"Design And Implementation of Cattle Health Monitoring system"

Kavitha Narayan B M[1], Dr Siddesha K[2], Sanjana V Nirgude[3], Kavya S K[4], Nikitha Gudodagi[5], Vittal Janakar[6]
[1]Assistant Professor, Department of ETE, Dr Ambedkar Institute of Technology, Bengaluru, Karnataka.
[2]Assistant Professor, Department of ECE, Dr Ambedkar Institute of Technology, Bengaluru, Karnataka.
[3,4,5,6]UG Students, Department of ETE, Dr Ambedkar Institute of Technology, Bengaluru, Karnataka

ABSTRACT

The livestock industry plays a vital role in ensuring food security and economic stability worldwide. This project report presents the design and implementation of a Cattle Health Monitoring System (CHMS) aimed at revolutionizing the management and care of cattle herds. The Cattle Health Monitoring System is an Internet of Things (IoT)-based multiparameter health tracking and alert system designed for real-time monitoring of vital signs and environmental conditions. The system is built around the ESP32 microcontroller, which serves as the core processing and communication unit. It integrates biomedical sensors such as the MAX30100 for heart rate and SpO_2 measurement, the AD8232 for ECG signal acquisition, and two DHT11 sensors one for ambient temperature and humidity and another calibrated for body temperature. A NEO-6M GPS module provides precise geolocation data to assist in patient tracking.

The collected parameters blood pressure (BP), SpO_2, heart rate, body temperature, ambient temperature, humidity, and ECG are transmitted to the Thing Speak cloud platform for continuous data storage and visualization. Additionally, the system is configured to send automated Telegram alerts every two minutes, containing the latest physiological readings along with GPS coordinates, ensuring timely updates to caregivers or medical personnel.

This is lowcost portable and efficient system demonstrate Practical integration of IOT and Biomedical application, enabling remote patient monitoring, early anomaly detection, and rapid emergency response.

1.Introduction

The Cattle Health Monitoring System (Comprehensive Automated Tele-Assisted Logger) is designed to address these limitations by creating an integrated, IoT-based health tracking solution capable of monitoring multiple physiological and environmental parameters simultaneously. Built around the ESP32 microcontroller, the system connects a range of sensors to measure blood pressure, heart rate, SpO_2 (oxygen saturation), body temperature, ambient temperature, humidity, and electrocardiogram (ECG) signals. To enhance mobility and emergency response, the system also incorporates the NEO-6M GPS module, which provides real-time location tracking. This combination of biomedical sensing, environmental monitoring, and geolocation ensures that both patients and healthcare providers can access comprehensive health data remotely.

Traditional health monitoring setups typically involve manual recording of readings using standalone devices. Such systems often suffer from data loss, human error, and limited accessibility. In contrast, the Cattle system overcomes these challenges through automation and connectivity. The ESP32 collects and processes sensor data, then transmits it wirelessly to the Thing Speak cloud platform, where readings are stored, analyzed, and visualized. This cloud integration enables long-term tracking of health patterns, helping medical personnel identify irregularities or early signs of health deterioration. Moreover, the system automatically sends regular Telegram alerts every two minutes, containing the latest measurements along with GPS coordinates. This feature is especially useful for remote patients, elderly individuals living alone, or those requiring constant observation after medical treatment. The Cattle Health Monitoring System exemplifies this transformation by providing a portable, low-cost, and intelligent solution that bridges the gap between patients and medical professionals. By enabling remote observation, the system reduces the dependency on hospital infrastructure and supports early medical intervention, which can potentially save lives.

1.1 Problem Statement

Cattle health monitoring is a critical aspect of livestock management, yet traditional methods are labour-intensive, time-consuming, and often fail to detect early signs of illness or distress. Farmers and livestock managers face challenges in continuously monitoring the health and wellbeing of cattle, which can lead to delayed interventions, increased mortality rates, and significant economic losses. The need for a robust, real-time monitoring system has become

more pressing with the increasing scale of livestock operations and the demand for higher productivity and animal welfare standards. Therefore, there is a need for the development of an advanced cattle health monitoring system. The system will provide continuous, real-time health data, enabling timely detection of health issues, improving herd management efficiency, and ultimately enhancing the overall health and productivity of the livestock.

