TEAM INTRODUCTION

Present event name, context, and introduce the team representing the project.

Event: TechnoCognition’25
Project: *IoT based Smart Farming System*
Context:
An IoT-based solution using ESP32,ESP32 CAM, DHT22, soil moisture sensor, and relay-controlled pump to enable real-time monitoring, automated irrigation, and sustainable farming through an MQTT dashboard.
Team Members:
Varshini V V
Thejassvinee Nachiappan
Srushti S Patil
B.M.S. College of Engineering (BMSCE)
3rd Year B.E – Electronics and Communication Engineering

DAYANANDA SAGAR UNIVERSITY

PROBLEM STATEMENT

Clearly define the central challenge or issue being addressed on a global or societal level.

- **Agriculture faces challenges like water scarcity, climate variations, and inefficient resource use.**
- **Manual observation and fixed irrigation lead to over/under-watering and reduced yield.**
- **Farmers lack real-time insights for timely, data-driven decisions.**
- **Need for an intelligent, low-cost system to monitor conditions, automate irrigation, and enable remote access.**

DAYANANDA SAGAR UNIVERSITY

SOLUTION OVERVIEW

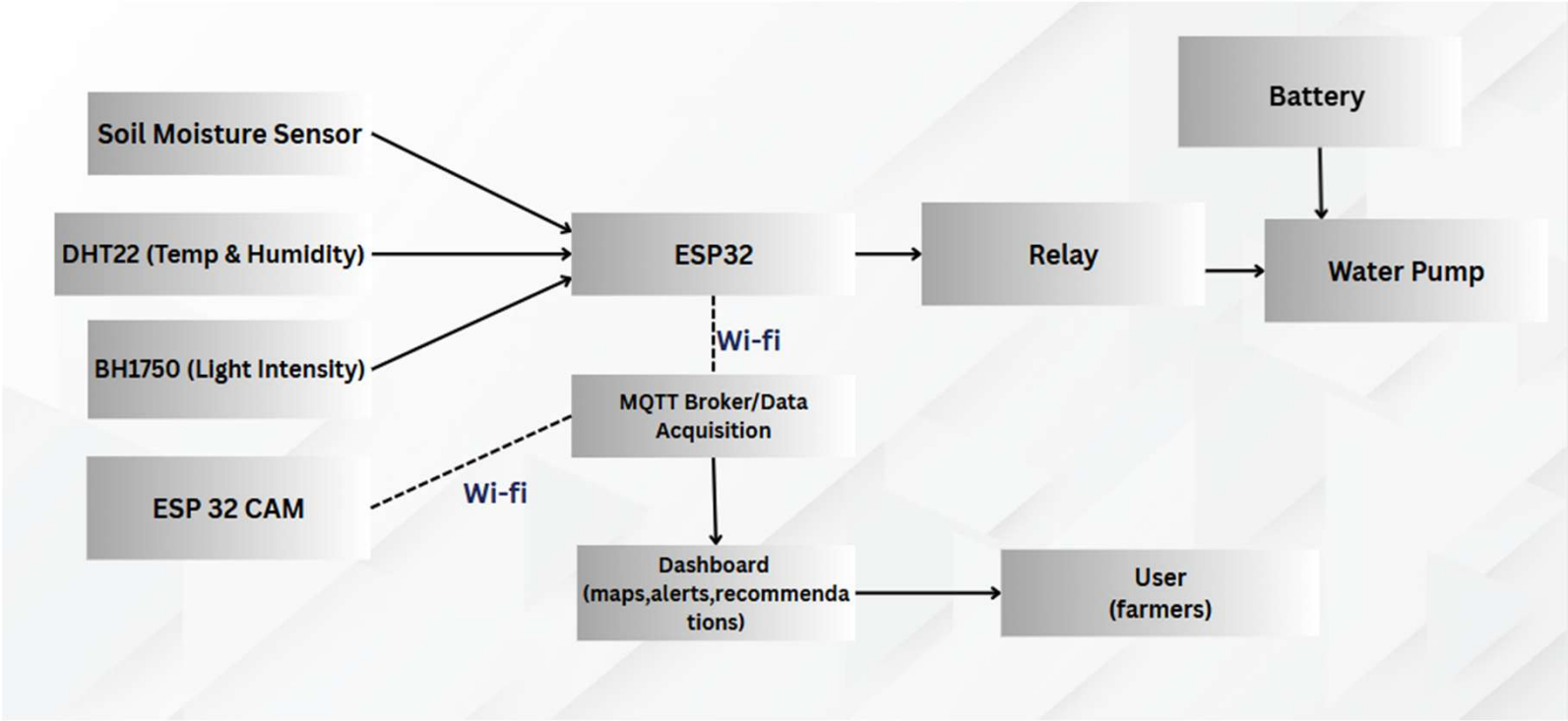
Summarize the innovative approach or prototype being proposed to tackle the identified problem.

