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Cattle Herd Management Using IoT

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ABSTRACT: Efficient livestock management is essential for improving farm productivity and maintaining accurate records of cattle health, breeding, and movement. Traditional cattle management systems rely heavily on manual record keeping, which is time-consuming, error-prone, and difficult to maintain for large herds. This research presents HerdMaster – a Cattle Herd Management System using IoT technologies, designed to digitize cattle identification and herd monitoring through RFID/NFC technology and a web-based platform.

In the proposed system, each cattle is assigned a unique RFID/NFC tag that enables quick identification and automated logging of entry and exit activities. A microcontroller-based system reads the tag information and transmits it to a cloud-based database where cattle records are stored and managed. The system provides a web application interface that allows farmers to manage cattle details, track herd movement, and access historical records such as birth information, breeding data, and health records.

The implementation results demonstrate that the system improves the efficiency and accuracy of livestock record management while reducing manual effort. By integrating RFID/NFC identification, cloud storage, and a web-based monitoring interface, the proposed system provides a reliable and scalable solution for modern cattle herd management.

KEYWORDS: Internet of Things, Smart Agriculture, Livestock Monitoring, Cattle Management System, Sensor Networks, Real-Time Monitoring, Smart Farming, IoT-based Agriculture.

I. INTRODUCTION.

Livestock farming plays a vital role in the agricultural sector and contributes significantly to food production and rural economies. Effective management of cattle herds requires accurate record keeping of animal identification, breeding history, health conditions, and daily farm activities. Traditionally, farmers maintain these records manually using notebooks or spreadsheets. However, manual record keeping becomes inefficient and difficult to manage when dealing with large herds of cattle.

One of the major challenges in traditional livestock management is the identification and tracking of individual animals. Farmers often rely on visual identification or manual tagging systems, which may lead to errors in record keeping. In addition, tracking cattle movement and maintaining historical records such as vaccination data, breeding information, and health status can be complicated and time-consuming.

With the advancement of Internet of Things (IoT) technologies, smart farming solutions have emerged that enable automated livestock monitoring and digital farm management. IoT-based systems allow devices to collect, process, and transmit data in real time, improving the efficiency of agricultural operations. RFID and NFC technologies are commonly used in livestock management to provide unique digital identification for each animal.

This research presents HerdMaster – a Cattle Herd Management System using IoT, designed to simplify livestock management through RFID/NFC-based identification and a web-based monitoring platform. In the proposed system, each cattle is assigned a unique RFID/NFC tag that stores identification information. When the tag is scanned using an RFID/NFC reader connected to a microcontroller, the system records the cattle information and transmits the data to a cloud database.

The stored data can be accessed through a web application that allows farmers to manage cattle records, monitor herd activities, and view historical information related to individual animals. The system also supports automatic logging of cattle entry and exit events, enabling efficient monitoring of herd movement.

By integrating RFID/NFC technology, microcontroller-based processing, cloud storage, and a web-based interface, the proposed system provides a modern and efficient approach to cattle herd management. This digital system reduces manual work, improves record accuracy, and supports better decision-making for farmers.

II. LITERATURE SURVEY

Recent developments in smart agriculture and precision livestock farming have encouraged researchers to apply Internet of Things (IoT) technologies for monitoring livestock health, behavior, and environmental conditions. IoT enables continuous data collection using sensors and wireless communication technologies, allowing farmers to monitor animals remotely and respond quickly to abnormal conditions.

Several studies have explored IoT-based systems for monitoring cattle health parameters such as body temperature, heart rate, rumination activity, and movement patterns. Traditional livestock monitoring relies on manual observation, which is time-consuming and often ineffective in large farms. IoT-based monitoring systems provide continuous data collection, enabling early detection of diseases and improving livestock productivity.

Researchers have proposed wearable devices such as smart collars and sensor tags that can be attached to cattle to collect physiological and behavioral data. These devices commonly integrate sensors like accelerometers, temperature sensors, and heart rate monitors to track animal activity and health status. The collected data is transmitted to cloud platforms or mobile applications where farmers can monitor cattle conditions in real time.

Another important area of research focuses on behavior monitoring using sensor data. Activity recognition techniques use motion sensors or accelerometers to classify cattle activities such as grazing, walking, resting, or rumination. Changes in these behaviors may indicate stress, illness, or reproductive cycles. Some studies have applied machine learning algorithms to analyze sensor data and predict cattle activities with high accuracy, enabling automated livestock management systems.