1.2 Significance

Early disease detection: A well-designed system can identify subtle changes in parameters like temperature, heart rate, and rumination, which can be early indicators of illness, this allows for quick intervention to prevent the spread of disease. Improved efficiency: Automation reduces the manual labour of farmers and labourers, as the system handles the continuous Monitoring Cost reduction. By enabling remote diagnosis, farmers can avoid the costs and time associated with physically transporting animals to a vet. Data-driven insights: A strong design ensures that data collected is accurate and processed effectively, leading to reliable health status generation (e.g., well, suspect, or abnormal). Remote access and collaboration: By sending data to a cloud platform or mobile application, the design facilitates collaboration between farmers and veterinarians, enabling remote consultation and quick management guidance.

1.3 Impacts

- Early disease detection: Continuous monitoring of parameters like heart rate, temperature, and rumination allows for the early detection of illness and potential outbreaks.
- Increased efficiency: It reduces the need for frequent manual checks, saving farmers time and labour costs.
- Improved decision-making: Real-time data and alerts enable farmers to make informed management decisions and respond quickly to health issues.
- Disease prevention: Early detection and isolation can prevent the spread of communicable diseases within a herd, improving overall biosecurity.

- Enhanced animal welfare: The system contributes to better animal health, which leads to improved productivity and quality of food products.

2. Literature Survey

Today, with the expanding agricultural sector and need for improved productivity of cattle in agricultural and livestock settings. This system leverages advanced technology, data analysis, and continuous monitoring to improve the overall health and management of cattle herds by offering real-time insights and early detection of health issues. The author [1] provides a comprehensive overview of animal health monitoring systems, including those used for cattle. It covers various aspects of monitoring, such as disease surveillance, early warning systems, and data analysis.

The author [2] provides a practical guide that covers a wide range of topics related to cattle health, including monitoring and maintaining the health of your cattle. It provides information on common diseases, preventive measures, and monitoring techniques. Preventive care, disease treatments and emergency procedures are some of the crucial aspects that must be looked into while developing the design for a cattle health monitoring system to know what parameters must be monitored to be able to detect the issue at the right time and take preventive measures.

The paper [3] aids in Monitoring Animal Health and Welfare, the Principles and Practices involved in cattle health monitoring. This book explores the principles and practices of monitoring animal health and welfare, including cattle .It covers various monitoring methods, such as clinical examinations, diagnostic testing, and remote sensing technologies which plays a crucial role in projects like ours that involve remote sensing and real time updation of data for analysis.

Precision Livestock Farming Applications, making Sense of Sensors to Support Farm Management. Book [4] focuses on the application of precision livestock farming techniques, including monitoring technologies, for improving cattle health and management. It covers topics such as sensor technologies, data analysis, and decision support systems.

The book [5] focuses on Bovine Medicine, Diseases and Husbandry of Cattle. Although this book primarily focuses on cattle diseases and husbandry, it also provides valuable information on monitoring cattle health. It covers topics such as clinical examination, diagnostic testing, and herd health management.

3.Implementation

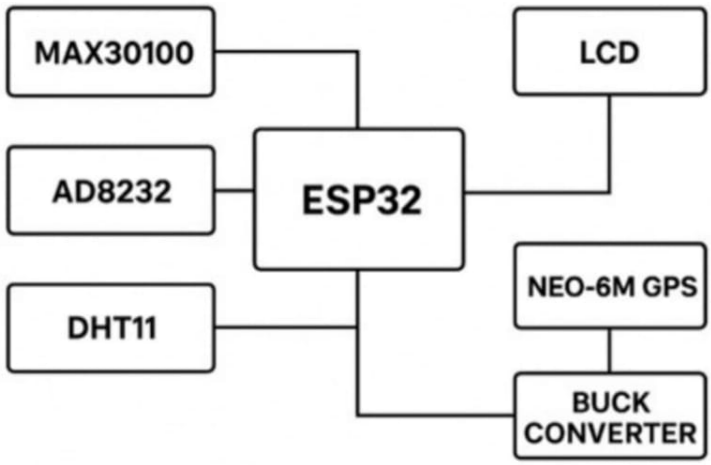

Fig 1: Block Diagram of Cattle Health Monitoring system

A block diagram of a cattle health monitoring system integrates various advanced technologies to ensure comprehensive monitoring and management of cattle health. At the core of the system is the ESP32 microcontroller, which acts as the central hub for data collection and transmission.

In operation, the system functions through the following sequence:

1. Sensors collect real-time physiological and environmental data.
2. ESP32 processes the input signals and prepares data packets.
3. The built-in Wi-Fi module transmits data to the Thing Speak cloud and activates Telegram API updates.
4. The GPS module provides live coordinates for accurate tracking.
5. The power circuit maintains a consistent 3.3V regulated output from the main 12V supply.

