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COW HEALTH MONITORING SYSTEM USING IoT

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Abstract:

The Cow Health Monitoring System using IoT provides an efficient and reliable solution for real-time livestock health management. The system employs sensors to continuously measure vital parameters such as body temperature and heart rate. These readings are transmitted instantly through an IoT module to a cloud platform or website, enabling farmers to remotely monitor each cow's health status. An automated alert mechanism notifies the farmer whenever abnormal or critical values are detected, allowing early diagnosis and timely intervention to prevent disease and reduce losses. In addition, the system integrates low-power sensors, microcontrollers, and wireless communication technologies to create a smart and automated health-tracking platform. By maintaining detailed health profiles for individual cows and enabling real-time data analytics, the system helps identify abnormal behavior, reducing the need for manual supervision. This scalable and cost-effective solution enhances farm productivity, supports precision livestock management, and promotes better animal welfare through proactive and data-driven decision-making.

Keywords **— Internet of Things (IoT), Cow Health Monitoring, Livestock Management, Real-time Data Transmission, Temperature Sensor, Heart Rate Sensor, Cloud-based Monitoring, Wireless Sensor Network (WSN),Smart Dairy Farming, Animal Welfare, Remote Monitoring, Sustainable Agriculture.**

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I. INTRODUCTION

Livestock health management plays a crucial role in ensuring the productivity, sustainability, and profitability of the dairy and agricultural sectors. Among all livestock, cows require particular attention because their health directly affects milk production, reproduction efficiency and overall farm output. Traditionally, farmers rely on manual observation to assess the health and behavior of cows. This approach is time-consuming, labor-intensive, and often inaccurate, especially in large farms where continuous monitoring of every animal is difficult. As a result, early signs of illness or stress

frequently go unnoticed, leading to delayed treatment, economic losses, and potential disease outbreaks within the herd. With the rapid advancement of technology, there is a growing need for modern, automated solutions that can support farmers in maintaining cattle health more effectively. The Internet of Things (IoT) has emerged as a powerful technology capable of transforming traditional livestock management practices. IoT enables smart communication between sensors, devices, and cloud platforms, allowing continuous data collection and real-time monitoring. In the context of cattle health, IoT-based systems make it possible to track vital parameters such as body temperature, heart rate, movement patterns, and environmental conditions with high accuracy. By equipping cows with wearable sensors connected to microcontrollers and wireless communication modules, farmers can monitor the physiological and behavioral status of each cow remotely through mobile applications or dashboards. Through real-time data transmission, farmers receive up-to-date information on the health status of their animals, enabling quick decision-making. Moreover, automated alert systems instantly notify farmers when abnormal readings indicate possible health issues such as fever, infections, stress, or calving. This early detection not only improves the chances of timely treatment but also prevents disease spread within the herd. Additionally, long-term data analytics help in understanding health trends, optimizing feeding practices, and improving farm management strategies.Overall, the integration of IoT into livestock management represents a major step toward precision farming. The Cow Health Monitoring System provides a cost-effective, reliable, and scalable solution that enhances animal welfare, boosts farm productivity, and supports data-driven agricultural practices.

A. Problem Description

Livestock, especially dairy cows, require continuous health monitoring to ensure consistent productivity and prevent disease outbreaks. However, in most traditional farming environments, farmers rely heavily on manual observation to identify signs of illness, stress, or abnormal behavior. This manual approach is time-consuming, subjective, and often inaccurate, particularly when managing large herds. Minor symptoms such as slight temperature variations or reduced movement can easily go unnoticed, leading to delayed diagnosis and improper treatment. Another major problem arises from the lack of real-time health data. Conventional monitoring methods do not provide continuous, up-to-date information, forcing farmers to depend on periodic checks or physical inspections. This limitation leads to gaps in understanding the cow's overall health condition. Without live data, it becomes difficult to detect early signs of diseases such as mastitis, infections, digestive issues, or heat stress. Delayed detection often results in higher treatment costs, reduced milk production, and increased risk of health complications. Additionally, farmers experience difficulty in tracking individual cow behavior and patterns over time, which is crucial for effective livestock management.

Furthermore, the absence of automated alert mechanisms contributes to inefficiency in traditional systems. When health issues arise, farmers are not alerted immediately, which can lead to emergencies or severe decline in the animal's condition. In large-scale dairy farms, monitoring each cow manually becomes nearly impossible, increasing the chances of oversight. The lack of a centralized system to store, analyze, and review health data also limits long-term planning and decision-making. Therefore, there is a clear need for an intelligent, automated solution that can continuously track vital parameters, send real-time alerts, and provide valuable insights to help farmers maintain herd health more efficiently.

