

FACULTY OF COMPUTING AND INFORMATION MANAGEMENT

BACHELOR OF INFORMATION TECHNOLOGY

**LIVESTOCARE HUB SYSTEM**

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# SOFWARE REQUIREMENT SPECIFICATION

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# INTRODUCTION

## Purpose

The purpose of this Software Requirements Specification (SRS) document for the Livestock Management System (LMS) is to provide a comprehensive and detailed description of the functional and non-functional requirements of the system. This document serves as a vital communication tool between project stakeholders, including farmers, livestock managers, application designers, developers, and testers, ensuring a clear understanding of the system's objectives, functionalities, and constraints.

### Specifically, the SRS aims to:

1. Clearly articulate the requirements and specifications of the LMS, including its features, functionalities, and performance expectations.
2. Establish a shared understanding among stakeholders regarding the scope and objectives of the LMS project.
3. Provide guidance and direction to the development team throughout the software development lifecycle, from design and implementation to testing and deployment.
4. Serve as a reference document for project managers, developers, and testers, enabling them to validate and verify the system's compliance with the specified requirements.
5. Facilitate effective communication and collaboration among stakeholders, ensuring alignment with project goals and minimizing the risk of misunderstandings or discrepancies.
6. Support decision-making processes related to the design, development, and enhancement of the LMS by providing a structured framework for evaluating proposed changes or additions.

### Intended Audience for the SRS:

The targeted audience for this SRS includes:

1. Farmers and Livestock Managers: End-users who will interact with the LMS to monitor and manage their livestock effectively.
2. Application Designers: Professionals responsible for designing the user interface (UI), user experience (UX), and overall system architecture of the LMS.
3. Developers: Software engineers and programmers tasked with implementing the functionalities and features outlined in the SRS document.
4. Testers: Quality assurance (QA) testers responsible for verifying the correctness, reliability, and usability of the LMS through testing and validation processes.
5. Project Managers: Individuals overseeing the development and deployment of the LMS, ensuring that project objectives are met within specified timelines and budget constraints.

By targeting these specific user groups, the SRS aims to provide tailored guidance and information relevant to their respective roles and responsibilities in the LMS project.

## Scope

### **System Overview**

The Livestock Management System (LMS) is a web-based application designed to facilitate efficient and effective management of livestock for farmers and livestock managers. The system aims to provide comprehensive monitoring, tracking, and analysis capabilities to optimize livestock health, productivity, and profitability.

### **System Functionality**

The LMS will:

* Allow users to register and create accounts to access the system.
* Provide functionalities for adding, editing, and deleting livestock records, including details such as species, breed, age, weight, and health status.
* Support real-time monitoring of livestock health indicators, such as temperature, heart rate, and activity level, using sensors and IoT devices.
* Enable users to set up alerts and notifications for critical events, such as illness, injury, or unusual behavior observed in livestock.
* Offer inventory management features to track feed, medication, and other supplies related to livestock care.
* Generate reports and analytics on key performance metrics, including growth rates, feed consumption, and health trends, to support data-driven decision-making.
* Facilitate communication and collaboration among stakeholders, allowing users to share information and coordinate tasks related to livestock management.

### **System Non-Functionality**

The LMS will not:

* Provide functionalities for livestock trading or sales transactions.
* Replace professional veterinary services or medical diagnosis for livestock health issues.
* Guarantee 100% accuracy or reliability of sensor data, as environmental factors and technical limitations may affect data quality.
* Store or process personal data of users beyond what is necessary for system operation and user authentication.

### **System Benefits and Objectives**

The primary benefits and objectives of the Livestock Management System include:

* Improving overall livestock health and welfare through proactive monitoring and early detection of health issues.
* Enhancing operational efficiency and resource utilization by streamlining record-keeping, inventory management, and communication processes.
* Empowering farmers and livestock managers with actionable insights and data-driven decision support tools.
* Increasing productivity and profitability of livestock operations by optimizing feed utilization, minimizing health risks, and maximizing growth rates.
* Fostering collaboration and knowledge-sharing among stakeholders within the livestock industry, leading to improved industry standards and practices.

