SMART FARMING DATABASE MANAGEMENT SYSTEM

A PROJECT REPORT

Submitted by

B R VIMAL AANANTH (2303811714821058)

in partial fulfillment of requirements for the award of the course

CGB1221-DATABASE MANAGEMENT SYSTEMS

in

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai and Approved by AICTE, New Delhi)

SAMAYAPURAM – 621 112

JUNE 2025

K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY (AUTONOMOUS)

SAMAYAPURAM – 621 112

BONAFIDE CERTIFICATE

Certified that this project report on **“SMART FARMING DATABASE MANAGEMENT SYSTEM”** is the bonafide work of **B R VIMAL AANANTH (2303811714821058)** who carried out the project work during the academic year 2024 - 2025 under my supervision.

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Submitted for the viva-voce examination held on 04.06.2025

INTERNAL EXAMINER

EXTERNAL EXAMINER

DECLARATION

I declare that the project report on **“SMART FARMING DATABASE MANAGEMENT SYSTEM”** is the result of original work done by me and best of my knowledge, similar work has not been submitted to **“ANNA UNIVERSITY CHENNAI”** for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfilment of the requirement of the completion of the course **CGB1221 – DATABASE MANAGEMENT SYSTEMS.**

Signature

B R VIMAL AANANTH

Place: Samayapuram

Date: 04-06-2025

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It is with great pride that I express our gratitude and in-debt to our institution "**K.Ramakrishnan College of Technology (Autonomous)**", for providing us with the opportunity to do this project.

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I wish to express our special thanks to the officials and Lab Technicians of our departments who rendered their help during the period of the work progress.

INSTITUTE

Vision:

- To serve the society by offering top-notch technical education on par with global standards.

Mission:

- Be a center of excellence for technical education in emerging technologies by exceeding the needs of industry and society.
- Be an institute with world class research facilities.
- Be an institute nurturing talent and enhancing competency of students to transform them as all – round personalities respecting moral and ethical values.

DEPARTMENT

Vision:

- To become a renowned hub for AIML technologies to producing highly talented globally recognizable technocrats to meet industrial needs and societal expectation.

Mission

- To impart advanced education in AI and Machine Learning, built upon a foundation in Computer Science and Engineering.
- To foster Experiential learning equips students with engineering skills to tackle real-world problems.
- To promote collaborative innovation in AI, machine learning, and related research and development with industries.
- To provide an enjoyable environment for pursuing excellence while upholding strong personal and professional values and ethics.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

- **PEO1:** Excel in technical abilities to build intelligent systems in the fields of AI & ML in order to find new opportunities.
- **PEO2:** Embrace new technology to solve real-world problems, whether alone or as a team, while prioritizing ethics and societal benefits.
- **PEO3:** Accept lifelong learning to expand future opportunities in research and product development.

PROGRAM SPECIFIC OUTCOMES (PSO)

- **PSO1:** Expertise in tailoring ML algorithms and models to excel in designated applications and fields.
- **PSO2:** Ability to conduct research, contributing to machine learning advancements and innovations that tackle emerging societal challenges.

PROGRAM OUTCOMES (POs)

Engineering students will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

ABSTRACT

The Smart Farming Database Management System (SFDMS) is a digital solution designed to modernize traditional agricultural practices through efficient data management. The system enables farmers to store and manage key information related to crops, soil conditions, weather data, and resource usage in a centralized platform. By organizing this data, the system supports better planning, timely interventions, and improved productivity on the farm. Smart Farming Database Management System includes essential modules such as user login, crop tracking, soil and weather monitoring, resource tracking, and alerts. These features help streamline daily operations, reduce manual work, and enable quick responses to abnormal farm conditions. Though the original project is implemented using MySQL and Python (Flask), this report includes a front-end simulation using HTML forms to represent the core functionality for academic purposes. The interface is simple and user-friendly, allowing easy data entry and system interaction. The design also ensures that the system can be adapted for both small-scale farms and larger agricultural enterprises. As farming becomes increasingly dependent on data and technology, systems like Smart Farming Database Management System play a crucial role in supporting digital transformation in agriculture. The project promotes automation, reduces human error, and supports scalability. It can be extended in the future with IoT integration, cloud connectivity, and AI-based analytics to offer predictive insights. Overall, Smart Farming Database Management System provides a foundation for smart agriculture by combining technology with farming to create a more efficient and sustainable system.

ABSTRACT WITH POs AND PSOs MAPPING

CO 5 : BUILD DATABASES FOR SOLVING REAL-TIME PROBLEMS.