II. RELATED WORK

Shabani et.al. [1] have propose a microservice-based architecture for real-time cattle health monitoring in their work titled "Special Issue Edge Computing for the IoT." The proposed system uses six microservices to receive, process, and send data, incorporating machine-learning algorithms like LightGBM to predict cattle health. Farmers are

notified in real-time about health issues and can monitor parameters such as body temperature, heart rate, humidity, and position 24/7.

Damayanthi and Venkatesh [2] have proposed an IoT-based system for monitoring dairy cow health in their work titled "IoT Based Cow Health Monitoring System." The proposed system aims to ensure the good health and wellbeing of dairy cows, which is crucial for sustainable milk production. It includes hardware devices, a cloud platform, an end-user application, and innovative data measurement and analysis algorithms. The system is designed to address the challenge of day-to-day monitoring on large farms by automating the detection of early disease symptoms and effectively monitoring animal welfare and the estrus cycle.

Srinivasa and Chatterjee [3] have proposed a health monitoring system for dairy cows in their research paper titled "CARE: IoT Enabled Cow Health Monitoring System." The primary goal is to routinely monitor dairy cow health by detecting various diseases based on behavioral changes and symptoms. Different sensors are installed on the cows' bodies and around the farm to record these changes, with sensory readings sent to the cloud. The proposed algorithm, CARE, classifies possible diseases based on recorded cow behavior and detects cow diseases with high accuracy. This framework is part of a smart health monitoring system.

Shinde et al. [4] This paper presents an IoT-based cattle health monitoring system using wearable sensors to track temperature, heart rate, and motion. The system employs an Arduino Uno and an ESP8266 Wi-Fi module to send data to a cloud platform for real time monitoring. It includes data acquisition, communication, and analysis units, enabling early disease detection and remote veterinary access.

Tamilselvan et al. [5] This study develops an Arduino and IoT-based system to monitor cattle health by measuring temperature, heart rate, and movement. The ESP8266 module transmits data to the ThingSpeak platform, and SMS alerts are sent when abnormal values are detected. The system provides real-time updates and facilitates timely medical interventions. The authors suggest future integration of AI for predictive health analytics.

Kuldharan et al. [6] this study develops an IoT-based solution for monitoring dairy cattle health by tracking body temperature and heart rate. Sensor data is collected through a collar-mounted unit and transmitted to the cloud via a microcontroller. Farmers and veterinarians can monitor health status through a mobile app, receiving alerts in case of abnormalities. The system aims to reduce financial losses through early disease detection.

Unold et al. [7] this study develops an"IoT-Based Cow Health Monitoring System" presents a modern solution for improving dairy cow health and wellbeing using Internet of Things (IoT) technology. The proposed system automates the monitoring process through IoT sensors and software analytics to track the health status of cows in real time. This helps address the inefficiencies and limitations of traditional manual monitoring, especially on large farms.

Hassaan [8] provides a systematic literature review (SLR) on the use of Internet of Things (IoT) technologies in cow health monitoring from 2017 to 2023. It highlights how IoT enables real-time health tracking, early disease detection, and improved productivity in livestock farming. The review identifies key benefits such as cost savings and enhanced animal health, while also noting challenges like high implementation costs, dependence on stable internet, and data security concerns. The study points out a research gap in realworld applications and emphasizes the need for more standardized, scalable, and affordable IoT solutions for effective cow health monitoring

Darvesh et al. [9] this study develops "IoT and AI-Based Smart Cattle Health Monitoring" introduces a smart system that uses IoT sensors and AI to monitor cattle health in real-time. The system collects vital data such as temperature and heart rate, which is then analyzed using AI to detect potential diseases early. This enables timely alerts and reporting to farmers via cloud-based platforms, improving livestock management and reducing economic losses. The study identifies a gap in real-time, automated health monitoring and emphasizes the need for AI integration.

Bhatla et al. [10] the paper "Real-Time Cattle Health Monitoring Using IoT, ThingSpeak, and a Mobile Application". It employs IoT sensors to collect data on temperature, heart rate, and activity levels, which is then transmitted to the ThingSpeak cloud for processing. A dedicated mobile application provides farmers with real-time health updates, enabling early disease detection and better livestock management. The study highlights the need for integrated, costeffective systems combining IoT, cloud platforms, and mobile access.

