Health Tracking and Monitoring of Cattle using WSN for Smart Farming

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ABSTRACT

The rapid advancement of farm automation has become essential in modern agriculture to meet the rising demand for increased milk production while minimizing labor and costs. A key focus of this automation is real-time health monitoring of dairy cows to ensure their well-being and productivity. This study presents an intelligent monitoring system that utilizes sensor technology to track vital health parameters such as body temperature and heart rate. The system is built using temperature sensors, heart rate sensors, and an Arduino UNO, which continuously collect and process physiological data. The gathered information is then transmitted to farm owners and veterinarians for timely intervention. Additionally, a GPS tracking mechanism is integrated to monitor the location of livestock, ensuring efficient farm management and preventing losses. By implementing this automated health tracking system, farmers can enhance productivity, improve animal welfare, and support sustainable dairy farming with minimal human intervention.

Keywords: Farm Automation, Real-time Health Tracking, Arduino UNO, Sensor Technology, Temperature Sensors, Heart Rate Sensors, GPS Tracking, Sustainable Dairy Farming.

I. INTRODUCTION

Cattle farming is a vital industry that contributes significantly to global food production, but ensuring the health and well-being of large herds presents several challenges. Traditional livestock monitoring methods require extensive manual labor and are often inefficient in detecting early signs of illness. To address these limitations, an IoT-based real-time health monitoring system has been developed using [1]a network of wireless sensor nodes.

This system continuously tracks key [2]health parameters such as body temperature, heart rate, activity levels, and feeding behavior. The collected data is transmitted to a cloud-based central server, where machine learning algorithms analyze it to identify early signs of diseases, stress, or abnormal behavior. This enables farmers and veterinarians to take timely preventive actions, reducing livestock mortality rates, minimizing veterinary expenses, and improving overall farm efficiency.

Additionally, GPS tracking ensures better herd management by preventing cattle loss and theft, further enhancing security and productivity. By integrating IoT, artificial intelligence, and cloud computing, this smart system modernizes cattle farming, leading to sustainable, data-driven, and efficient livestock management. This approach not only improves farm productivity but also ensures high-quality dairy and meat products by minimizing disease risks and contamination.

II. EXISTING METHOD

Cattle farming plays a crucial role in the agricultural sector, supplying essential resources such as dairy products, meat, and raw materials. As global demand for high-quality livestock products rises, ensuring the health and well-being of cattle has become a top priority. However, managing large herds presents significant challenges, as diseases, stress, and inadequate nutrition can lead to reduced productivity, economic losses, and food safety concerns. Traditional monitoring methods, which rely on manual inspections and scheduled veterinary visits, are time-consuming, labor-intensive, and often ineffective in detecting early symptoms of illness.

To address these limitations, advanced cattle health monitoring systems now incorporate wireless sensor technology, IoT, and machine learning to provide real-time tracking and automated health assessments.

Wearable sensors attached to individual animals continuously measure vital parameters such as body temperature, heart rate, respiratory patterns, movement, and feeding behavior.

The collected data is transmitted to a centralized cloud-based platform, where machine learning algorithms analyze patterns to detect potential health issues. If abnormalities are identified, instant alerts are sent to farmers and veterinarians via mobile applications, ensuring timely intervention and reducing the risk of disease outbreaks.

The integration of automated health monitoring significantly reduces reliance on manual labor, enhances operational efficiency, and allows large-scale farms to manage livestock more effectively. Moreover, continuous tracking improves food safety and product quality by minimizing the risk of contamination and ensuring compliance with hygiene and safety standards. The incorporation of GPS technology further enhances farm management by enabling real-time location tracking, preventing theft, and ensuring the security of valuable livestock.

Additionally, the use of predictive analytics and data-driven insights helps farmers make informed decisions regarding nutrition, breeding, and veterinary care, promoting sustainable and profitable farming practices. By leveraging modern technology, cattle farming can transition into a more efficient, cost-effective, and environmentally sustainable industry, ensuring better productivity and enhanced animal welfare.

