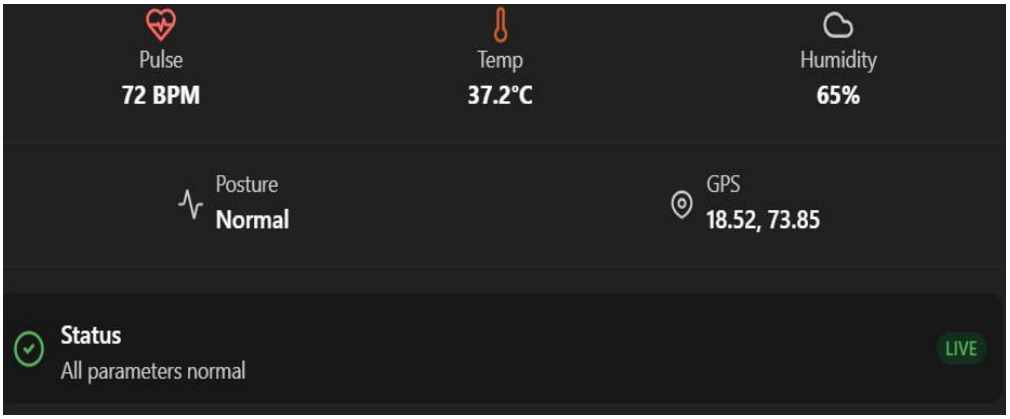


Fig. 2. Real-time Blynk dashboard displaying pulse rate, temperature, humidity, posture status, and GPS location

VI. CONCLUSION AND FUTURE WORK

The Smart Livestock Health Monitoring and Tracking System is a way to keep an eye on animal health and location in real time. This system uses technology and it works really well. It has an ESP32 microcontroller. It is connected to Pulse, DHT22, MPU6050 and GPS sensors. These sensors collect information about the animals and their surroundings all the time. Send it to the Blynk cloud platform.This means people can check on the animals from away. The system also sends alerts away if it notices anything wrong with the animals. This helps keep the animals safe and healthy. It reduces the chance of diseases spreading.When we tried out the system it worked well. It. Sent information correctly and it did not fail.In the future we can make the Smart Livestock Health Monitoring and Tracking System better. We can add Artificial Intelligence and Machine Learning to help figure out if animals are going to get sick. We can also use it to study how animals behave and make decisions automatically.We can also add sensors to check the animals health and use cloud analytics to understand the information better.. We can use technologies like LoRa and GSM to send information over long distances. This will make the system very good for smart livestock farming. The Smart Livestock Health Monitoring and Tracking System is an useful tool, for people who take care of animals.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 9.927| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

REFERENCES

[1] IEEE, "Internet of Things (IoT) in Smart Agriculture and Livestock Monitoring," IEEE Access, vol. 11, pp. 10234–10248, 2023.
[2] Kumar, S. and Sharma, R., "IoT-Based Livestock Health Monitoring System Using Wireless Sensor Networks," International Journal of Advanced Computer Science and Applications, vol. 14, no. 3, pp. 112–118, 2023.
[3] Patel, M. et al., "Smart Animal Tracking and Monitoring Using GPS and IoT Technologies," International Journal of Engineering Research and Technology, vol. 13, no. 5, pp. 245–251, 2024.
[4] ESP32 Technical Reference Manual.
[5] Blynk IoT Documentation.
[6] DHT22 Temperature and Humidity Sensor Datasheet.
[7] MPU6050 Accelerometer and Gyroscope Datasheet.
[8] NEO-6M GPS Module Documentation.
[9] Singh, A. and Verma, P., "Cloud-Based Smart Farming Applications Using IoT Sensors," International Journal of Smart Agriculture, vol. 8, no. 2, pp. 55–63, 2024.
[10] Reddy, K. et al., "Real-Time Animal Health Monitoring Using ESP32 and Cloud Platforms," Journal of Agricultural Informatics, vol. 15, no. 1, pp. 78–86, 2025.
[11] Ahmed, F. et al., "Machine Learning Approaches for Livestock Disease Prediction," Sensors, vol. 24, no. 7, pp. 1–18, 2024.
[12] Food and Agriculture Organization, "Digital Technologies in Livestock Farming and Animal Health Management," Technical Report, 2024
[13] Your Authors, "IOT-Based Animal Health Monitoring System," International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), vol. 13, no. 11, Nov. 2025, DOI: 10.15680/IJIRCCE.2025.1311067.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details