## Definitions, Acronyms and Abbreviations

### **Definitions**

* Livestock: Domesticated animals raised in an agricultural setting for commercial purposes, including cattle, sheep, goats, pigs, and poultry.
* Livestock Management System (LMS): The web-based application designed to assist farmers and livestock managers in monitoring, tracking, and managing livestock effectively.
* Sensor: A device that detects and responds to physical stimuli, such as temperature, humidity, or motion, and provides corresponding output signals.
* IoT (Internet of Things): The network of interconnected devices equipped with sensors, software, and other technologies that enable them to collect and exchange data over the internet.
* Inventory Management: The process of overseeing and controlling the flow of goods, supplies, and materials within an organization or business, including tracking stock levels, ordering, and storage.
* Data Analytics: The process of analyzing raw data to uncover insights, patterns, and trends that can inform decision-making and drive business improvements.
* User Authentication: The process of verifying the identity of a user accessing a system or application, typically through the use of credentials such as usernames and passwords.

### **Acronyms and Abbreviations**

* LMS: Livestock Management System
* IoT: Internet of Things
* UI: User Interface
* UX: User Experience
* API: Application Programming Interface
* GPS: Global Positioning System
* RFID: Radio Frequency Identification
* QA: Quality Assurance

## Overview (summary of the SRS document)

The SRS document for the Livestock Management System (LMS) serves as a comprehensive guide outlining the requirements, functionalities, and constraints of the system. It begins with an Introduction section, which provides an overview of the document's purpose, scope, definitions, and intended audience.

The Scope section identifies the system to be produced (LMS) and explains its functionalities and limitations in detail. It describes the system's objectives, benefits, and non-functional aspects, such as what the system will and will not do.

The Definitions, Acronyms, and Abbreviations section defines important terms and provides the full meaning of acronyms and abbreviations used in the document. This section ensures clarity and consistency in understanding key concepts and terminology.

# GENERAL DESCRIPTION

## System perspective

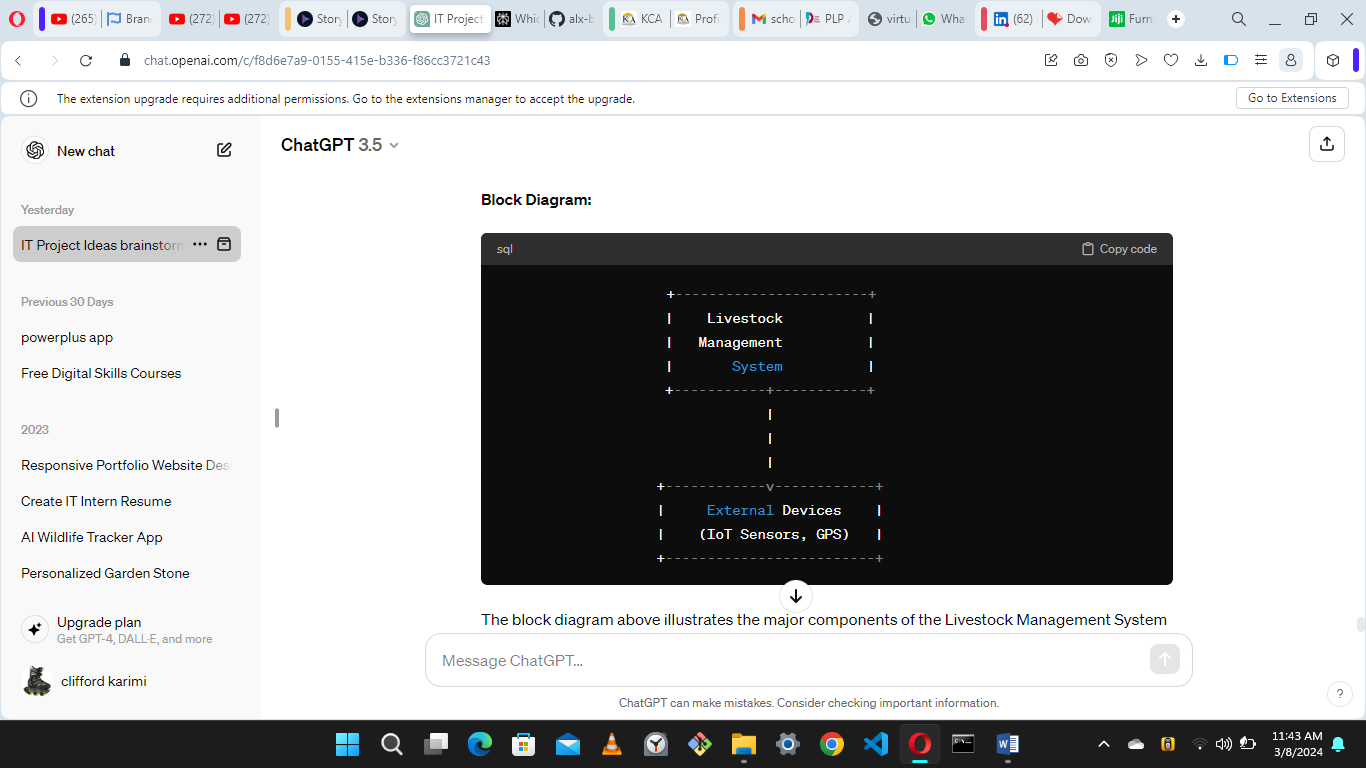
The Livestock Management System (LMS) is a standalone web-based application designed to operate independently as a centralized platform for farmers and livestock managers. The system is self-contained and does not rely on integration with external systems or components for its core functionality.