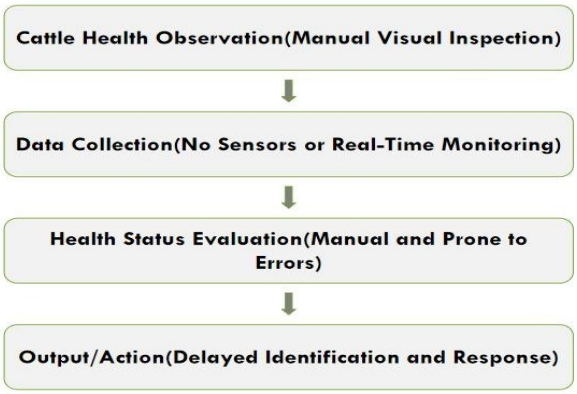

Figure 1: Representing the Existing method

III. PROPOSED METHOD

Traditional cattle health monitoring relies heavily on manual inspections and scheduled veterinary visits. While these methods have been used for years, they are time-consuming, labor-intensive, and often fail to catch early signs of illness. As farms grow larger and the demand for dairy and meat production increases, it becomes more challenging to ensure the well-being of every animal.

To address these challenges, a smart cattle health monitoring system powered by IoT has been introduced. This system uses [3]wireless sensor networks (WSN) to track cattle in real time and automate health assessments, helping farmers detect potential health issues early and take preventive measures before they become serious problems.

At the heart of this system are advanced sensors that monitor vital health indicators such as body temperature, heart rate, respiratory patterns, movement, and feeding behavior. These sensors constantly collect data, allowing the system to detect any abnormalities that may indicate illness, stress, or other health concerns. Even small fluctuations in an animal's vital signs can signal an underlying issue, and the system ensures that these signs are not overlooked.

By providing [7]early alerts, farmers and veterinarians can act quickly, reducing the risk of disease outbreaks and minimizing livestock losses. The system also includes a GPS module to track the cattle's location, preventing theft and straying. If an animal wanders off or is at risk of getting lost, farmers can easily locate it using real-time tracking. Additionally, an LCD display and a buzzer alert system provide instant notifications on-site, ensuring that any critical health concerns can be addressed immediately.

All the collected data is sent to a cloud-based[10] platform via IoT connectivity, allowing farmers to monitor their livestock remotely from their mobile devices or computers. This eliminates the need for constant physical monitoring, reducing the workload while ensuring that the cattle remain under close observation. The system also uses predictive analytics, meaning it can study historical health data and identify patterns that help forecast potential illnesses before they escalate. This proactive approach not only improves herd health but also reduces veterinary costs and prevents unnecessary use of antibiotics.

Since farmers can now rely on real-time insights rather than estimations, resources such as veterinary care and feed supplies can be allocated more efficiently, cutting down on waste and optimizing farm operations. Beyond making herd management easier, this system

plays a crucial role in food safety. By keeping cattle healthy and preventing the spread of diseases, it helps ensure that the dairy and meat products reaching consumers meet the highest hygiene and safety standards.

This is especially important in today's world, where food quality regulations are strict, and consumers are increasingly concerned about where their food comes from. By minimizing contamination risks and improving animal health, the system helps produce better-quality dairy and meat, ultimately benefiting both farmers and consumers.

Additionally, it promotes more sustainable farming practices by reducing wastage, optimizing feeding routines, and minimizing the overuse of medications.With access to precise, data-driven insights, farmers can also make better decisions when it comes to breeding and feeding. They can identify which animals are the healthiest and most productive, leading to improved milk production and higher-quality meat over time.

Figure 2: The block diagram of Proposed method

The ability to track individual health trends means that farmers can improve genetic selection and overall herd performance, making cattle farming more efficient and sustainable. Furthermore, the system helps reduce the environmental impact of large-scale livestock farming by cutting down on wasted resources and lowering carbon footprints.Ultimately, the [11]IoT - based cattle health monitoring system is transforming the way farmers care for their livestock. It makes farm operations more efficient, improves animal welfare, and ensures a higher standard of food production.

By blending modern technology with traditional farming practices, this system supports a future where cattle farming is not only more productive but also more sustainable and humane.

