

IDEA DETAILS

Track Name	Embedded System and IOT		
Category	Engineering		
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Problem Statement	To Develop a IoT-enabled Milk Dairy Automation Solution leveraging IoT to optimize milk data recording, processes, reduce manual errors, and provide real-time access to data, thus enhancing efficiency and transparency in dairy management.		

NEED

When a farmer goes to a dairy it was seen that the measurement of fat and weight is recorded manually, which leads to an error. The productivity and profitability are affected by problems with inaccurate milk data, and lack of transparency. So, to minimize the errors, to increase efficiency in milk data management and transparency we proposed this solution.

IDEA DISCRPTION

In rural parts of India, many dairy farms still rely on outdated methods to manage milk data. Farmers must manually record all aspects of their operations, like milk quantity and quality, which takes time and increases the risk of errors. Additionally, this information is not available in real time, making it challenging to stay organized and often resulting in missing or hard-to-find data. Since much of this work is done on paper or spreadsheets, it can be difficult for all parties involved to access the same data seamlessly.

To address these challenges, we are developing a solution called Digitalized Automated Milk Dairy Data Manipulation Technology. This system leverages the Internet of Things (IoT), which enables devices to connect and share information automatically, optimizing system operations without manual intervention. Our approach removes the need for farmers to handle all record-keeping tasks themselves. Instead, it will automatically collect, organize, and present milk data, enhancing dairy management and supporting informed decision-making. By incorporating digital technology, we also aim to bring greater transparency and fairness to the dairy industry. Accessible and reliable data will simplify business transactions and improve communication among stakeholders.

The main objective of our project is to streamline dairy farming for the digital age. By using IoT-based smart technology to manage milk data, we aim to make dairy operations faster, more accurate, and more accessible for everyone involved.

SOLUTION AND PROTOTYPE

The proposed IoT-based milk quality analysis system utilizes the ESP32 microcontroller, an OLED display, and ThingSpeak cloud platform for real-time monitoring and analysis, offering an affordable and scalable solution for small and medium-sized dairy farms. The system measures various milk quality parameters, including fat content, protein, lactose, SNF, water content, and bacterial count, using specialized sensors. Data collected by the ESP32 is wirelessly transmitted to ThingSpeak for storage, analysis, and visualization.

The OLED display provides real-time feedback on milk quality, with alerts for any parameter exceeding acceptable ranges. Additionally, the system sends notifications via SMS or email when quality thresholds are breached, enabling immediate action to maintain standards. The modular and scalable design allows easy integration of future features.

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The web application, developed using React, integrates real-time data from ThingSpeak and features modules for milk collection, financial management, and cattle feed inventory. Firebase supports authentication and real-time data updates, ensuring accuracy and security. The application's client-server model and agile development approach ensure scalability, robust performance, and easy future maintenance.

This system enhances operational efficiency and decision-making in dairy management, offering continuous monitoring, better quality control, and improved management of daily operations.

- **WORKING:**

The proposed system integrates an IoT-based solution using the ESP32 microcontroller, OLED display, and ThingSpeak cloud platform for real-time milk quality monitoring. This affordable and scalable system is designed to cater to small and medium-sized dairy farms. The ESP32 connects wirelessly to Wi-Fi, transmitting milk quality data to the ThingSpeak platform, where it is stored, analyzed, and visualized.

The core of the system is a milk analyzer that measures quality parameters such as fat content, protein levels, lactose, SNF, water content, and bacterial count. Specialized sensors, such as capacitive sensors for fat measurement and ultrasonic sensors for density, collect this data. The ESP32 processes the data and displays real-time results on the OLED screen. Alerts are displayed for any abnormal readings, allowing farmers to make immediate decisions to ensure milk quality and prevent spoilage.

Once the data is captured, the ESP32 transmits it to ThingSpeak via Wi-Fi, enabling continuous remote monitoring through a web interface or mobile app. The system includes a real-time alert mechanism, sending notifications via SMS or email when quality thresholds are breached. This proactive management approach improves dairy production standards.

The system is designed to be modular and scalable, allowing the integration of additional sensors as needed, making it adaptable to evolving dairy industry requirements.

For the web application, React is used to develop an interactive and scalable dashboard that visualizes real-time data fetched from ThingSpeak APIs. Modules are created for managing milk collection, financial data, and cattle feed inventory, allowing for efficient data handling and processing. Firebase supports real-time database features for secure data handling and user authentication.

The entire system is developed with an iterative process using agile methodologies, ensuring continuous refinement and testing to meet the project's goals of scalability, reliability, and real-time control in dairy management.

- **DISCRIPTION OF COMPONENTS/TOOLS:**

Hardware Components

- ESP32 Microcontroller.
- Sensors for Fat, SNF, Lactose, and Protein analysis.
- OLED Display.
- RFID Reader for Farmer Identification.
- Power Supply and Connecting Cables.

Software Components

- React-based Web Application.
- Firebase for Authentication and Database Management.
- ThingSpeak for IoT Data Visualization
- Internet Connectivity via ESP32's Wi-Fi

- **ADVANTAGES OVER PRESENT IDEAS**

1. Give solution to optimize the milk data process using IoT, ensuring real-time tracking and accurate monitoring for increased efficiency and transparency.
2. Reduces manual work, errors in process of storing data of milk collection.
3. Implemented technological solutions to optimize milk processing conditions, ensuring consistent fat content and improving overall milk quality for farmers.
4. Minimizes manual efforts in managing financial records and inventory related to cattle feed and accessories.
5. Cost Efficient than exitsing products