- **IoT-based Precision Farming system to overcome the limitations of traditional farming.**
- **Integration of multiple sensors with a microcontroller (ESP32) for smart monitoring and automated irrigation.**
- **Continuous measurement of key environmental parameters:**
  Soil moisture
  Temperature
  Humidity
  Light intensity
- **Relay-operated water pump controlled automatically based on soil moisture data.**
- **Smart alerts and weather forecast integration for better irrigation planning.**
- **Crop-specific water requirement settings for optimized farming.**
- **Wireless data transmission using protocols like MQTT to an IoT platform.**
- **Real-time visualization of sensor data through dashboards and mobile applications.**
- **Remote farmer access & alert system for efficient decision-making and farm management.**

DAYANANDA SAGAR UNIVERSITY

IMPLEMENTATION/PROTOTYPE

Showcase the technical realization and functioning of the solution through key demonstrations.



DAYANANDA SAGAR UNIVERSITY

TECHNOLOGY STACK

Present tools, frameworks, architecture, hardware/software components, and data flow.

Tools, Architecture & Components

Tools & Frameworks: Arduino IDE, MQTT broker, Wi-Fi, IoT Dashboard

Hardware: ESP32 (Wi-Fi MCU),ESP32 CAM, DHT22 (temp & humidity), Soil Moisture Sensor, Relay Module, Water Pump, 9V Battery

Software: WiFi.h, PubSubClient.h, DHT.h libraries for connectivity, MQTT communication, and data sensing

Architecture & Data Flow:

- Sensors measure soil moisture, temperature, and humidity.
- ESP32 processes data and controls the pump via relay.
- Data is sent wirelessly to MQTT broker.
- Dashboard displays live readings and allows remote pump control.

Outcome: Real-time monitoring, smart irrigation automation, and scalable IoT design.

DAYANANDA SAGAR UNIVERSITY

IMPACT & SCALABILITY

Highlight the potential benefits, measurable outcomes, and how the solution can scale globally.

- **Smart Automation:** Controls water pump automatically based on soil moisture.
- **Real-Time Monitoring:** Tracks temperature, humidity, and soil data via MQTT dashboard.
- **Efficiency**: Saves up to 40% water and reduces manual effort.
- **Remote Access:** Monitor and control the system wirelessly from anywhere.
- **Scalable Design**: Low-cost ESP32 setup can be expanded for farms, gardens, or smart cities.
- **Sustainability:** Promotes efficient resource use and eco-friendly practices.

DAYANANDA SAGAR UNIVERSITY

RESULTS/FUTURE SCOPE

Outline future steps, support needed, and conclude with acknowledgements and a call-to-action.

Future Steps:

- Add more sensors (pH, rainfall, light intensity) for advanced analysis.
- Integrate AI/ML for predictive irrigation and data analytics.
- Develop a mobile app for live monitoring and control.
- Enable solar-powered and battery backup operation.

Support Needed:

- Guidance on cloud integration and data visualization.
- Access to advanced sensors and testing environments.
- Collaboration with agricultural or environmental experts.