As agriculture continues to evolve, innovations like this will be key to feeding a growing global population while maintaining ethical and environmentally responsible farming practices traditional

IV. RESULTS

The cattle health monitoring system successfully measured and analyzed key physiological parameters, including temperature, heart rate, pH levels, and respiratory rate. The LCD display provided real-time data visualization, and the buzzer alert system effectively signaled health abnormalities based on predefined thresholds. The system's integration of GPS tracking further enhances its usability by allowing real-time location monitoring.

The system was designed to operate efficiently with low power consumption, making it suitable for continuous monitoring in remote farm areas. Key components such as the Arduino micro controller, sensors, and GPS module demonstrated optimal power efficiency, ensuring long-term operation with minimal energy requirements.

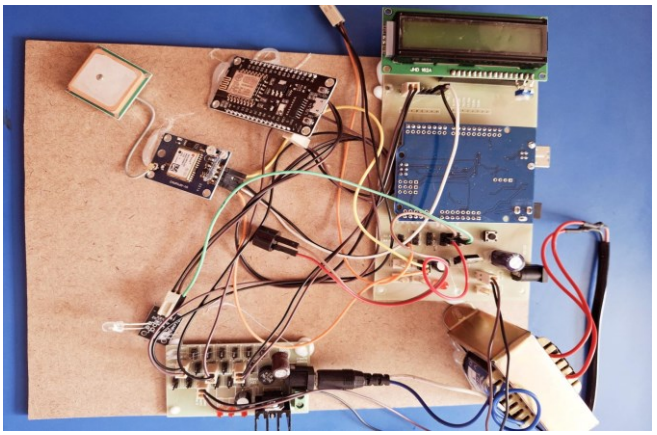

Figure 3: Project kit with required components.

The overall power consumption remained within acceptable limits for battery or solar-powered applications. The hardware components used in this project were carefully selected to ensure cost-

effectiveness without compromising performance. The system utilized readily available sensors and modules, making it an affordable yet efficient solution for cattle health monitoring. The total cost of implementation remained reasonable, making it accessible to farmers and livestock owners for practical deployment.

The data collected was consistent with expected values for healthy cattle, confirming the system's reliability. Additionally, the real-time GPS tracking feature proved beneficial for monitoring animal movement and ensuring timely intervention in case of emergencies.

Table 1 : Showing the values of Temperature and Pulse rate

Time Interval	Temperature(C)	Pulse Rate(BPM)
1	28.75	121
2	34.51	101
3	32.32	123
4	30.99	129
5	26.56	137
6	25.06	101
7	35.58	120
8	33.66	132
9	31.08	111

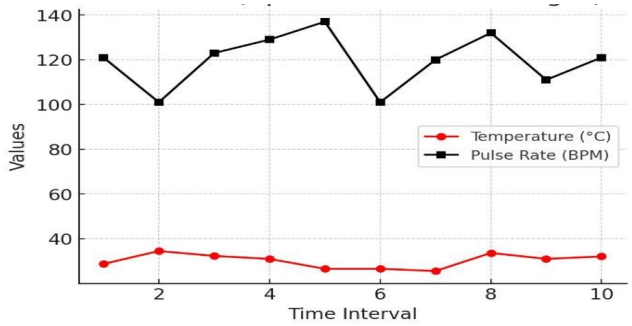

Figure 4: A sample line graph showing the Temperature and Pulse rate

V. CONCLUSION

The IoT-based livestock health monitoring system introduced in this project provides a reliable, automated solution for real-time disease detection and herd management. By leveraging wireless sensors to track vital health indicators, the system helps in the early identification of health issues, allowing farmers and veterinarians to intervene before serious problems arise. This proactive approach reduces veterinary costs, enhances livestock productivity, and promotes better animal welfare.

Furthermore, the integration of cloud computing and machine learning algorithms ensures efficient data analysis, improving decision-making processes in livestock management. The inclusion of GPS tracking also strengthens farm security by preventing cattle loss and theft.

As technology continues to evolve, future enhancements in sensor accuracy, real-time data analysis, and system scalability will further improve the effectiveness of this system. By adopting such innovative solutions, farmers can achieve a more sustainable, productive, and data-driven approach to livestock farming, ultimately ensuring a healthier and more efficient agricultural ecosystem.

VI. REFERENCES

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