Volume 9, Issue 4, April – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1600

Smart Cattle Care: An IOT Based Monitoring and Management System

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Abstract:- The "Smart Cattle Care" system, which utilizes Internet of Things (IoT) technology to alter the way cattle are monitored and cared for in agricultural settings, marks a ground-breaking innovation in livestock management. This ground-breaking system combines a network of specialized sensors, wearables, and communication modules to gather and transmit real-time data on important aspects like location, environmental conditions, and health measurements. After that, using cloud-based platforms and cutting-edge analytics and artificial intelligence algorithms, the data is processed and examined. This all-encompassing strategy equips farmers with timely knowledge about the health and behavior of their cattle, allowing for proactive disease detection, improved breeding management, and increased overall productivity. The technology also allows for automatic regulation of feeding and climate, ensuring the provision of ideal circumstances for living. Smart Cattle Care greatly improves operational efficiency, lowers costs, and ultimately promotes enhanced animal care and agricultural sustainability by providing a user-friendly dashboard interface and rapid notifications. This study provides a thorough description of the Smart Cattle Care system, emphasizing its essential features, advantages, and prospective effects on contemporary livestock management techniques.

Keywords:- *IOT, Cattle Health Monitoring System, Smart Farming, Remote Monitoring, Cloud Computing, Cattle Behavior Analysis, Wireless Sensors Networks.*

I. INTRODUCTION

Internet of Things (IoT) is an emerging paradigm that connects the physical and digital worlds to solve real life problems. IoT forecasts the interconnection of a wide variety of intelligent things/objects in our surroundings, which have the ability to accumulate processes and communicate data. IoT has brought great attention to substantial services providers, industries, and businesses such as smart grids, autonomous vehicles, healthcare, data acquisition, and smart farming. IoT enables the vision of smart agriculture through real- time data gathering, analyzing, processing, and allowing the improvement of overall farm management while helping the farmers to make more informed decisions. The growing impact of IoT in agriculture can be categorized into three sub- domains i.e., Precision Farming, Greenhouse, and Livestock. This project aims to review and synthesize the research published in the domain of IoT enabled livestock management. As a matter of fact, scalability, interoperability, and the open/persuasive nature of IoT have revolutionized the livestock industry for vast pastures and constrained farms. Animal health can be easily monitored and tracked using smart wearable sensors and devices such as smart collars. IoT-based livestock not only includes animalsˆa health monitoring and controlling, but also many other deployments have been incorporated such as optimal environment and field supervision for feeding approaches. In addition, bee-hives analysis is also another important aspect in the IoT-based cattle field. Several wireless sensors have been utilized to monitor the behavioral analysis and odour gas.

II. LITERATURE SURVEY

The presented literature survey explores the transformative role of the Internet of Things (IoT) in the livestock industry, particularly focusing on animal health monitoring and smart management [1]. The study delves into various aspects of IoT-based livestock systems, elucidating the network infrastructure, topologies, platforms, communication protocols, and connections [2].

The IoT-based livestock network architecture comprises layers, starting with the Application Layer, which employs protocols like MQTT, CoAP, XMPP, AMQP, and SSL for data flow and migration. The Transport Layer ensures the reliability of information through protocols like TCP and UDP. The Network Layer uses 6LoWPAN, IPv6, and RPL to monitor livestock applications and transmit data [4]. At the bottom-most layer, the Physical Layer employs standards such as IEEE 802.15.4 for sensing animal health-related parameters.

Different topologies are proposed for livestock monitoring. Intelligent gateways and wearable sensors are used to capture animal health vitals, allowing remote monitoring by veterinarians [2][5]. These topologies integrate various technologies like WiMAX, IMT advanced, and IP, enabling the secure transmission of medical data and supporting services such as ultrasound signal capturing and extraction [6].

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The applications of IoT in livestock management are diverse. Smart collars, wearable sensors, and devices enable real-time monitoring of animals' health, movement, and behavior [5]. These IoT applications extend beyond health monitoring to include optimal environment and field supervision for feeding, as well as behavioral analysis for animals like bees. IoT-based systems facilitate efficient data analysis through artificial intelligence (AI) and machine learning (ML) algorithms, aiding in predictive analytics and informed decision-making [7][2].

Convenience to the farmer: The person, who is the direct in-charge of the cow farm,[1],[5],[3]can identify cow health problems within a minute or an hour. This job becomes very difficult when the number of cows grows to a few hundred in a big cow farm. Sometimes the proper precautions become late.[7] To avoid such loss, an IoT based health monitoring of cow is very useful.

