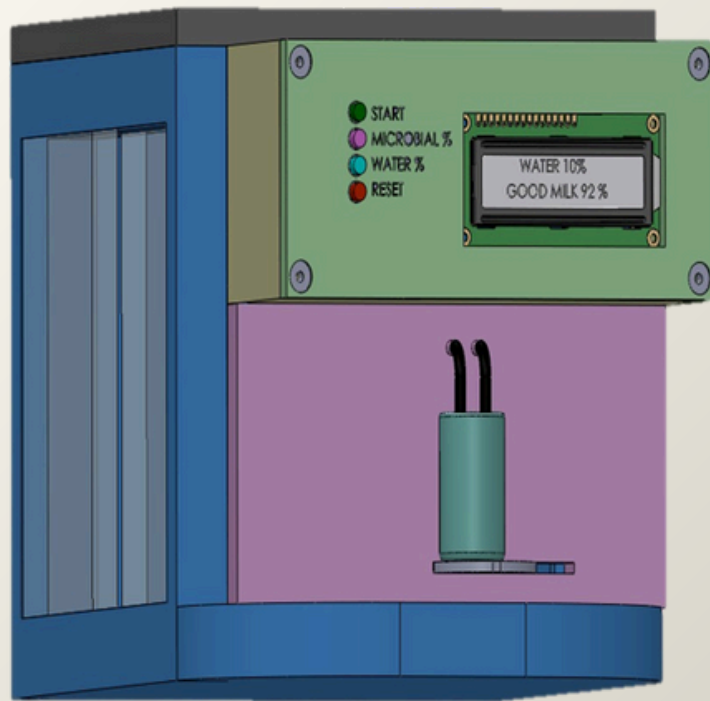


MILK-DETECTIVE

A Dual-Mode System for Rapid Microbial and Adulteration Analysis of Milk



PROJECT OVERVIEW

To create a dual-function automated system for milk quality analysis that detects water adulteration through curd-whey separation and evaluates microbial freshness using impedance sensing, without using chemicals or long testing time.

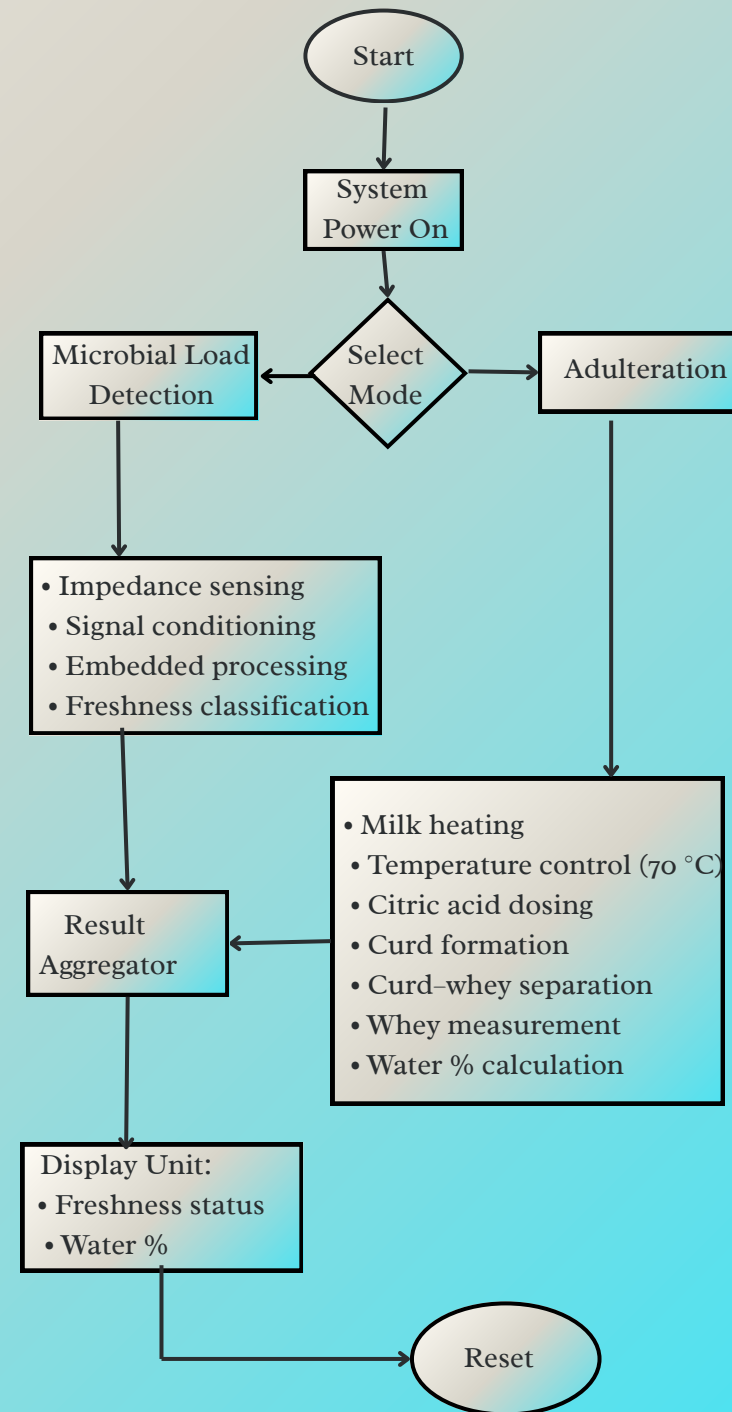
KEY CONCEPTS

- Rapid microbial freshness evaluation using electrical impedance sensing
- Milk adulteration detection through curd-whey separation