ABSTRACT	POs MAPPED	PSOs MAPPED
The proposed project, Smart Farming Database Management System, is a web-based solution developed to address the challenges of managing agricultural operations efficiently. It leverages browser-based technologies and IndexedDB to build a real-time, client-side database system that records, tracks, and analyzes data related to farms, fields, sensors, irrigation, and harvests. The system enables farmers and agricultural personnel to make data-driven decisions without relying on traditional, manual record-keeping methods. By integrating modules for data input, live sensor monitoring, and analytics, the system offers real-time insights into crop health, water usage, and yield performance. Its structured data handling, automated updates, and accessible interface exemplify how database systems can be used to solve practical, real-world problems. The project fully supports the course outcome CO5, demonstrating the ability to design and implement databases tailored for real-time, domain-specific needs. It also reflects core program outcomes such as modern tool usage, system design, and the application of engineering knowledge in practice.	**PO1 -3** **PO2 -3** **PO3 -3** **PO4 -3** **PO5 -3** **PO6 -3** **PO7 -3** **PO8 -3** **PO9 -3** **PO10 -3** **PO11-3** **PO12 -3**	**PSO1 -3** **PSO2 -3** **PSO3 -3**

Note: 1- Low, 2-Medium, 3- High

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INTRODUCTION

1 INTRODUCTION

Smart farming is an innovative approach that incorporates digital technologies into agriculture to enhance productivity, sustainability, and efficiency. It enables farmers to make data-driven decisions by analyzing environmental conditions, resource usage, and crop performance. The Smart Farming Database Management System (SFDMS) is designed to manage all aspects of farm data digitally. It allows users to store and retrieve information about crops, soil health, weather conditions, and resource tracking. By integrating real-time monitoring and automated alert mechanisms, this system helps in timely interventions, improving crop yield and reducing wastage. Through the systematic collection and analysis of farm data, SFDMS empowers farmers with insights that promote better farming practices and long-term sustainability.

1.1 OBJECTIVE

The primary objective of the Smart Farming Database Management System is to develop a comprehensive platform that supports modern agricultural needs. It is built to simplify the management of various agricultural activities through a centralized database. The system ensures accurate recording of crop details, soil quality, environmental parameters, and resource utilization. By offering easy access to this data, it helps farmers and administrators monitor performance, make informed decisions, and respond promptly to any irregularities. Ultimately, the goal is to automate routine processes and offer a smarter way to manage farming activities using database technology.

1.2 OVERVIEW

The SFDMS offers a user-friendly interface and is structured around essential farming modules such as user management, crop monitoring, soil and weather tracking, and resource management. Users can log in to the system, input and view data relevant to their farms, and generate reports based on real-time or historical information. The system is designed to support both administrators and farmers, each with specific roles and access privileges. It integrates form-based data entry for manual input and is adaptable for sensor-based IoT integration. With a well-structured database backend, the platform ensures data consistency and integrity while supporting meaningful analysis and visualization.

1.3 SQL AND DATABASE CONCEPTS

The project is fundamentally based on core SQL and database management concepts. It uses a relational database model to define the structure of data through well-organized tables, employing primary and foreign keys to maintain referential integrity. SQL commands are utilized for creating, reading, updating, and deleting data (CRUD operations). Normalization techniques are applied to eliminate data redundancy and ensure efficient storage. The database design supports relationships among various entities like users, farms, crops, resources, and alerts. Advanced features such as JOIN queries, constraints, and indexing are also considered to enhance performance and scalability. Overall, the application of these concepts provides a reliable backbone for data processing within the Smart Farming Database Management System.

CHAPTER 2

PROJECT METHODOLOGY

2.1 PROPOSED WORK

The proposed system is a web-based application that provides a simulation of a smart farming environment through HTML forms and static data representation. It replaces traditional manual logs with structured digital records. The user interface is designed using HTML and CSS to simulate interactions such as entering crop information, tracking resources, and submitting environmental data. Although the original implementation connects to a backend using Python and MySQL, the current version uses HTML as a front-facing mock up for presentation and educational purposes. The modular structure allows each function to be managed independently, facilitating scalability and future integration with databases or IoT components.

2.2 BLOCK DIAGRAM

The system begins with a user interacting with a browser-based interface. The interface includes structured forms for different modules such as crop management and sensor data input. Submitted data can be processed or displayed within the system to simulate results, such as crop listings or alert messages. While this version does not process data dynamically, it is designed to demonstrate how real-time interaction would occur with a database-backed engine in a full-stack application.