This integrated design ensures continuous, automated, and cloud-enabled health monitoring with minimal human intervention, demonstrating an efficient and scalable approach to modern telehealth systems.

All collected data is transmitted in real-time to a cloud platform, where it is stored and analyzed. This integration allows for remote monitoring and provides actionable insights through data analytics, enabling timely interventions and health management decisions. The cloud platform also facilitates the creation of historical health records for each animal, supporting better health management practices and improving overall herd health. This comprehensive block diagram ensures a robust and efficient cattle health monitoring system that leverages modern technology for optimal livestock management.

4. Results

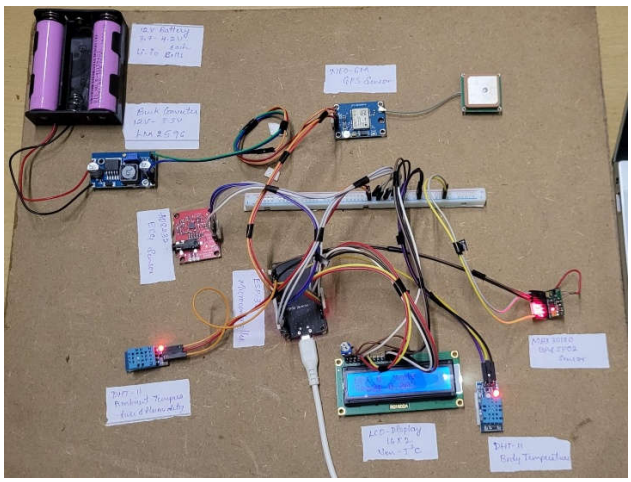

Fig 2: Circuit connection and Values monitored on LCD display

This image displays an electronics project that integrates several sensors and components, likely for an Internet of Things (IoT) monitoring system.

Components: The system includes a GPS sensor, an ESP32 microcontroller, a buck converter (LM2596), an LCD display (1602A), a pulse oximeter and heart rate sensor (MAX30150), and ambient temperature/humidity (DHT-11) and body temperature (PHT-11) sensors.

Potential Applications: Based on the sensors, the project could be related to health monitoring, environmental tracking, or a combination of both.

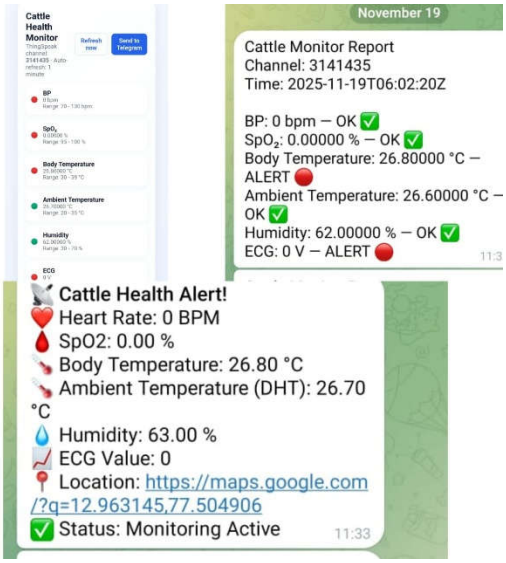

Fig 3 : Alert Mechanism in phone

This image displays an electronics project that integrates several sensors and components, likely for an Internet of Things (IoT) monitoring system.

Components: The system includes a GPS sensor, an ESP32 microcontroller, a buck converter (LM2596), an LCD display (1602A), a pulse oximeter and heart rate sensor (MAX30150), and ambient temperature/humidity (DHT-11) and body temperature (PHT-11) sensors.

Potential Applications: Based on the sensors, the project could be related to health monitoring, environmental tracking, or a combination of both.

5.Conclusion

The Cattle Health Monitoring System successfully demonstrates how the integration of IoT (Internet of Things) and biomedical sensing can revolutionize healthcare monitoring and accessibility. By combining multiple health parameters—such as heart rate, SpO_2, body temperature, humidity, ECG, and GPS-based location—the system provides a unified platform for continuous and real-time health analysis.

The use of the ESP32 microcontroller as the central processing unit enables efficient sensor interfacing, wireless connectivity, and power management. Through the incorporation of Thing Speak for cloud data visualization and Telegram for instant message alerts, the system ensures that users and medical professionals can monitor vital signs remotely and respond promptly to potential health emergencies.

This project not only validates the concept of affordable, portable health monitoring but also highlights the growing potential of IoT-based medical devices in preventive healthcare. The successful implementation of both hardware and software components confirms the system's reliability, stability, and adaptability under various environmental and physiological conditions.

