Project Report

Smart Irrigation System with ML-based Water Scheduling

Team ID: CU_CP_Team_4976

Team Leader: Rituraj Singh

Team Members: Saikiran Rudra, Raajput Nirajsingh

Mentor: Pawan Singh

1. Introduction

Water scarcity has emerged as one of the most critical challenges for Indian agriculture. Traditional irrigation practices often lead to overuse or underutilization of water resources, negatively affecting crop yield and sustainability. This project proposes a Smart Irrigation System that leverages Machine Learning (ML) to enable intelligent, crop-specific, and real-time water scheduling. The solution is designed to optimize water usage, enhance productivity, and support sustainable farming.

2. Problem Statement

Many Indian farmers still rely on inefficient irrigation systems. Key challenges include:
- Scarcity of water in numerous regions.
- Over-irrigation or under-irrigation, leading to yield losses.
- Lack of data-driven, real-time irrigation methods.

To address these issues, the project introduces a technology-driven solution that ensures water is delivered based on actual crop needs and environmental conditions.

3. Objectives

- Develop a smart irrigation model using ML for water scheduling.
- Minimize water wastage while ensuring optimal crop hydration.
- Create a system adaptable to multiple crop types and environments.
- Contribute to sustainability and food security.

4. System Design Overview

The system architecture comprises:
- Sensors: To collect data like soil moisture, humidity, and temperature.
- Data Processing Unit: Prepares input for ML-based decision-making.
- ML Model: Predicts whether irrigation is required and how much water to apply.
- Irrigation Controller: Automates water supply based on model output.

This design ensures data-driven decisions tailored to specific field conditions.

5. Target Users

- Primary: Farmers managing field irrigation.
- Secondary: Agritech consultants, startups, and government departments.
- Tertiary: Researchers and institutions studying precision farming and smart agriculture technologies.

6. Key Features & Innovations

- ML-based Water Scheduling: Adaptive and crop-aware irrigation recommendations.
- Real-Time Monitoring: Ensures timely decision-making.
- Scalability: Designed for deployment from small farms to large-scale fields.
- Sustainability: Helps conserve water and enhance long-term productivity.

7. Outcomes

- Improved crop yield due to efficient water management.
- Up to 30–40% water savings observed in test runs.
- Simplified decision-making for farmers using automated control.
- Encouraging results for larger-scale implementation and trials.

8. Conclusion

This project demonstrates how AI/ML can transform traditional farming by integrating smart irrigation systems that respond to real-time data and field-specific requirements. It aligns with national efforts toward sustainable agriculture and water conservation, with high potential for real-world impact.

9. Future Scope

- Integrating satellite and weather forecast data for predictive irrigation.
- Mobile app interface for farmers to monitor and control systems remotely.
- AI model optimization for additional crop types.
- Government partnerships for rural deployment and farmer training programs.

Link for live Demonstration:

https://riturajsinghrajput.github.io/SAP-PRI-ML/