BLOCK DIAGRAM

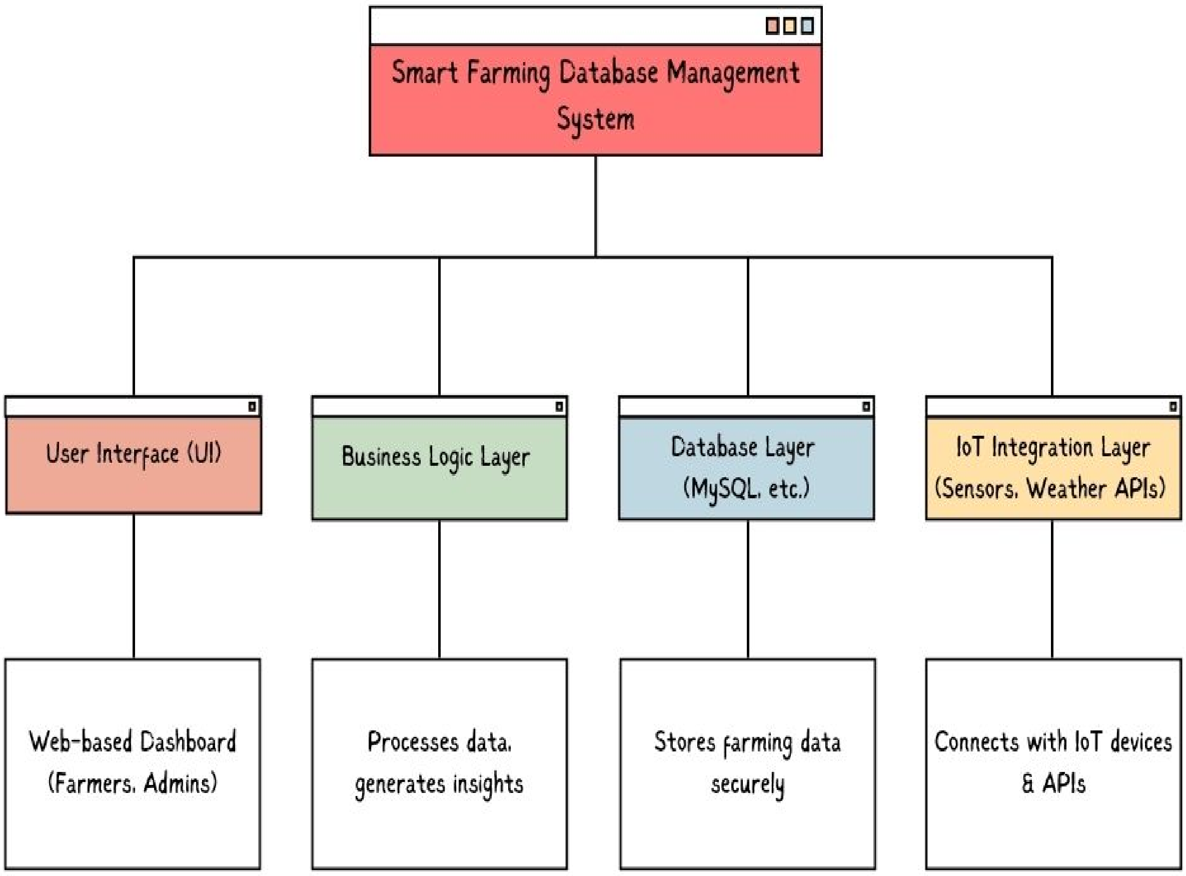

Figure no. : 2.2.1 – Block Diagram For Smart Farming Database Management System

CHAPTER 3

MODULE DESCRIPTION

The Smart Farming Database Management System (SFDMS) is composed of several interconnected modules that work collaboratively to facilitate digital farm management. Each module is responsible for handling specific tasks, ranging from user access control to real-time environmental monitoring. These modules are described in detail below:

3.1. USER MANAGEMENT MODULE

This module is responsible for managing the authentication and access control of users interacting with the system. It supports user registration, login, and role-based permissions. Users can be categorized into two main roles: farmers and administrators. The administrator has access to all system functionalities, including managing users and generating reports, while the farmer can input and monitor farm data. This module ensures security and privacy by validating credentials and limiting access to authorized users only.

3.2. CROP MANAGEMENT MODULE

The crop management module enables users to record and maintain details about crops grown on the farm. It allows farmers to enter information such as crop name, type, planting date, and expected harvest date. This module provides a centralized space to track the status of crops, analyze planting patterns, and prepare for harvesting schedules. It also supports data updates, so farmers can revise entries as needed during the crop lifecycle.