Conclusion & Call-to-Action:

- Our IoT-based system demonstrates **smart, automated, and sustainable irrigation** using ESP32 and sensors.
- With further development, it can **revolutionize resource management** and **support global sustainability goals**.
- *Let's innovate today for a smarter, greener tomorrow!*

DAYANANDA SAGAR UNIVERSITY

Large-Scale Farm Implementation Using LoRa

This work demonstrates how the proposed system can be scaled and deployed as a real-time smart farming solution for large agricultural fields using LoRa-based sensor networks.

Smart farming over multiple acres requires a communication system that can operate reliably across long distances, where Wi-Fi or Bluetooth fail. LoRa provides a low-power, long-range solution ideal for distributed soil, humidity, and temperature sensors. A LoRa-based system uses multiple sensor nodes placed across the farm, each transmitting data to a central gateway that relays information to the cloud or Node-RED dashboard via MQTT. This allows real-time monitoring and automated irrigation decisions even in remote rural areas.

Key Points:

- LoRa range: **5–15 km**, ideal for farms over acres.
- Node design: ESP32/Arduino + SX1278, soil/moisture sensors, solar-powered, sleep mode for long battery life.
- Architecture: Nodes → LoRa Gateway → Cloud/MQTT → Node-RED.
- Coverage: 1 node per **1–3 acres**, gateway installed at **8–12 m** height

DAYANANDA SAGAR UNIVERSITY

Deployment, Impact & Real-Time Large Farm Application

This work demonstrates how the proposed system can be scaled and deployed as a real-time smart farming solution for large agricultural fields using LoRa-based sensor networks.

For large fields, the farm is divided into monitoring zones, with each zone containing one or more LoRa nodes depending on crop density and irrigation layout. A single high-mounted LoRa gateway can cover the entire land if placed strategically to maintain line-of-sight.

Key Points:

- Place **1 node per 1–3 acres** for accurate coverage.
- Install gateway at **8–12 meters** height for best range.
- Ensure no major obstacles (trees, metal structures) block LoRa signals.
- Use multiple gateways for very large or hilly terrains.