Automated abnormal behaviour monitoring: A certain health disorder can be identified in an animal by minutely studying the changes that occur in their behavioural appearances[6].

Here different sensors always record the behavioural changes of the cattle. If any abnormal values are recorded, then specifically that can be sent to the stock person as an alarm[1],[2],[4]. Automated multi-disease prediction: The proposed CDP algorithm predict few common cow diseases by monitoring the changes in the cowŝ behaviour. This is useful for the quick treatment of some not so serious disease in the region where the doctors are not available very easily.[1],[5],[6],[7]

III. METHODOLOGY

A. Site of Study

There has been a growing concern about the welfare and management of cattle due to various factors such as limited grazing lands, disease outbreaks, and inefficiencies in traditional livestock management practices. These issues have led to a decline in the overall health and productivity of cattle herds, impacting both the livelihoods of farmers and the supply of meat and dairy products to consumers. One significant challenge in cattle management is the lack of real-time monitoring and data-driven decision-making tools. Traditional methods rely heavily on manual observation and periodic check-ups by veterinarians, which can be time-consuming, costly, and often reactive rather than proactive in addressing potential health or productivity issues.

B. IoT for Data Collection

Various parameters related to the health, behavior, and environment of the cattle are gathered using IoT sensors and devices deployed in the cattle housing facilities. These sensors may include wearable health monitors, environmental sensors, and smart feeding systems. Parameters such as body temperature, heart rate, activity levels, and feeding patterns are continuously monitored and collected in real-time. Additionally, environmental factors such as temperature, humidity, air quality, and lighting conditions within the cattle housing facilities are also measured using appropriate sensors.

C. Machine Learning for Classification and Prediction

Collected data is then stored in a database for further machine learning operations Like Data Preprocessing, Classification, Feature Scaling, and Suggestions/Predictions.