3.3. SOIL AND WEATHER MONITORING MODULE

This module simulates the integration of environmental sensors and APIs that collect and store real-time data about the soil and weather conditions. It records soil pH, moisture content, temperature, and humidity levels. In advanced setups, this module can be connected to IoT sensors to automate the data input process. The collected data helps farmers understand the current condition of their land and take appropriate actions such as irrigation or fertilization.

3.4. RESOURCE TRACKING MODULE

Efficient resource management is critical for sustainable farming, and this module plays a key role in tracking the usage and availability of essential resources. It allows users to input data on water usage, fertilizers, and pesticides applied to specific crops or fields. By maintaining a digital log of resource consumption, this module helps reduce waste, monitor costs, and ensure the right quantity of inputs is used at the right time.

3.5. ALERTS AND NOTIFICATION MODULE

This module generates alerts when certain thresholds or critical conditions are met. For example, if soil moisture drops below a safe level or if an input is overused, the system notifies the user to take immediate action. These alerts can be based on sensor readings or data entered manually. This feature enhances farm responsiveness and helps in preventing crop damage or resource wastage by facilitating timely interventions.

3.6. DATA ANALYTICS AND REPORTING MODULE

This module compiles and processes the data collected from various other modules to generate meaningful insights and reports. These reports include summaries of crop performance, environmental conditions, and resource usage.

The analytics can also show patterns over time, enabling users to make strategic decisions. For administrators, this module helps evaluate system usage and farm efficiency, while for farmers, it provides valuable feedback on operations.

3.7. IOT INTEGRATION MODULE

Though simulated in this version, this module is designed to support real-time data collection from IoT devices like soil sensors, temperature gauges, and weather monitoring tools. It serves as the bridge between physical farm environments and the digital database system. The IoT integration ensures that data is logged automatically, reducing manual work and increasing accuracy. In the future, it can also support APIs for weather forecasts and AI tools for predictive insights.

CHAPTER 4

CONCLUSION & FUTURE SCOPE

The Smart Farming Database Management System (SFDMS) presents a practical and scalable approach to modernizing agriculture through digital transformation. By integrating structured data management with essential farming operations, the system helps reduce manual effort and improves accuracy in recording and monitoring vital farm information. With modules for user management, crop tracking, soil and weather monitoring, and resource logging, Smart Farming Database Management System ensures that farmers have quick access to real-time and historical data, enabling smarter decisions and better crop outcomes. Although the current implementation uses HTML to simulate the interface, the project effectively demonstrates the core design of a functioning database management system for agriculture. The project has proven how a systematic, modular approach can improve farm efficiency and transparency even in small-scale setups. It also serves as a foundation for incorporating more advanced features like IoT, AI, and cloud computing. With continuous development, Smart Farming Database Management System can evolve into a complete smart farming platform that bridges traditional agriculture with the power of modern technology.

FUTURE SCOPE

- **IoT Device Integration**: Connect real-time sensors for automated data collection from the farm (e.g., soil moisture, temperature).
- **Mobile Application Support**: Develop an Android/iOS app to allow farmers to access the system on-the-go.

- **Cloud-Based Storage**: Enable remote data access and backups using cloud platforms like AWS or Firebase.
- **AI-Based Crop Prediction**: Use machine learning models to predict yields, detect diseases, or suggest optimal planting times.
- **Voice Command Features**: Add support for voice input to assist users with limited literacy or accessibility needs.
- **GIS Mapping**: Visualize farm data using geographic maps for improved land and resource management.
- **Multilingual Interface**: Provide system support in regional languages to improve accessibility for rural users.
- **Automated Alerts via SMS/Email**: Notify users of abnormal conditions or reminders using messaging services.

CHAPTER 5

APPENDIX A - SOURCE CODE

INDEX.HTML

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Smart Farming DBMS</title>
  <link rel="stylesheet" href="styles.css">
</head>
<body>
  <div class="container">
    <h1>Smart Farming Dashboard</h1>
    <div class="tab">
      <button onclick="openTab(event, 'Farms')">Farms</button>
      <button onclick="openTab(event, 'Fields')">Fields</button>
      <button onclick="openTab(event, 'Sensors')">Sensors</button>
      <button onclick="openTab(event, 'Irrigation')">Irrigation</button>
      <button onclick="openTab(event, 'Harvest')">Harvest</button>
      <button onclick="openTab(event, 'Analytics')">Analytics</button>
    </div>
    <div id="Farms" class="tabcontent">
      <h2>Add Farm</h2>
      <input id="farmName" placeholder="Farm Name">
      <input id="farmLocation" placeholder="Location">
      <input id="farmArea" type="number" placeholder="Area (acres)">
      <input id="farmSoil" placeholder="Soil Type">
      <button onclick="addFarm()">Add Farm</button>
```

