Software Requirements Specification (SRS)

GreenTech Smart Farm System (GTSF)

---

1. Introduction

1.1 Purpose

This Software Requirements Specification (SRS) document describes the functional and non-functional requirements for the development of the **GreenTech Smart Farm System (GTSF)**. The document is intended for developers, system designers, project supervisors, and stakeholders involved in the planning, design, implementation, and evaluation of the system.

1.2 Intended Audience

- Software developers
- System engineers
- Project supervisors/examiners
- Farmers and agricultural stakeholders
- IoT and data analysts

1.3 System Overview

The GreenTech Smart Farm System (GTSF) is a smart farm management solution that integrates **Science, Technology, Engineering, and Mathematics (STEM)** principles to monitor, analyze, and optimize crop growth. The system collects real-time environmental and soil data using sensors, processes the data digitally, and provides actionable insights to farmers through desktop and mobile applications.

1.4 Objectives

- Digitize farm monitoring and irrigation processes
- Improve crop yield and resource efficiency
- Enable data-driven decision-making for farmers
- Provide real-time and remote access to farm conditions

---

2. Scope of the System

The GTSF system will provide the following capabilities: - Monitoring soil moisture levels - Monitoring soil nutrient levels - Monitoring soil salinity and electrical conductivity - Monitoring soil and ambient temperature - Monitoring light intensity - Monitoring water content - Providing irrigation control and automation - Displaying real-time and historical data - Offering AI-based adjustment and farming recommendations

The system will be accessible via **desktop and mobile platforms (Android and iOS)** through a unified user dashboard designed for farmers.

---

3. STEM Integration Statement

3.1 Science

GTSF integrates scientific principles by monitoring factors that affect plant growth, such as: - Soil nutrient levels - Soil salinity - Water content - Temperature - Light intensity

3.2 Technology

The system integrates technology through: - Desktop and mobile applications - Internet connectivity - Cloud and offline databases - Digital dashboards and data visualization

3.3 Engineering

Engineering is applied through: - Sensor networks deployed in gardens - Data acquisition hardware - System architecture ensuring reliability and scalability - Integration between hardware, software, and databases

3.4 Mathematics

Mathematics is applied through: - Processing numeric sensor readings - Generating graphs and trends - Performing calculations for irrigation timing - Supporting AI-based recommendations to improve crop yield

---

4. System Description

4.1 Product Perspective

GTSF is an IoT-based smart farming system consisting of: - Field sensors - Microcontrollers (e.g., ESP32) - Backend services and databases - Desktop and mobile applications

4.2 Product Functions

- Collect environmental and soil data
- Store data locally and/or in the cloud
- Display live sensor readings
- Provide weather and environmental summaries
- Recommend adjustments for optimal growth
- Control irrigation systems remotely

4.3 User Classes and Characteristics

User Type	Description
Farmer	Primary user managing crops and irrigation
Admin	Manages system configurations and maintenance
Technician	Handles sensor and hardware setup

---

5. Functional Requirements

5.1 User Authentication

- The system shall provide a welcome page
- The system shall provide a user authentication page
- The system shall allow secure login and logout

5.2 User Dashboard

- The system shall display a unified user dashboard
- The dashboard shall show real-time sensor data

5.3 Garden Setup

- The system shall allow users to connect hardware components
- The system shall allow users to select crops for monitoring

5.4 Monitoring Features

The system shall support: - Live soil moisture graphs - Soil temperature readings - Salinity readings - Soil nutrient level monitoring - Electrical conductivity monitoring - Light intensity monitoring - Weather data display

5.5 Plant Monitoring

- The system shall track plant growth conditions
- The system shall alert users when conditions are unfavorable

5.6 Irrigation System

- The system shall support manual irrigation control
- The system shall support automated irrigation based on sensor data

5.7 AI-Based Recommendations

- The system shall analyze collected data
- The system shall provide adjustment recommendations

- The system shall suggest actions to improve crop yield

---

6. Non-Functional Requirements

6.1 Performance Requirements

- Real-time data updates
- Minimal latency in sensor communication

6.2 Reliability

- The system shall operate continuously
- Offline data storage shall be supported when internet is unavailable

6.3 Usability

- Simple and intuitive user interface
- Mobile-friendly design

6.4 Security

- Secure user authentication
- Data encryption for sensitive information

6.5 Scalability

- The system shall support multiple gardens
- The system shall support expansion with additional sensors

---

7. Hardware Requirements

- Soil moisture sensors
- Soil temperature sensors
- Soil nutrient sensors
- Salinity and EC sensors
- Light intensity sensors
- Water level sensors
- Microcontroller (e.g., ESP32)
- Internet connectivity modules

---

8. Software Requirements

8.1 Frontend

- Web application (HTML, CSS, JavaScript)
- Mobile application (Android & iOS)

8.2 Backend

- Server-side APIs
- Database (cloud and offline support)

8.3 Data Storage

- Real-time database for sensor data
- Historical data storage for analytics

---

9. Constraints and Assumptions

9.1 Constraints

- Dependence on sensor accuracy
- Internet availability may be limited in rural areas

9.2 Assumptions

- Farmers have access to smartphones or computers
- Sensors are properly installed and calibrated

---

10. Future Enhancements

- Integration with satellite weather data
- Advanced AI crop disease detection
- SMS alerts for non-smartphone users
- Multi-language support

---

11. Conclusion

The GreenTech Smart Farm System (GTSF) aims to modernize farming practices by leveraging IoT, data analytics, and AI. By providing real-time monitoring, intelligent recommendations, and irrigation automation, the system supports sustainable agriculture and improved crop productivity.