However, the LMS may interact with external devices, such as IoT sensors or GPS trackers, for data collection and analysis purposes. These external devices serve as inputs to the system, providing real-time data on livestock health, location, and environmental conditions. The LMS processes and analyzes this data within its platform to generate insights and support decision-making by users.

### **External Interfaces and Hardware Overview**

* **Interfaces:** The principal external interfaces of the LMS include communication channels for data exchange with external devices, such as APIs for integrating with IoT sensors and GPS systems. These interfaces enable the system to receive data inputs from external sources and incorporate them into its database for analysis and visualization.
* **Hardware and Peripheral Equipment:** The LMS primarily relies on standard web infrastructure and does not require specialized hardware or peripheral equipment beyond the devices used for accessing the web application (e.g., desktop computers, laptops, tablets, smartphones) and any external sensors or devices employed for data collection.

### **Block Diagram**



## System Functionality

The Livestock Management System (LMS) offers a range of comprehensive functionalities to facilitate efficient and effective management of livestock for farmers and livestock managers. Below is a detailed description of the key functions the system will perform:

### User Registration and Authentication:

1. **Users can register for an account on the LMS by providing basic information such as name, email address, and password.**
2. **Upon registration, users must verify their email address to activate their account.**
3. **The system employs secure authentication mechanisms to ensure only authorized users can access the platform.**

### Livestock Record Management:

1. **Users can add, view, edit, and delete records for individual livestock within the system.**
2. **Each livestock record includes details such as species, breed, age, weight, gender, identification (e.g., ear tag number), and health history.**
3. **Users can upload photos or attach documents (e.g., vaccination records, medical reports) to individual livestock records for reference.**

### Health Monitoring:

1. **The LMS provides tools for real-time monitoring of livestock health indicators, including temperature, heart rate, activity level, and rumination.**
2. **Users can input or import data from external sensors or devices, such as IoT sensors or wearable health monitors, to track and analyze health metrics.**
3. **The system generates alerts and notifications for abnormal health readings, prompting users to take appropriate action (e.g., contacting a veterinarian)**

### Alerts and Notifications:

1. **Users can set up customizable alerts and notifications based on predefined criteria or thresholds for various events, such as illness, injury, or low feed levels.**
2. **Notifications can be delivered via email, SMS, or push notifications within the LMS interface, ensuring timely awareness of critical issues.**

### Inventory Management:

1. **The LMS includes features for tracking and managing inventory related to livestock care, such as feed, medication, supplements, and equipment.**
2. **Users can record inventory transactions (e.g., purchases, usage, and disposal) and track inventory levels in real-time.**
3. **The system provides automated alerts for low inventory levels or expiration dates, enabling proactive management of supplies.**

### Reporting and Analysis:

1. **Users can generate reports and analytics on key performance metrics, such as growth rates, feed consumption, health trends, and productivity.**
2. **The system offers customizable reporting templates and visualization tools to present data in meaningful formats, such as charts, graphs, and tables.**
3. **Reports can be exported or shared with stakeholders for further analysis or decision-making purposes.**