A. Comparative Analysis of Related Work

Existing IoT-based cattle health monitoring systems mainly focus on tracking basic vital parameters such as body temperature, heart rate, movement, and environmental conditions. Many earlier systems rely on wearable sensors that send data to microcontrollers and cloud platforms for real-time display. These models successfully automate data collection and reduce manual supervision, but most of them are limited to one-way monitoring, where farmers only receive data without deeper analysis. While the systems provide real-time values, they often lack a unified platform that integrates alerts, visualization, and detailed health history for each animal, which reduces their effectiveness in large-scale farms.

Some advanced studies introduced cloud analytics, microservices, or AI-based prediction techniques to detect abnormal behavior and possible diseases. These solutions offer improved accuracy and automated alert mechanisms, making them suitable for farms needing continuous surveillance. However, they often require high-end hardware, complex software architectures, or costly cloud services. This creates challenges for small and medium dairy farmers who need simple, affordable, and easily deployable health monitoring solutions. Additionally, many of these systems do not provide a clear interface for farmers to interact with the data, limiting user accessibility. Compared to these systems, the present project offers a more practical, low-cost, and user-friendly approach by integrating Arduino UNO with heart rate and temperature sensors to provide continuous health monitoring. The collected data is displayed locally through an LCD and updated on a website, allowing farmers to monitor cattle health remotely. The inclusion of real-time alerts for abnormal conditions ensures faster decision-making and early diagnosis. This makes the system more efficient and accessible than models that rely solely on sensor readings without instant notifications. Moreover, the project enhances usability by providing features such as a dashboard, prediction logs, health result pages, and notification panels. These features help farmers understand both current and past health trends of each cow, improving accuracy in decision-making. Unlike many existing works that focus only on data collection or algorithmic prediction, this system combines real-time monitoring, user-friendly visualization, alert mechanisms, and data storage in a single platform. This integrated approach makes the solution more suitable for practical farm environments and contributes toward improving cattle health management in a reliable and cost-effective way.

III. METHODOLOGY

The system operates by continuously monitoring two key health parameters: heart rate and body temperature. The heart rate sensor and temperature sensor constantly capture real-time readings and send them to the Arduino Uno for processing. The Arduino interprets these values and displays the current health status on the LCD screen so the user can instantly view their condition. Simultaneously, the Arduino updates the website with the same data, where it is categorized under “Active Health” when all readings fall within the normal range. In the event of any abnormal condition—such as a sudden rise in body temperature, unusually low or high heart rate, or irregular sensor patterns—the Arduino immediately identifies the deviation and triggers an alert. This abnormal status is clearly shown on the LCD display and is also highlighted on the website under the “Abnormal Condition” or “Health Alert” section. The website may use color indicators or notifications to make the alert more visible.This

process ensures that the user, caregivers, or medical personnel can quickly detect any risk and take immediate action, improving safety and enabling timely medical intervention.

