Software Requirements Specification for SFWRENG 4G06: subtitle describing software

Team 28, Cowvolution Minds
Aryan Patel
Harshpreet Chinjer
Krish Patel
Martin Ivanov
Shazim Rahman

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Revision History

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

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6 The Scope of the Work

6.1 The Current Situation

The current state of dairy farming presents challenges in efficiently predicting the health, productivity, and breeding outcomes of cattle. Farmers typically rely on historical records, but the analysis is done manually, often leading to reactive management. The existing systems do not utilize advanced technologies such as machine learning for predictive analytics. As a result, there is limited proactive management regarding milk production, breeding success, and herd longevity, which directly impacts farm profitability and sustainability.

The current solution environment lacks integration of large datasets from multiple sources, such as individual cow health records, breeding history, and environmental conditions, into a single system that can offer actionable predictions.

6.2 The Context of the Work

This project aims to develop a machine learning model that will leverage historical herd data to predict important traits such as milk yield, breeding success rates, and the likelihood of a cow leaving the herd. This model will be integrated into a farm management system, providing farmers with actionable insights. The goal is to move from reactive to proactive herd management.

The model will use data such as the health, breed, and genetic history of both the mother and father to predict traits in calves. The software will be developed as part of a partnership with CATTLEytics Inc., ensuring seamless integration into their existing platform used by dairy farmers.

6.3 Work Partitioning

The project will be divided into several key components:

1. **Data Collection and Preprocessing:**
    - Collection of historical data from existing systems, including cow health records, breeding data, and productivity metrics.
    - Cleaning and standardizing the data for input into the machine learning model.
2. **Model Development:**
    - Designing and implementing the machine learning model for trait prediction (e.g., milk production, herd retention).
    - Training and validating the model on historical datasets.
    - Iterative testing and refinement.
3. **Integration:**

- Integrating the prediction model into the CATTLEytics farm management system.
- Ensuring that outputs are presented in a user-friendly format for farmers to make decisions.

4. **Testing and Validation:**
    - Testing the software in real-world farm environments to validate predictions and refine the user interface.
5. **Documentation and Training:**
    - Providing clear documentation for users and training for farmers to effectively use the system.

6.4 Specifying a Business Use Case (BUC)

Title: Predicting Cow Traits for Optimized Herd Management

Primary Actor: Dairy farmer using the CATTLEytics system.

Precondition: The farmer has access to a herd management system integrated with the prediction model. Historical data on breeding, milk production, and herd turnover are available.

Trigger: The farmer initiates the model to predict the outcomes of a planned breeding or evaluates the likelihood of an existing cow leaving the herd.

Main Success Scenario:

1. The farmer selects cows for breeding and inputs the necessary data (e.g., parent traits).
2. The system processes the input and returns predictions for milk yield and herd retention likelihood.
3. Based on the model's predictions, the farmer makes informed decisions on breeding strategies or management actions to prevent herd loss.

Postconditions:

- The farmer has actionable insights to improve herd productivity and manage herd turnover proactively.

7 Business Data Model and Data Dictionary

7.1 Business Data Model

This section will be completed once the relevant data model details are available.

7.2 Data Dictionary

This section will be completed once the relevant data model details are available.

8 The Scope of the Product

8.1 Product Boundary

The product's primary function is to predict cow traits such as milk production, breeding success, and herd retention based on parental data. The machine learning model will integrate into a platform like CATTLEytics, and its boundaries will include:

- **Included**: The product will use historical data to generate predictive insights on milk production, breeding success rates, and herd retention likelihood. Farmers will be able to input relevant data to receive predictions.
- **Not Included**: Real-time data collection and analysis, live health monitoring, or any complex integrations with external devices (e.g., IoT sensors).

This product will focus solely on predictive analytics based on historical data and will not handle aspects like data collection or advanced herd management automation beyond providing insights.

8.2 Product Use Case Table

This table outlines the core use cases currently identified for the product, based on available information.

ID	Title	Actor	Description
PUC1	Predict Breeding Success	Dairy Farmer	Farmers input breeding data to get predictions on the likelihood of successful breeding.
PUC2	Forecast Milk Production	Dairy Farmer	Farmers input cow data to get a prediction of future milk production.
PUC3	Predict Herd Retention Likelihood	Dairy Farmer	Farmers receive predictions on whether cows are likely to stay in or leave the herd.

8.3 Individual Product Use Cases (PUC's)

8.3.1 PUC1: Predict Breeding Success

- **Primary Actor**: Dairy Farmer
- **Preconditions**: Farmer has historical data about cow and parental traits available for input.
- **Trigger**: The farmer initiates a request to predict breeding success.
- **Main Success Scenario**:

1. The farmer enters relevant breeding data.
2. The system processes the input using historical records.
3. A prediction is generated on the likelihood of breeding success.

- **Postcondition**: The farmer gets an actionable prediction to decide whether to proceed with the breeding.

8.3.2 PUC2: Forecast Milk Production

- **Primary Actor**: Dairy Farmer
- **Preconditions**: Historical data for milk production and parental traits is available for input.
- **Trigger**: The farmer requests a prediction for future milk production.
- **Main Success Scenario**:

1. The farmer inputs the cow's data.
2. The system processes the input data.
3. A prediction on future milk production is generated.

- **Postcondition**: The farmer receives a prediction that helps in planning milk yield expectations.

8.3.3 PUC3: Predict Herd Retention Likelihood

- **Primary Actor**: Dairy Farmer
- **Preconditions**: Health and productivity data is available for the cows in question.
- **Trigger**: The farmer requests predictions on herd retention likelihood.
- **Main Success Scenario**:

1. The farmer selects a cow or group of cows for analysis.
2. The system processes the available data.
3. A prediction is generated on whether the cows are likely to stay in or leave the herd.

- **Postcondition**: The farmer receives predictions to assist in managing herd turnover.

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Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning. Please answer the following questions:

1. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.

2. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?