```html
    <div id="farmList"></div>
  </div>
    <div id="Fields" class="tabcontent">
      <h2>Add Field</h2>
      <select id="fieldFarm"></select>
      <input id="fieldName" placeholder="Field Name">
      <input id="fieldCrop" placeholder="Crop Type">
      <button onclick="addField()">Add Field</button>
      <div id="fieldList"></div>
    </div>
     <div id="Sensors" class="tabcontent">
      <h2>Install Sensor</h2>
      <select id="sensorField"></select>
      <select id="sensorType">
        <option value="moisture">Soil Moisture</option>
        <option value="temp">Temperature</option>
      </select>
      <input id="sensorBrand" placeholder="Brand">
      <button onclick="installSensor()">Install</button>
      <div id="sensorList"></div>
    </div>
    <div id="Irrigation" class="tabcontent">
      <h2>Irrigation Log</h2>
      <select id="irrigationField"></select>
      <input id="irrigationLiters" type="number" placeholder="Liters Used">
      <button onclick="logIrrigation()">Log</button>
      <div id="irrigationList"></div>
    </div>
    <div id="Harvest" class="tabcontent">
```

```
      <h2>Record Harvest</h2>
      <select id="harvestField"></select>
      <input id="harvestAmount" type="number" placeholder="Yield">
      <input id="harvestUnit" placeholder="Unit">
      <button onclick="recordHarvest()">Record</button>
      <div id="harvestList"></div>
    </div>
   <div id="Analytics" class="tabcontent">
      <h2>Field Health Report</h2>
      <select id="analyticsField"></select>
      <button onclick="generateAnalytics()">Analyze</button>
      <div id="analyticsOutput"></div>
    </div>
  </div>
  <script src="script.js"></script>
</body>
</html>
```

STYLES.CSS

```
body {
  font-family: Arial;
  background: #f0f0f0;
  padding: 20px;
}
.container {
  background: #fff;
  padding: 20px;
  border-radius: 8px;
}
.tab button {
```

```css
  padding: 10px;
  background: #3498db;
  color: white;
  border: none;
  margin-right: 5px;
  cursor: pointer;
}
.tabcontent {
  display: none;
  margin-top: 20px;
}
input, select {
  margin: 5px 0;
  padding: 8px;
  width: 100%;
  box-sizing: border-box;
}
button {
  margin-top: 10px;
}
```

SCRIPT.JS

```javascript
let db;
const openDB = indexedDB.open("FarmDB", 1);
openDB.onupgradeneeded = (e) => {
  db = e.target.result;
  db.createObjectStore("farms", { keyPath: "id", autoIncrement: true });
  db.createObjectStore("fields", { keyPath: "id", autoIncrement: true });
  db.createObjectStore("sensors", { keyPath: "id", autoIncrement: true });
  db.createObjectStore("irrigations", { keyPath: "id", autoIncrement: true });
```

```
  db.createObjectStore("harvests", { keyPath: "id", autoIncrement: true });
};

openDB.onsuccess = (e) => {
  db = e.target.result;
  loadFarms();
};
function addFarm() {
  const tx = db.transaction("farms", "readwrite");
  const store = tx.objectStore("farms");
  store.add({
    name: farmName.value,
    location: farmLocation.value,
    area: farmArea.value,
    soil: farmSoil.value
  });
  tx.oncomplete = loadFarms;
}
function loadFarms() {
  const tx = db.transaction("farms", "readonly");
  const store = tx.objectStore("farms");
  const req = store.getAll();
  req.onsuccess = () => {
    farmList.innerHTML = req.result.map(f => `<p>${f.name} - ${f.area} acres</p>`).join("");
    fieldFarm.innerHTML = req.result.map(f => `<option value="${f.id}">${f.name}</option>`).join("");
  };
}
function addField() {
  const tx = db.transaction("fields", "readwrite");
```

```
  const store = tx.objectStore("fields");
  store.add({
    farmId: fieldFarm.value,
    name: fieldName.value,
    crop: fieldCrop.value
  });
  tx.oncomplete = loadFields;
}
function loadFields() {
  const tx = db.transaction("fields", "readonly");
  const store = tx.objectStore("fields");
  const req = store.getAll();
  req.onsuccess = () => {
    fieldList.innerHTML = req.result.map(f => `<p>${f.name} - ${f.crop}</p>`).join("");
    sensorField.innerHTML = irrigationField.innerHTML = harvestField.innerHTML =
analyticsField.innerHTML =
      req.result.map(f => `<option value="${f.id}">${f.name}</option>`).join("");
  };
}
function installSensor() {
  const tx = db.transaction("sensors", "readwrite");
  const store = tx.objectStore("sensors");
  store.add({
    fieldId: sensorField.value,
    type: sensorType.value,
    brand: sensorBrand.value
  });
  tx.oncomplete = loadSensors;
}
function loadSensors() {
```