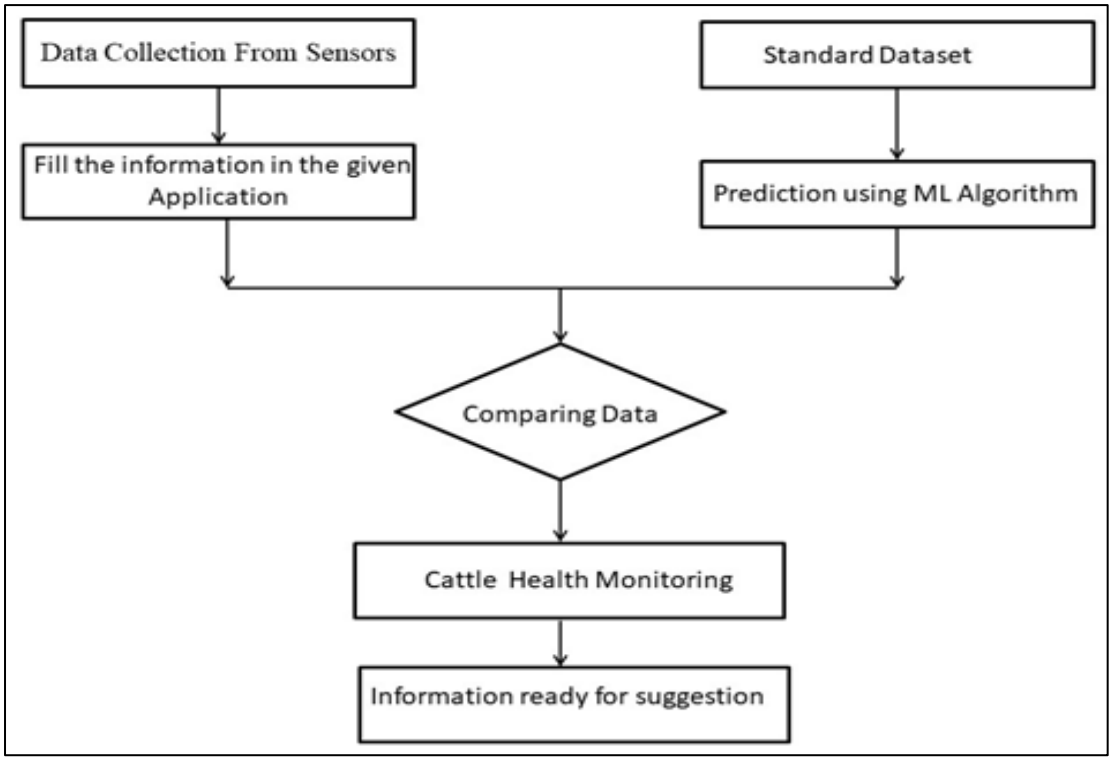

Fig 1: Flow of CattleCare

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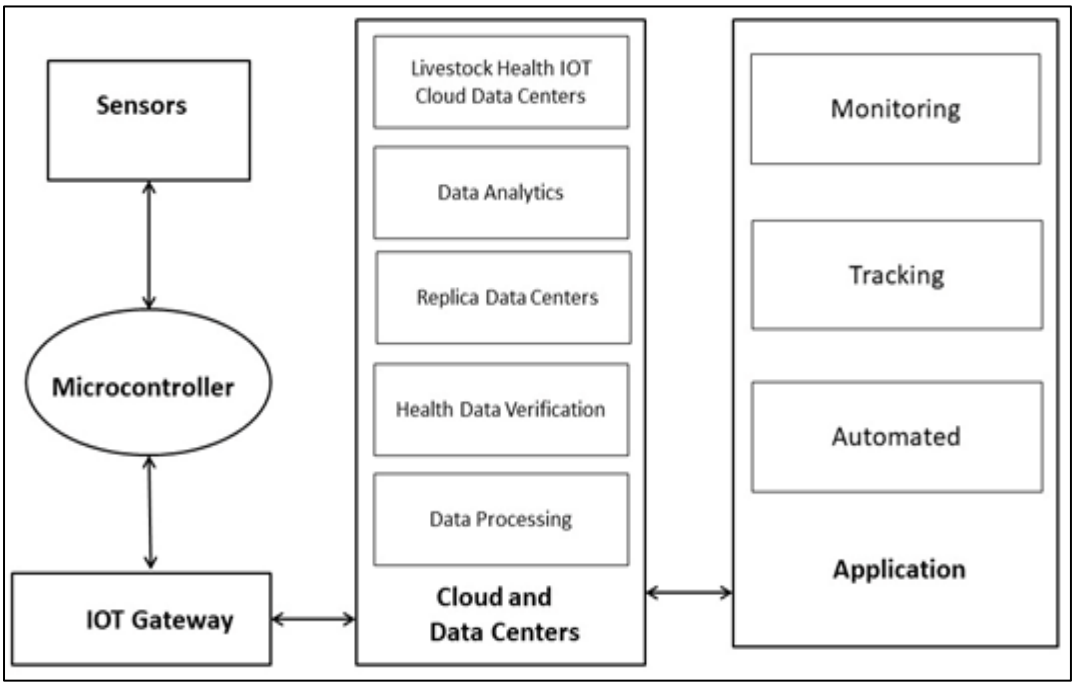

Fig 2: System Architecture

D. Data Transmission for Field Data

Collected data from the farm field is transmitted through MQTT protocol to the cloud storage server i.e., google firebase. The microcontroller esp32 collects the data from the sensors. RS-485 is a connector that behaves as an electrical interface and layers for the sending of data from sensors to esp32 is done many waysbut the proposed system uses RS485.

IV. APPLICATION OF ML ALGORITHM

To predict cattle health and optimize management practices, sensor data collected from IoT devices is pre-processed and utilized in a trained machine learning model within the cattle care app. This model employs various algorithms to analyze the data and make predictions regarding the health and well-being of the cattle. One of the primary benefits of using machine learning in the cattle care app is its capability to handle complex relationships between different variables. By examining factors such as vital signs, feeding patterns, environmental conditions, and historical health data, the model can forecast potential health issues or stress indicators in individual cattle. The ML algorithm assesses the pre-processed sensor data to generate predictions that directly impact cattle welfare. Additionally, it can provide insights into optimal management practices, such as adjusting feeding schedules or environmental conditions, to ensure the overall health and productivity of the herd.

V. REMOTE MONITORING

An app shows the user the updated value after using the cattle data to track the behavior of the cattle. The data is updated on a regular basis. The app's updated value is shown, providing users with the most recent knowledge on behavior and health of the cattle. Regular updates are provided within the app, ensuring users have access to the most recent information regarding the well-being of their cattle. This includes insights into factors such as temperature and feeding patterns, all of which contribute to the overall health and productivity of the herd.

VI. CONCLUSION

The integration of Internet of Things (IoT) technologies in the livestock industry has revolutionized animal management, including health monitoring, behavior analysis, and environmental control. Real-time health monitoring through wearable sensors, smart feeding systems, and environmental sensors allows farmers to make data-driven decisions. Artificial intelligence and machine learning algorithms enable predictive analytics, disease management, and resource allocation. However, challenges like scalability, interoperability, and security need to be addressed for widespread adoption.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1600

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