In the future, enhancements such as machine learning-based anomaly detection, mobile application integration, and medical-grade sensor calibration can further increase accuracy and usability. Thus, the Cattle Health Monitoring System represents a significant step toward intelligent, accessible, and patient-centered healthcare offering a bridge between individuals, caregivers, and technology-driven medical innovation.

6.Future Scope

The Cattle Health Monitoring system serves as a foundation for future advancements in cattle management and smart Agri sector solutions. This innovative system opens doors to exciting possibilities:

- Predictive Analytics: Integrating AI-driven predictive analytics can help anticipate health patterns based on parameters and improve user experience.
- Renewable Energy Integration: By harnessing renewable energy sources, the system could operate sustainably, reducing its environmental footprint.
- Advanced health Monitoring: Scaling the system to manage by improving the overall system and expanding the vision by looking into more health parameters would provide comprehensive preventive measures and solutions.
- Machine Learning for Security: Utilizing machine learning algorithms could enhance security to prevent loss or manipulation of data.

The integration of health monitoring systems with automated feeding and medication dispensing systems could enable timely treatment protocols based on real-time health data. Integrating genetic information into the health monitoring system could help farmers select and breed cattle with better predisposition to health and disease resistance. Developments in wearable technology could lead to more comfortable and non-intrusive sensor devices that cattle can wear without discomfort, improving data accuracy and reducing stress.

The future scope of the Cattle health monitoring system extends beyond the present capabilities, encompassing a realm where technology continues to reshape. By embracing these future possibilities, the system has the potential to revolutionize how we perceive cattle health in our ever-evolving cattle Agri-allied sector.

7.References

[1]. Philip k. Thornton, Delia Grace, and Timothy P, Robinson,” Animal Health monitoring and Surveillance System”.

[2]. Heather Smith Thomas, Cattle Health Handbook”

[3]. Paul Stacey and Andrew Knight “Monitoring Animal Health and Welfare: Principles and Practices “

[4]. A.H. Andrew, R.W. Blowey, and H.Boyd,”Bovine Medicine : Diseases and Husbandry of Cattle”

[5]. Mr. Arhath Kumar, Mr V Haesha Vardhan, Mrs Swetha J and Ms. Shanmuga Priya R,” Internet-based cattle health monitoring system using raspberry Pi,” International Journal of Health Sciences,6(s1)

[6]. Er. SHUBHAM RAUNIYAR, “IoT Based Advanced Animal Health Monitoring System using Raspberry Pi3,” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, May 2020.

[7] T.Vigneswaria, N. Kalaiselvi, K. Mathumitha, Amara Niveditha C and Adhithi Sowmian, “Smart IOT Cloud Based Livestock Monitoring System: A Survey,” Turkish Journal of Computer and Mathematics Education, April 2021.

[8]. Adersh.S, Shyam S, Sreehari S, Akhil A G, “HEALTH MONITORING SYSTEM FOR DAIRY COWS,” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, June 2021.

[9]. Seema Kumaria, Dr. Sumit Kumar Yadavb, “Development of IoT Based Smart Animal Health Monitoring System using Raspberry Pi,” Special Issue based on proceedings of 4th International Conference on Cyber Security (ICCS), 2018.

[10]. Varun Mhatre, Vishwesh Vispute, Nitin Mishra(2020), “IoT based Health Monitoring System for Dairy Cows,” Proceedings of the Third International Conference on Smart System and Inventive Technology (ICSSIT 2020), 2020.

[11]. Isak Shabani, Tonit Biba and Betim C, “Design of a Cattle-Health- Monitoring System Using Microservices and IoT Devices,” Research Gate MDPI, May 2022.

[12]. Akhila Suresh and T V Sarath, “An IoT Solution for Cattle Health Monitoring,” IOP Conference Series: Materials Science and Engineering, 2019.

[13]. Bhisham Sharma, Deepika Koundal, “Cattle health monitoring system using wireless sensor network: a survey from innovation perspective,” The Institution of Engineering & Technology, May 2017.

[14]. Kunja Bihari Swain, Satyasopan Mahato, Meerina patro, sudeepta ku- mar pattnayak , “Cattle health monitoring system using Arduino and LabVIEW for early detection of diseases,” International Conference on Sensing, Signal Processing and Security, 2017.

[15]. Kevin Smith, Angel Martinez, Roland Craddolph, Howard Erickson, Daniel Andresen, and Steve Warren, “An Integrated Cattle Health Monitoring System,” EMBS Annual International Conference, September 2006.