Location tracking is also a key feature in modern livestock management systems. GPS-enabled IoT devices help farmers track cattle location in open grazing environments and prevent livestock loss. These systems transmit location and health information through wireless networks such as GSM, Wi-Fi, or cellular communication technologies.

Recent research has also focused on integrating IoT with artificial intelligence and data analytics to enhance livestock monitoring systems. AI-based models analyze large volumes of sensor data to detect disease symptoms, abnormal behavior, and environmental stress factors. Such technologies support early disease detection, improve animal welfare, and increase farm productivity.

Furthermore, continuous monitoring using IoT sensors can improve feeding management, detect reproductive cycles, and reduce veterinary costs. Real-time data allows farmers to optimize feeding schedules, identify health problems early, and improve the overall welfare of livestock.

Despite these advancements, several challenges remain in implementing IoT-based livestock monitoring systems. Many existing systems require high infrastructure costs, reliable internet connectivity, and advanced data processing capabilities. Some systems also focus on monitoring limited parameters rather than providing a comprehensive livestock management solution.

III. METHODOLOGY

The proposed Cattle Herd Management Using IoT system is designed to digitally manage cattle information using NFC-based identification technology and cloud-based data management. The system enables farmers to easily identify

and monitor cattle through a web-based platform. The architecture of the system consists of four main components: NFC Tag, Microcontroller Unit, Cloud Database, and Web Application.

NFC Tag for Cattle Identification

In the proposed system, each cattle is assigned a unique NFC (Near Field Communication) tag that stores identification information. The NFC tag acts as a digital identifier for each animal in the herd. When the NFC tag is scanned using an NFC-enabled device or reader, the stored identification data is retrieved instantly. This eliminates the need for manual record keeping and helps farmers easily identify individual cattle within the herd.

Microcontroller Processing Unit

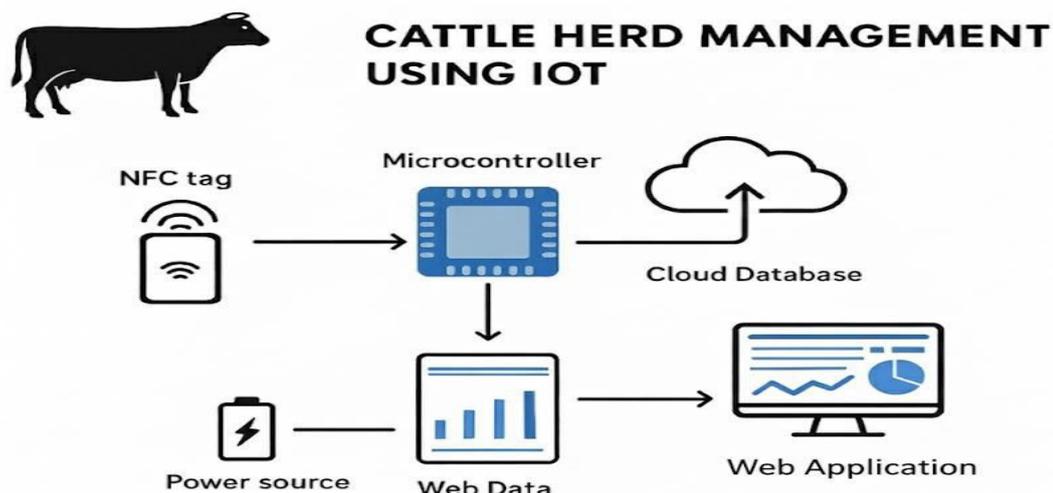
The micro-controller serves as the central processing unit of the system. When an NFC tag is scanned, the micro-controller reads the identification data from the NFC tag and processes the information. The micro-controller then sends the collected data to the cloud database through an internet connection. This allows the system to store and update cattle information in real time.

Cloud Database Integration

The cloud database is used to store all cattle-related data, including identification records and herd management information. When data is received from the micro-controller, it is securely stored in the cloud database. This centralized data storage ensures that cattle information can be accessed remotely at any time. The use of cloud technology also improves scalability and data reliability for herd management systems.

Web Application for Monitoring

The web application provides an interface for farmers to access and manage cattle data stored in the cloud database. The application retrieves information from the database and displays it in the form of dashboards and management records. Through this web-based interface, farmers can monitor cattle details, track herd information, and maintain digital records of livestock. The web application simplifies herd management and improves accessibility of cattle information.