```
  const tx = db.transaction("sensors", "readonly");
  const store = tx.objectStore("sensors");
  store.getAll().onsuccess = (e) => {
    sensorList.innerHTML = e.target.result.map(s => `<p>${s.type} - ${s.brand}</p>`).join("");
  };
}
function logIrrigation() {
  const tx = db.transaction("irrigations", "readwrite");
  const store = tx.objectStore("irrigations");
  store.add({
    fieldId: irrigationField.value,
    liters: irrigationLiters.value
  });
  tx.oncomplete = loadIrrigation;
}
function loadIrrigation() {
  const tx = db.transaction("irrigations", "readonly");
  const store = tx.objectStore("irrigations");
  store.getAll().onsuccess = (e) => {
    irrigationList.innerHTML = e.target.result.map(i => `<p>Field ${i.fieldId} - ${i.liters} L</p>`).join("");
  };
}
function recordHarvest() {
  const tx = db.transaction("harvests", "readwrite");
  const store = tx.objectStore("harvests");
  store.add({
    fieldId: harvestField.value,
    yield: harvestAmount.value,
    unit: harvestUnit.value
```

```
  });
  tx.oncomplete = loadHarvests;
}
function loadHarvests() {
  const tx = db.transaction("harvests", "readonly");
  const store = tx.objectStore("harvests");
  store.getAll().onsuccess = (e) => {
    harvestList.innerHTML = e.target.result.map(h => `<p>${h.yield} ${h.unit}</p>`).join("");
  };
}
function generateAnalytics() {
  analyticsOutput.innerHTML = `<p>Field ${analyticsField.value} health analysis: Coming Soon...</p>`;
}