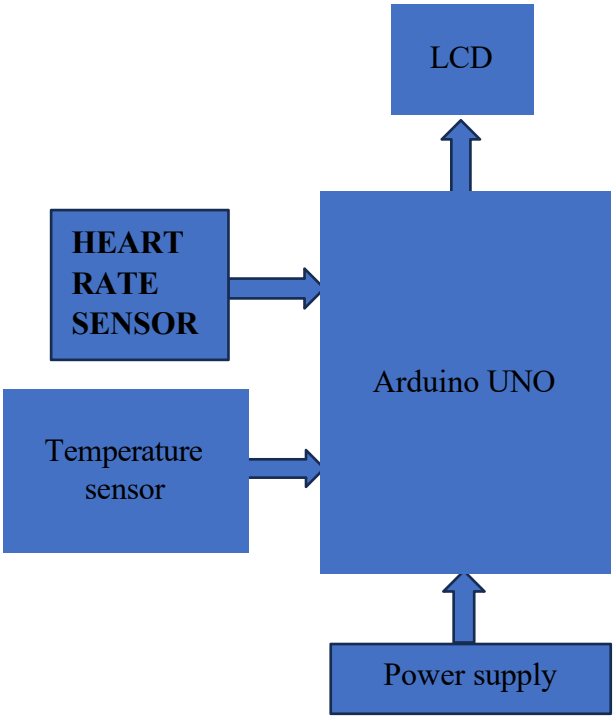

Fig 1. Workflow for Cow Health Monitoring System Using IoT

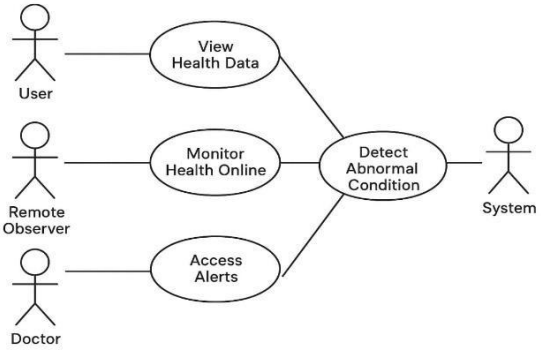

Fig 2. Specification using use case diagram

The use-case diagram Fig 2 shows how the system detects abnormal health conditions and allows users, doctors, and remote observers to view health data and receive alerts. It highlights the interaction between the monitoring system and all actors who access real-time health information.

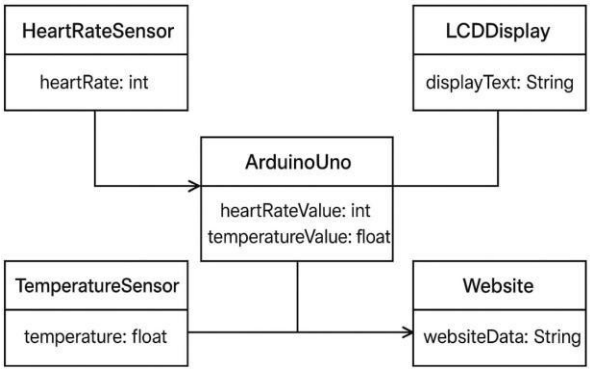

Fig 3. Class Diagram

Fig 3 shows Class diagrams are a fundamental element of object-oriented modeling. They visually represent the various objects in a system, along with their attributes, operations, and the relationships between them, as illustrated.

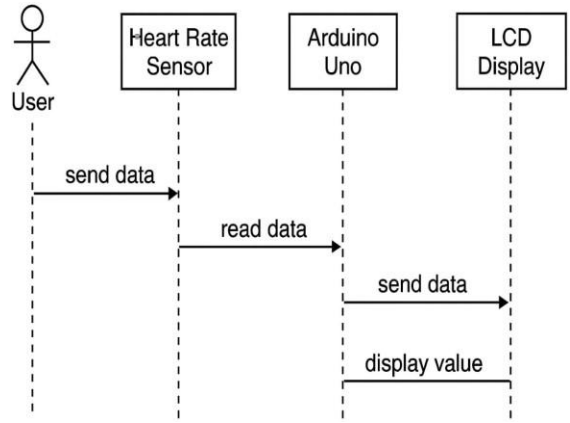

Fig 4. Sequence Diagram

Fig 4 shows A sequence diagram simply depicts interaction between objects in a sequential order i.e. the order in which these interactions take place.

IV. RESULTS

The Cow Health Monitoring System successfully recorded and displayed real-time The Cow Health

Monitoring System successfully recorded and displayed real-time temperature and heart rate readings using the Arduino-based hardware setup. The sensors provided continuous and accurate input values, which were processed by the Arduino and displayed on the LCD without delay. The website interface also showed live sensor data, allowing users to monitor cattle health remotely. The system was able to correctly classify the health condition of cows as Healthy, Sick, or Critical based on predefined threshold values, demonstrating reliable performance during testing. The testing results showed that integration between sensors, Arduino, and the web dashboard worked effectively with most test cases passing as expected.

V. CONCLUSIONS

The cow health monitoring system offers a reliable and efficient way to continuously track vital signs such as heart rate, body temperature, and activity levels. Using an Arduino Nano with various sensors, the system provides accurate, real-time health data for each cow. An integrated LCD display gives immediate local feedback, helping farmers quickly identify abnormalities or sudden changes in the animal's condition. This early detection capability prevents serious health issues, reduces veterinary expenses, minimizes productivity loss, and promotes better animal welfare by ensuring cows remain healthy and stress-free, ultimately improving milk yield and quality.

By delivering continuous health data, the system enables farmers to make informed decisions about feeding schedules,breeding plans, and medical treatments. Long-term data trends help identify recurring problems and improve farm management strategies. The solution reduces the need for manual inspections, Overall, this system is an essential tool for modern dairy farming, combining real-time monitoring,data-driven decisions, and improved animal welfare to increase productivity, enhance milk quality, and promote sustainable farm practices.

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