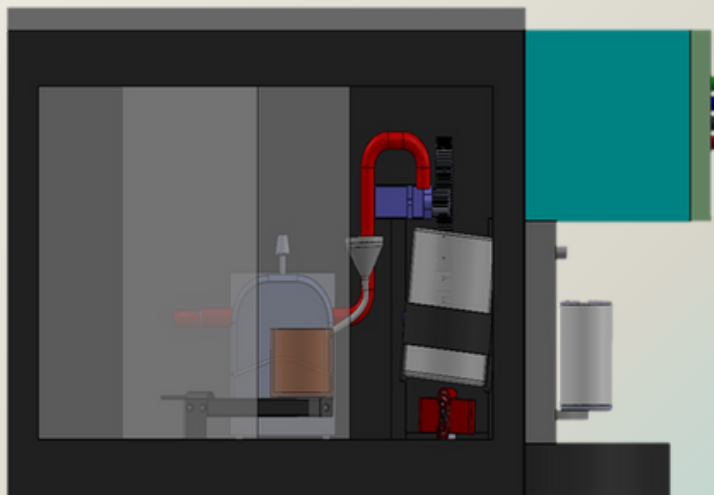
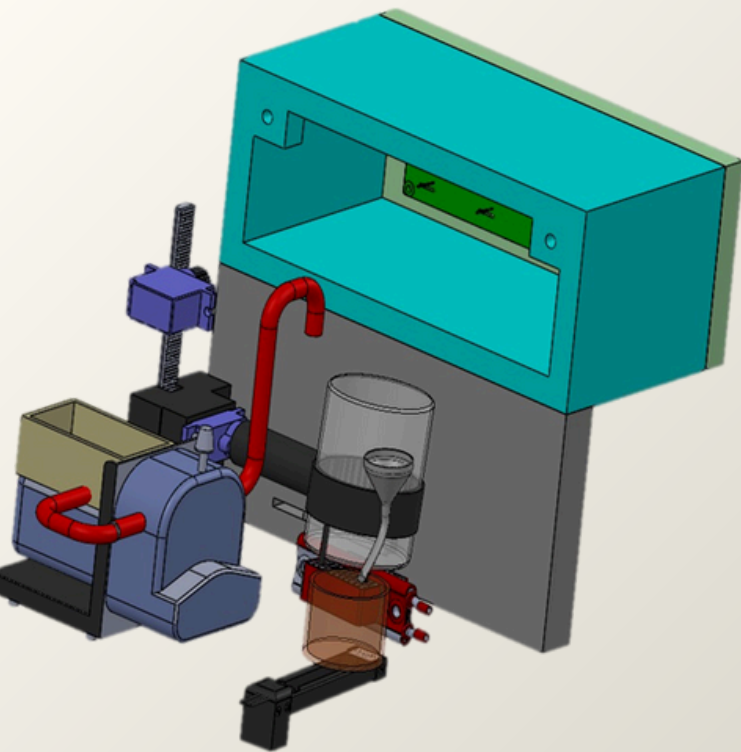
FUNCTIONALITY

- The user selects the required test mode (microbial freshness or water adulteration) using the device interface.
- A fixed volume of milk sample is introduced into the test chamber for analysis.
- The system performs impedance-based sensing for microbial freshness evaluation or controlled curd-whey separation for water adulteration detection.
- Sensor data is processed by the embedded controller to determine the freshness status or calculate the percentage of added water.
- The final results are displayed clearly on the screen to support immediate quality decision-making at the milk collection point.

WORK FLOW CHART



DESIGN PROTOTYPE



NOVELTY

1. Dual-Mode Milk Quality Assessment in a Single Platform :

Combines microbial freshness evaluation and water adulteration detection in one automated system.

2. Chemical-Free Microbial Freshness Detection

Eliminates the need for reagents, incubation, and laboratory testing.

3. Automated and Standardized Curd–Whey Separation :

Uses controlled heating and citric acid dosing to achieve repeatable and accurate results.

4. Portable, Hygienic, and Field-Deployable Design :

Suitable for on-site use at milk collection centers and dairy farms.

FABRICATION CHALLENGES

- Achieving stable and accurate impedance measurements in liquid milk
- Maintaining precise temperature control during milk heating
- Ensuring accurate citric acid dosing for consistent curd formation
- Designing a hygienic and food-safe sensing and processing unit
- Synchronizing sensing, heating, and measurement operations in real time

FUTURE SCOPE & IMPROVEMENTS

- IoT integration for real-time remote milk quality monitoring and data logging
- AI-based algorithms for improved microbial freshness classification accuracy
- Energy-efficient heating using solar or low-power thermal systems
- Compact and rugged system design for large-scale field deployment
- Integration with industrial dairy processing and quality control systems

TARGET USERS

- Dairy farmers
- Milk collection centers
- Dairy processing industries
- Food quality testing laboratories