IV. EXPERIMENTAL RESULTS



Fig.1 User Interface

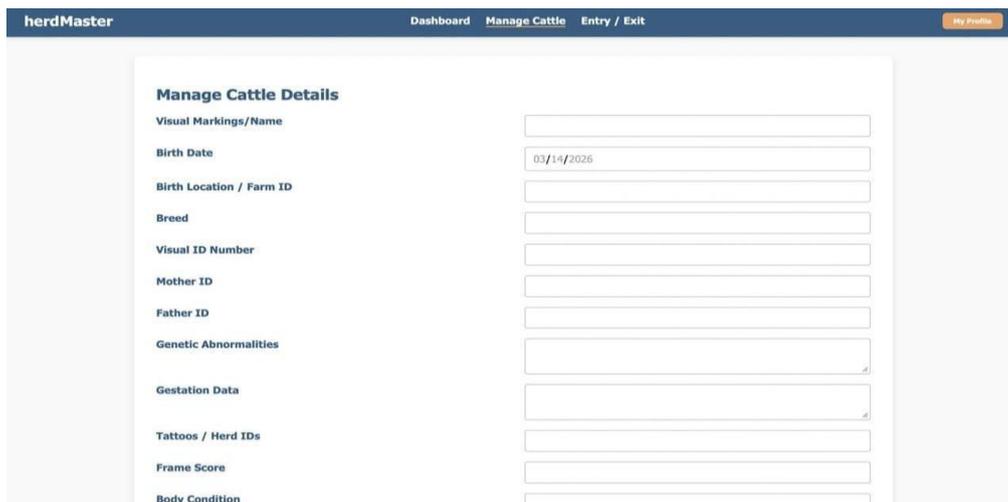


Fig 2. Manage Cattle Page

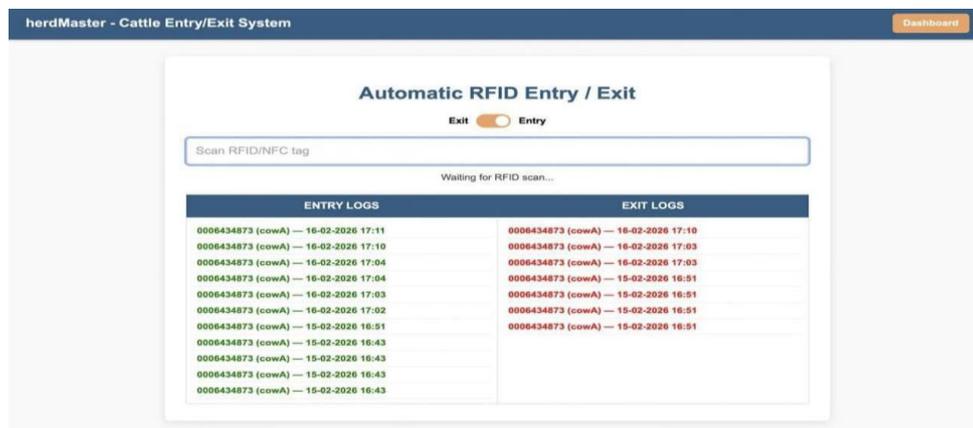


Fig 3. Cattle entry-exit

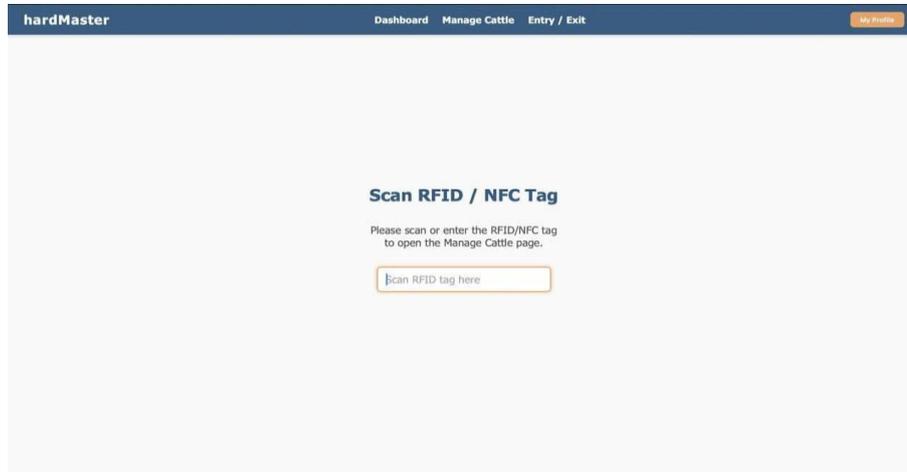


Fig 4. RFID Tag Scan

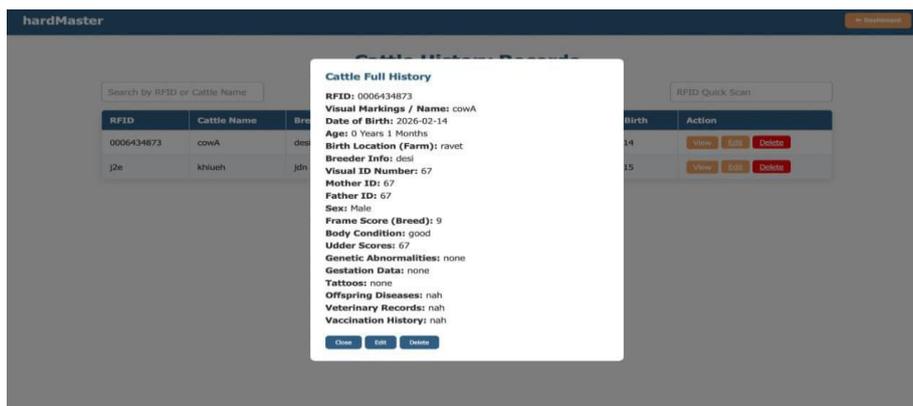


Fig 5. Cattle Info

The experimental implementation of the HerdMaster – Cattle Herd Management System demonstrates the successful integration of RFID/NFC-based identification, cloud-based data storage, and a web-based management platform for livestock monitoring. The developed system enables farmers to digitally manage cattle information, track herd movement, and maintain historical records through a centralized interface.

The main dashboard of the system provides users with quick access to key management modules including Manage Cattle, Entry/Exit Monitoring, Cattle History, and RFID Scanner functionality. The dashboard interface simplifies navigation and allows farmers to efficiently access different herd management operations.

The Manage Cattle module allows users to add, update, and manage detailed information about individual cattle. The system supports storing important attributes such as visual markings, birth details, breed information, parental identification, genetic abnormalities, gestation data, body condition, and other livestock-related records. This module enables farmers to maintain organized digital records of cattle that can be easily accessed and updated through the web application.

The Automatic RFID Entry/Exit System records the movement of cattle entering or leaving the farm premises. When an RFID or NFC tag attached to a cattle is scanned, the system automatically logs the entry or exit event along with the timestamp. The recorded data is stored in the database and displayed in the system interface, allowing farmers to monitor cattle movement and maintain accurate activity logs.