### Communication and Collaboration:

1. **The LMS facilitates communication and collaboration among stakeholders within the livestock industry.**
2. **Users can share information, notes, or observations about individual livestock or general management practices.**
3. **The system supports collaboration features such as commenting, tagging, and task assignment to streamline communication and coordination efforts.**

## User Characteristics

The Livestock Management System (LMS) caters to a diverse range of users, each with specific roles, responsibilities, and requirements within the livestock management process. Understanding the characteristics and requirements of these users is essential for designing a system that meets their needs effectively. Below are the primary user classes and their general characteristics:

### Farmers:

* + **Characteristics:** Farmers are the primary caretakers of livestock on farms or ranches.
  + **General Characteristics:** Farmers may have varying levels of education and experience in agriculture. Some may have grown up on family farms and possess extensive practical knowledge, while others may be newer to the industry and seeking assistance with modern farming techniques.
  + **Technical Expertise:** Farmers may have a range of technical expertise, from basic computer skills to advanced knowledge of agricultural technologies.
  + **User Requirements:** Farmers require user-friendly interfaces and intuitive workflows that simplify the management of livestock and provide actionable insights to optimize farm operations.

### Livestock Managers:

* + **Characteristics:** Livestock managers are professionals specializing in the management and care of livestock.
  + **General Characteristics:** Livestock managers typically have formal education and training in animal husbandry, veterinary science, or agricultural management.
  + **Technical Expertise:** Livestock managers possess a strong understanding of livestock behavior, health, and nutrition, as well as experience with agricultural technologies and management practices.
  + **User Requirements:** Livestock managers require advanced analytics and reporting tools to track key performance metrics, identify trends, and make informed decisions about livestock management strategies.

### Veterinarians:

* + **Characteristics:** Veterinarians are medical professionals specializing in the health and well-being of animals.
  + **General Characteristics:** Veterinarians hold advanced degrees in veterinary medicine and have specialized training in diagnosing and treating animal diseases and injuries.
  + **Technical Expertise:** Veterinarians possess extensive knowledge of animal anatomy, physiology, and pharmacology, as well as experience with diagnostic tools and medical treatments.
  + **User Requirements:** Veterinarians require access to detailed health records and diagnostic data for individual livestock, as well as communication tools to collaborate with farmers and livestock managers on treatment plans and preventive care.

### System Administrators:

* + **Characteristics:** System administrators are responsible for managing and maintaining the LMS platform.
  + **General Characteristics:** System administrators have technical expertise in system administration, database management, and network security.
  + **Technical Expertise:** System administrators possess advanced knowledge of software development, deployment, and maintenance practices, as well as experience with server infrastructure and cloud computing technologies.
  + **User Requirements:** System administrators require robust security features, backup and recovery capabilities, and monitoring tools to ensure the reliability and availability of the LMS platform.

## General Constraints

The Livestock Management System (LMS) must adhere to various constraints related to regulatory policies, hardware limitations, safety, and security considerations to ensure compliance, reliability, and user trust. These constraints play a crucial role in shaping the design, implementation, and operation of the system. Below are the key general constraints:

### Regulatory Policies:

* + **Data Privacy Regulations:** The LMS must comply with data privacy regulations such as the General Data Protection Regulation (GDPR) or local data protection laws. This includes policies governing the collection, storage, processing, and sharing of personal and sensitive data related to livestock and users.
  + **Access Control Policies:** Regulatory policies may require strict access controls to regulate user access and modification of data within the system. Access privileges should be assigned based on user roles and responsibilities to ensure appropriate data handling and confidentiality.

### Hardware Limitations:

* + **Compatibility:** The LMS should be compatible with a range of hardware devices, operating systems, and web browsers to accommodate diverse user environments. Hardware limitations, such as device specifications and processing capabilities, may influence system performance and usability.
  + **Scalability:** Hardware limitations may impose constraints on the scalability of the system, affecting its ability to handle increasing volumes of data or user traffic over time. The system should be designed to scale vertically or horizontally to meet growing demand without sacrificing performance or reliability.