DAYANANDA SAGAR UNIVERSITY

Cost-Effective Farming Solution

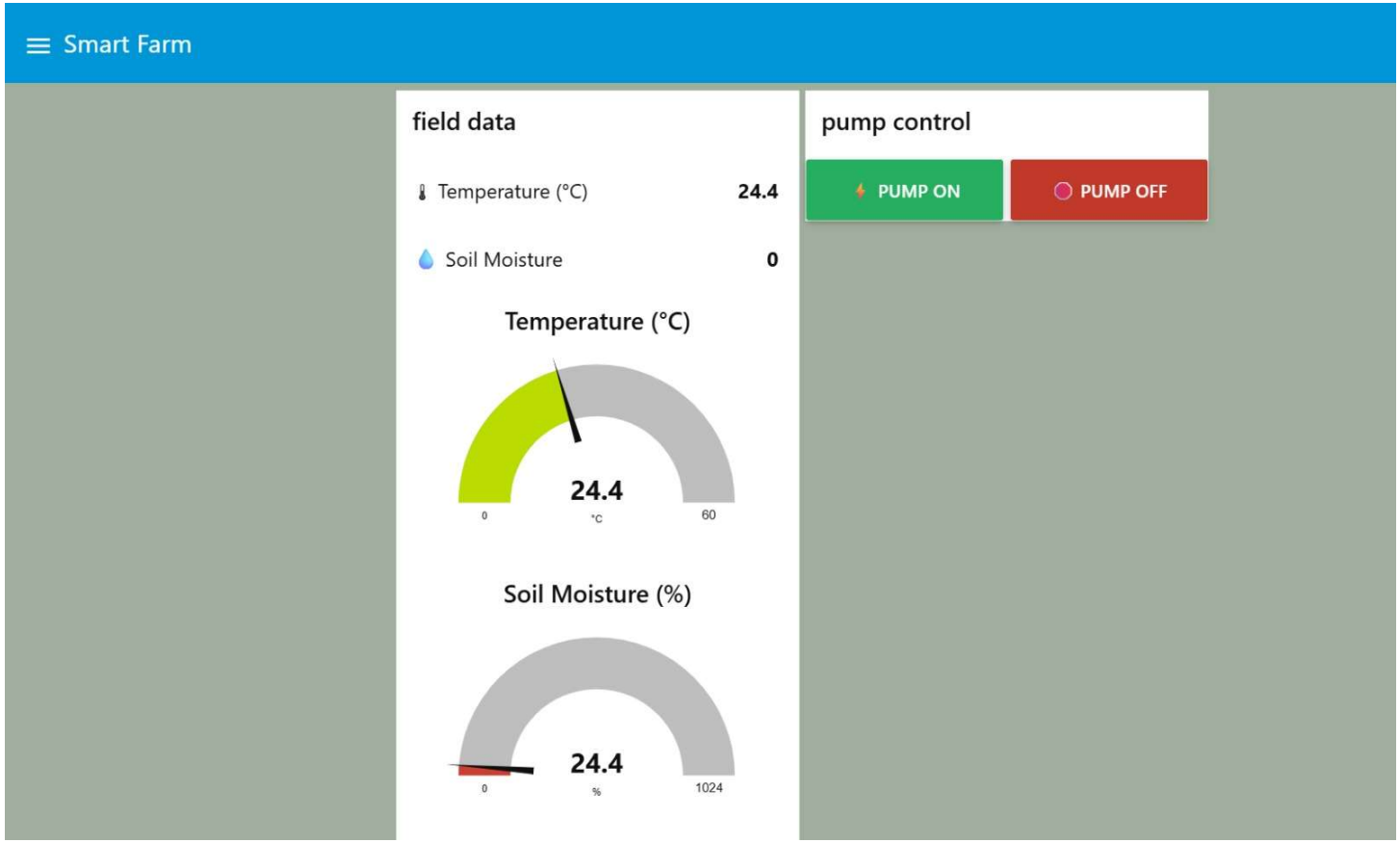
Component Group	Cost (₹)
Soil Moisture Nodes	23,400
Weather Stations	3,360
Zone Control (Valves + Relay)	4,500
Pump Controller	3,450
Gateway	4,500
Misc + Installation	7,000
Grand Total (Electronics + Automation)	**45,660**

DAYANANDA SAGAR UNIVERSITY

FARM

DAYANANDA SAGAR UNIVERSITY

DASHBOARD



DAYANANDA SAGAR UNIVERSITY

Deployment, Impact & Real-Time Large Farm Application

This work demonstrates how the proposed system can be scaled and deployed as a real-time smart farming solution for large agricultural fields using LoRa-based sensor networks.

ASSUMPTIONS MADE OVER A YEAR

- Farm size: 1 acre
- Current water usage: 8,00,000 L/year
- Water saved after automation: 30–50% → taking average 40% Cost of pumping water (electricity + labour): ₹50 per 10,000L
- Labour saved: ₹700/month (visits + manual irrigation) → ₹8,400/year

Component group cost (project hardware): 45,660

FARMERS PROFITABILITY

Investment: ₹4,630 (one time)
Annual savings: ₹8,800 (starting year 2)
Payback period: 6–7 months
Net profit over 5 years:→ ₹8,800 × 4 years + ₹4,170 = **₹39,370**

Impact and Scalability of LoRa-Based Smart Farming

A LoRa-enabled farm improves productivity by providing continuous visibility into field conditions. The system is highly scalable; adding new sensors is as easy as installing another node and registering it.

IMPACT

40–70% water savings through precise irrigation.
Improved crop yield and reduced human labor.
Works in rural areas with poor internet connectivity.
Easily expandable as the farm grows

Future Scope for Large-Scale Deployment

The system can be further enhanced with AI and advanced automation tools, enabling predictive analytics and smart agriculture practices.

SCOPE

- AI-based irrigation control systems.
- Integration with weather APIs and satellite data.
- Drones + IoT for pest detection.
- Smart fertigation and nutrient-level monitoring.
- Farm-to-market traceability using blockchain.

THANK YOU