The Cattle History module provides a comprehensive view of historical records for each animal. Users can retrieve detailed information including RFID identification, birth information, parent IDs, health-related attributes, genetic conditions, and vaccination records. This feature helps farmers track the lifecycle and medical history of cattle in an organized manner.

The experimental results demonstrate that the HerdMaster system successfully performs the following functions:

- ✓ **Digital registration and management of cattle information**
- ✓ **RFID/NFC-based identification and scanning of cattle**
- ✓ **Automatic logging of cattle entry and exit activities**
- ✓ **Centralized storage of herd data in a cloud-based database**
- ✓ **Retrieval and visualization of cattle history through a web interface**

V. CONCLUSION

This research presented a Cattle Herd Management System using IoT technology designed to improve the efficiency of livestock management through digital monitoring and identification. The proposed system utilizes NFC-based identification, microcontroller processing, cloud database storage, and a web-based monitoring application to simplify the management of cattle records.

The implementation of NFC tags allows each cattle to be uniquely identified, eliminating the need for traditional manual record keeping. The microcontroller reads the NFC tag data and sends it to a cloud-based database, where the information is stored and managed securely. Through the web application interface, farmers can easily access cattle information, monitor herd records, and maintain livestock data in a structured digital format.

The developed system improves the accuracy and accessibility of cattle data while reducing the effort required for manual herd management. By integrating IoT technologies with livestock monitoring, the system provides a reliable and scalable solution for modern cattle farming.

Future improvements may include integration of GPS-based cattle tracking, health monitoring systems, mobile application support, and advanced analytics for predicting cattle health and behavior. These enhancements can further improve the effectiveness of IoT-based livestock management systems.

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