function openTab(evt, tabId) {
  document.querySelectorAll('.tabcontent').forEach(t => t.style.display = 'none');
  document.getElementById(tabId).style.display = 'block';
}
```

APPENDIX B – SCREENSHOTS

INTERACTIVE DASHBOARD

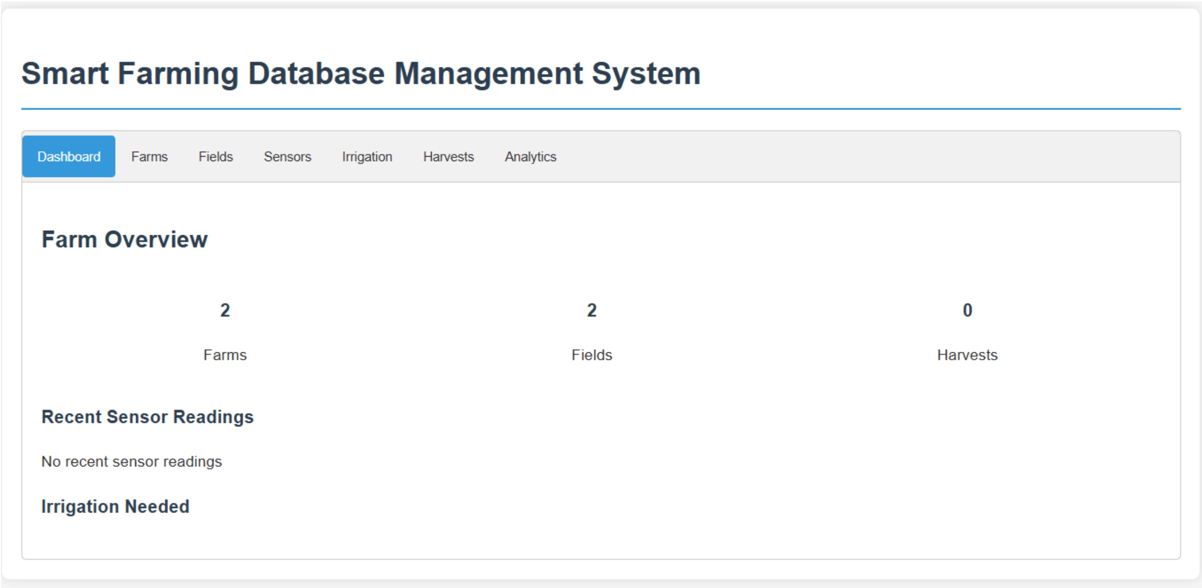

Figure no. : B.1 – Interactive Dashboard

FARM MANAGEMENT

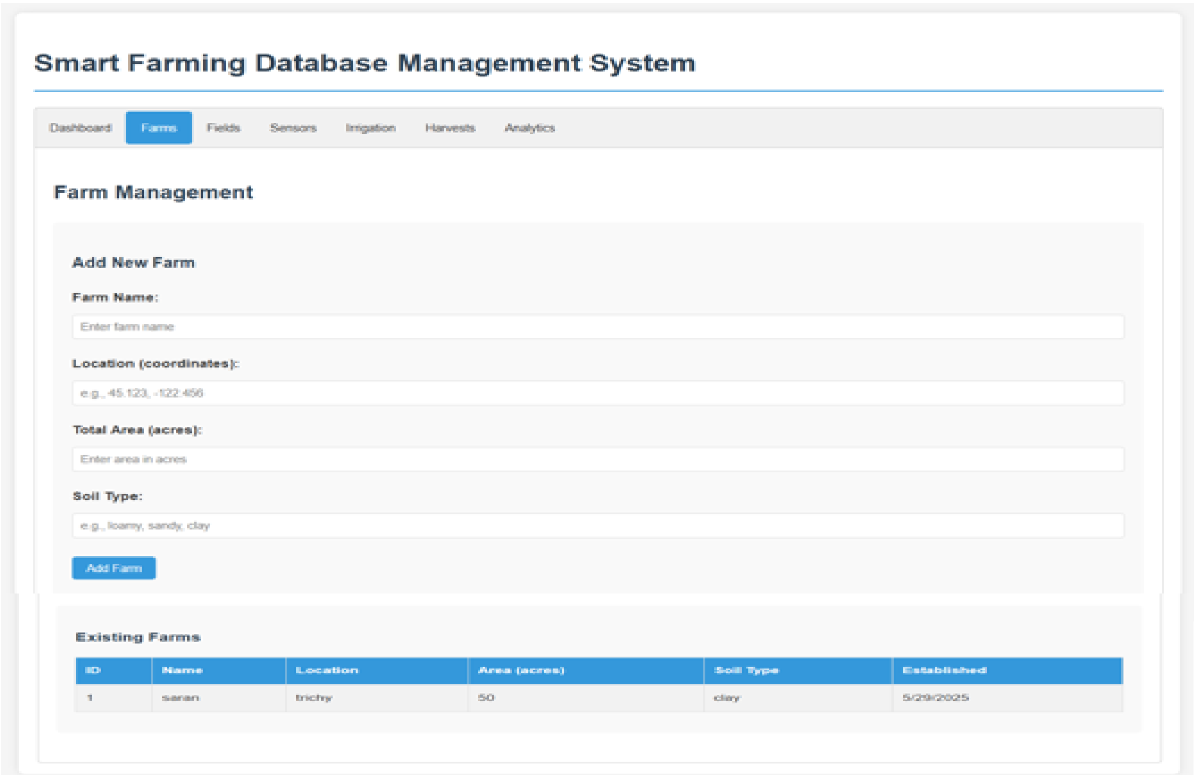

Figure no. : B.2 – Farm Management

SENSOR READINGS

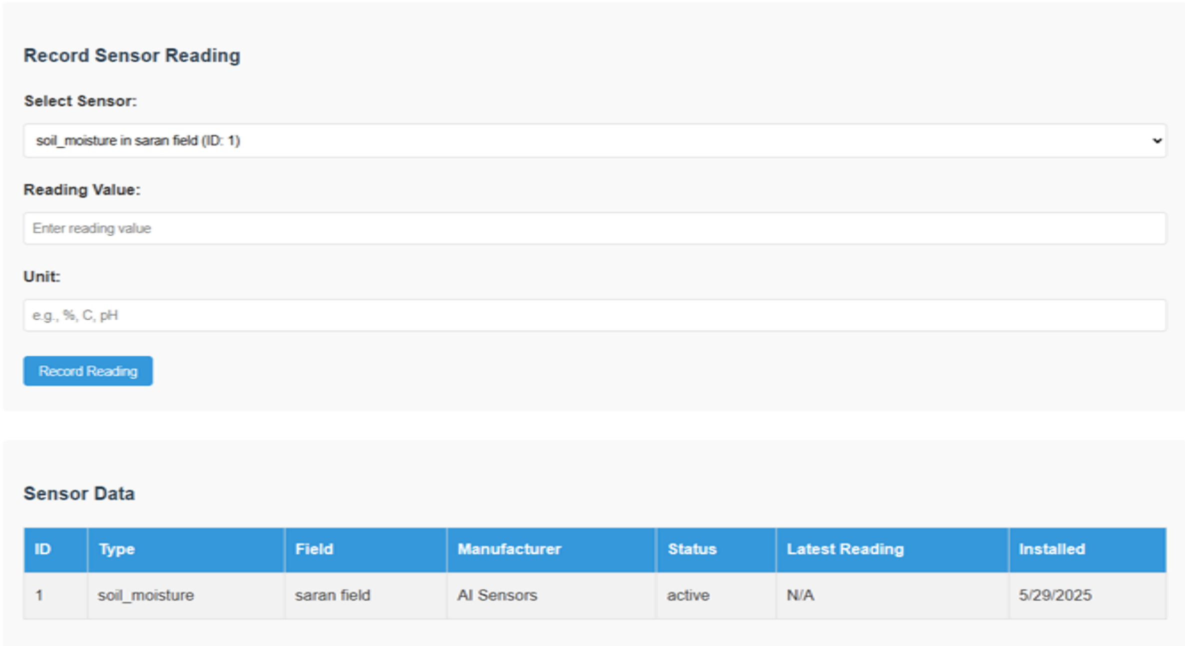

Figure no. : B.3 – Sensor Readings

FARM ANALYTICS

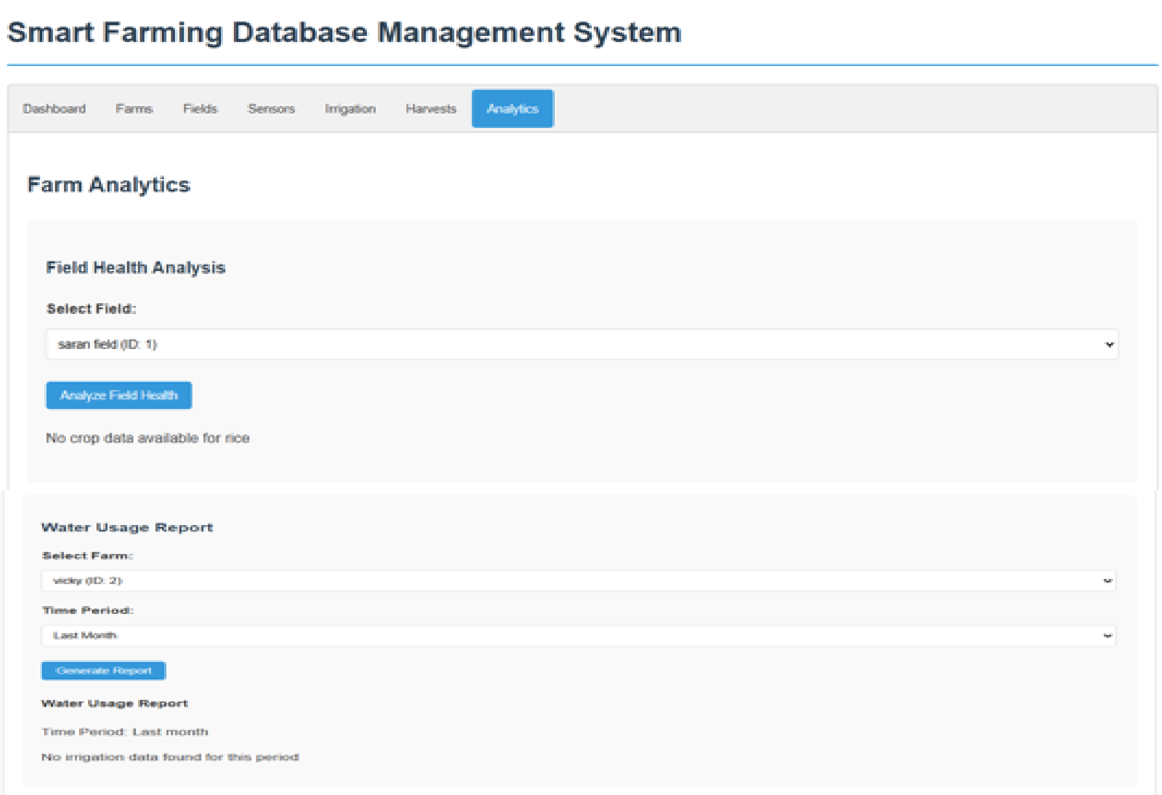

Figure no. : B.4 – Farm Analytics

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This version strikes a balance between sources while offering enough depth for reference.