### Safety and Security Considerations:

* + **Data Security:** The LMS must implement robust data security measures to protect against unauthorized access, data breaches, or malicious attacks. This includes encryption, authentication, access controls, and secure communication protocols to safeguard sensitive information stored and transmitted within the system.
  + **User Authentication:** Strong user authentication mechanisms, such as multi-factor authentication (MFA) or biometric authentication, may be required to verify the identity of users accessing the system and prevent unauthorized access.
  + **Backup and Recovery:** Safety considerations include implementing regular data backups and disaster recovery plans to mitigate the risk of data loss or system downtime in the event of hardware failures, natural disasters, or cyber incidents.
  + **Compliance Standards:** The LMS should adhere to industry standards and best practices for information security, such as ISO/IEC 27001, to ensure compliance with regulatory requirements and instill trust among users.

By addressing these general constraints proactively during the design and development phases, the LMS can mitigate risks, enhance system reliability, and build user confidence in the platform's security and compliance posture.

## Assumptions and dependencies

### **Assumptions**

1. **User Familiarity:** It is assumed that users of the Livestock Management System (LMS) have a basic understanding of computer operations and web-based applications. While the system aims to be user-friendly, some level of digital literacy is expected from users to navigate the interface and utilize its functionalities effectively.
2. **Access to Internet Connectivity:** The system assumes that users have access to stable internet connectivity to access the LMS platform from various locations, such as farms, ranches, or agricultural facilities. Limited or unreliable internet access may impact the system's usability and real-time data synchronization capabilities.
3. **Compliance with Regulatory Requirements:** The system assumes that users and administrators will comply with relevant regulatory policies and data protection laws governing the collection, storage, and processing of livestock data. This includes obtaining necessary permissions or consent for data sharing and ensuring the confidentiality and security of sensitive information.
4. **Availability of External Devices:** The system assumes the availability and proper functioning of external devices, such as IoT sensors, GPS trackers, or wearable health monitors, used for data collection and monitoring purposes. Any dependencies on external hardware must be accounted for in system design and implementation.

### **Dependencies**

1. **Data Sources:** The LMS is dependent on external data sources, such as sensor data from IoT devices, weather forecasts, or market data, for real-time monitoring and analysis of livestock health and environmental conditions. Integration with these data sources requires reliable APIs and data pipelines to ensure seamless data ingestion and processing.
2. **Third-Party Services:** The system may rely on third-party services or APIs for functionalities such as geolocation services, payment processing, or communication tools. Dependencies on external services necessitate robust error handling mechanisms and contingency plans in case of service disruptions or outages.
3. **Hardware Infrastructure:** The LMS depends on the availability and performance of hardware infrastructure, including servers, databases, and networking equipment, to support system operations. Scalability and reliability of hardware resources are critical factors in ensuring system performance and availability under varying loads.
4. **User Engagement:** The success of the LMS depends on user engagement and adoption rates within the target user base. User training, support, and feedback mechanisms are essential to promote system usage and address user needs effectively.

By acknowledging these assumptions and dependencies, the LMS project can better anticipate potential challenges, mitigate risks, and develop strategies to ensure the system's successful implementation and adoption within the intended user community.

# SPECIFIC REQUIREMENTS

## **Functional Requirements**

### **Inputs and Outputs**

#### Sources of Inputs:

1. User input: Farmers, livestock managers, and veterinarians input data regarding livestock details, health observations, and inventory management through the system's user interface.
2. External sensors: Data from IoT sensors, GPS trackers, and wearable health monitors provide real-time information on livestock health indicators, environmental conditions, and location.
3. System-generated data: The system may generate data internally based on user interactions, such as system logs, audit trails, and automated alerts.

#### Destination of Outputs:

1. User interface: Processed data is displayed to users through the system's graphical user interface (GUI) for viewing, editing, and analysis.
2. Reports: Generated reports and analytics are presented to users in printable or downloadable formats for offline reference or sharing with stakeholders.

### Quantities, Units of Measure, Ranges:

* Quantities: Inputs may include numerical data such as temperature, weight, age, and inventory quantities.
* Units of Measure: Temperature may be measured in Celsius or Fahrenheit, weight in kilograms or pounds, and age in months or years.
* Ranges of Valid Inputs and Outputs: Valid input ranges for temperature may be -40°C to 50°C, weight 0 kg to 2000 kg, and age 0 years to 20 years.

### Timing

* The time taken to produce a report online depends on factors such as the complexity of data processing, system performance, and user interaction. Simple reports may be generated instantly, while more complex analytics may require several seconds to minutes.

### Processing

#### Validation of Input Data:

* The system should validate input data to ensure accuracy, completeness, and consistency. Validation rules may include data type checks, range checks, and format validation (e.g., date formats).

### Exact Sequence of Operations

1. User Authentication: Users authenticate themselves using credentials (username/password, biometric authentication).
2. Data Input: Users input livestock details, health observations, and inventory updates through the system's forms.
3. Data Processing: The system validates input data, performs calculations (e.g., health metrics), and updates the database accordingly.
4. Report Generation: Users request reports or analytics through the system interface.
5. Report Rendering: The system retrieves relevant data, processes it, and generates formatted reports or visualizations for display.
6. Response to Abnormal Situations: The system displays error messages or alert notifications in case of input validation failures, system errors, or abnormal conditions detected during processing.

### Methods for Transformation

* Equations, algorithms, and business logic are used to transform input data into meaningful outputs. For example, calculating average daily weight gain, determining health status based on vital signs, or predicting feed requirements based on livestock size and activity level.

Incorporating these functional requirements ensures that the Livestock Management System (LMS) effectively processes input data, generates accurate outputs, and responds appropriately to user interactions and system conditions. Additionally, flowchart diagrams can be utilized to visualize the exact sequence of operations and processing logic within the system.

## User Interface Requirements

### User Interface Design:

1. **Forms and Pages:**
   * Registration Form: Collects user information for account creation.
   * Livestock Record Form: Allows users to input details such as species, breed, age, and health observations for individual livestock.
   * Inventory Management Form: Facilitates the tracking and management of inventory items such as feed, medication, and supplies.
   * Dashboard Page: Provides an overview of key metrics and alerts, allowing users to monitor livestock health and performance at a glance.
   * Reports Page: Displays generated reports and analytics on livestock data, allowing users to view and analyze trends over time.
2. **Reports:**
   * Health Status Report: Summarizes health observations and vital signs for individual livestock.
   * Inventory Report: Provides a detailed inventory overview, including current stock levels and usage history.
   * Performance Analytics: Visualizes key performance metrics such as growth rates, feed consumption, and productivity trends.

### Hardware Interfaces:

* The LMS requires standard hardware components such as PCs or mobile devices with sufficient RAM, processor speed, and free disk space to run the web-based application smoothly. Specific hardware requirements may vary based on the scale of operations and user load.

### Software Interfaces:

* Operating System: The system is compatible with modern operating systems such as Windows, macOS, and Linux.
* Web Browser: Users can access the LMS through popular web browsers such as Google Chrome, Mozilla Firefox, and Safari.
* Database Management System (DBMS): The system relies on a robust DBMS (e.g., MySQL, PostgreSQL) to store and manage data efficiently.

### Communications Interfaces:

* Online Communication: The system requires internet connectivity for online communication between users and the LMS platform. This includes data synchronization, real-time updates, and communication features such as messaging or notifications.

### Other Requirements:

* **Frequency of Use:** The system is designed for frequent use by farmers, livestock managers, and veterinarians as part of their daily livestock management activities.
* **Accessing Capabilities:** Users can access the LMS from various devices (e.g., desktops, laptops, tablets, smartphones) with internet connectivity.
* **Static and Dynamic Organization:** The user interface features both static elements (e.g., navigation menus, forms) and dynamic elements (e.g., real-time data updates, interactive charts).
* **Retention Requirements for Data:** The system retains data according to regulatory requirements and user preferences, with options for data archival and deletion.
* **Operations:** The system supports both interactive operations (user-initiated tasks) and unattended operations (automated processes, background tasks). Backup and recovery operations are conducted periodically to ensure data integrity and availability in case of system failures or data loss incidents.

By specifying these user interface requirements, hardware and software interfaces, communication protocols, and other operational considerations, the Livestock Management System (LMS) can deliver a user-friendly and robust platform for efficient livestock management operations.

# APPENDICES