JSK AgroSense –
Smart Farming IoT Network
User Guide

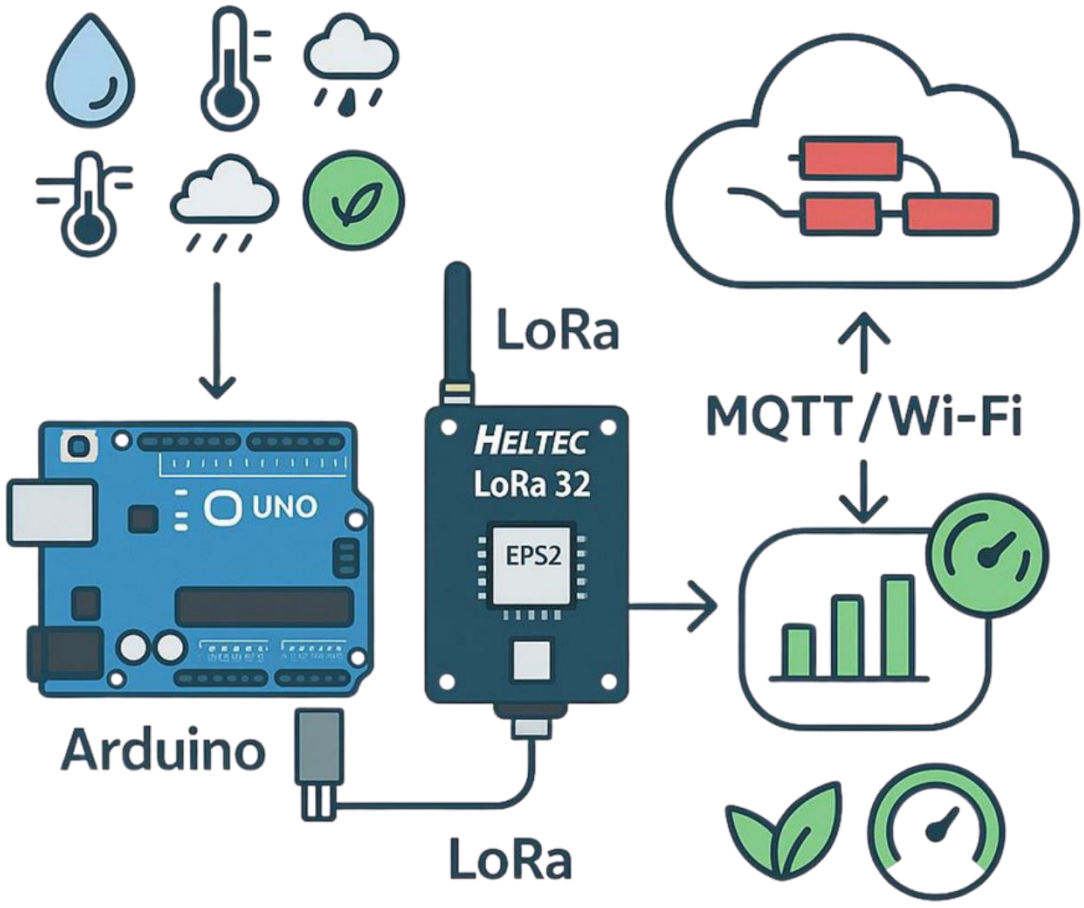

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Figure 1- Prototype 1.0

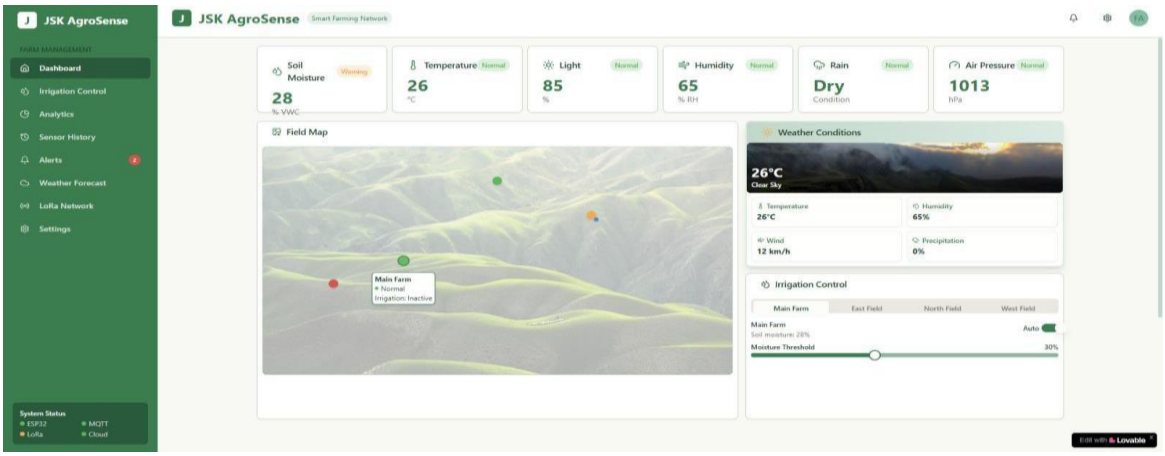


Figure 2- Proposed dashboard

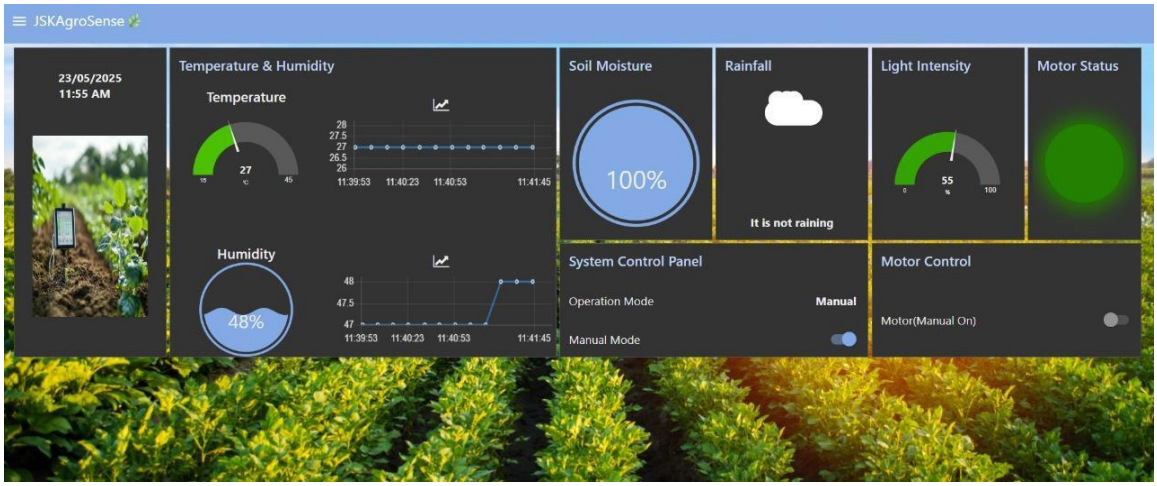


Figure 3-Node-Red Dashboard

Contents

1. Project Overview

JSK AgroSense is a smart farming system designed to monitor environmental conditions in remote agricultural fields and send data to a cloud dashboard for real-time monitoring. The system uses sensors to collect temperature, humidity, soil moisture, and rain status, and communicates using LoRa and MQTT protocols.

- **Remote Sensor Node**

  – **Hardware:** Arduino Uno + SX1278 LoRa transceiver.

  – **Sensors & Actuator:** Soil moisture probe, temperature/humidity sensor, and a servo-driven irrigation valve.

  – **Function:** Reads each sensor, formats the data as a comma-separated string (including a field ID), and transmits packets over LoRa to the local gateway.

- **Local Gateway Node**

  – **Hardware:** Heltec LoRa 32 module (ESP32 + LoRa) at the main farm.

  – **LoRa Integration:** Continuously listens for incoming SX1278 packets, parses out sensor values and node ID.

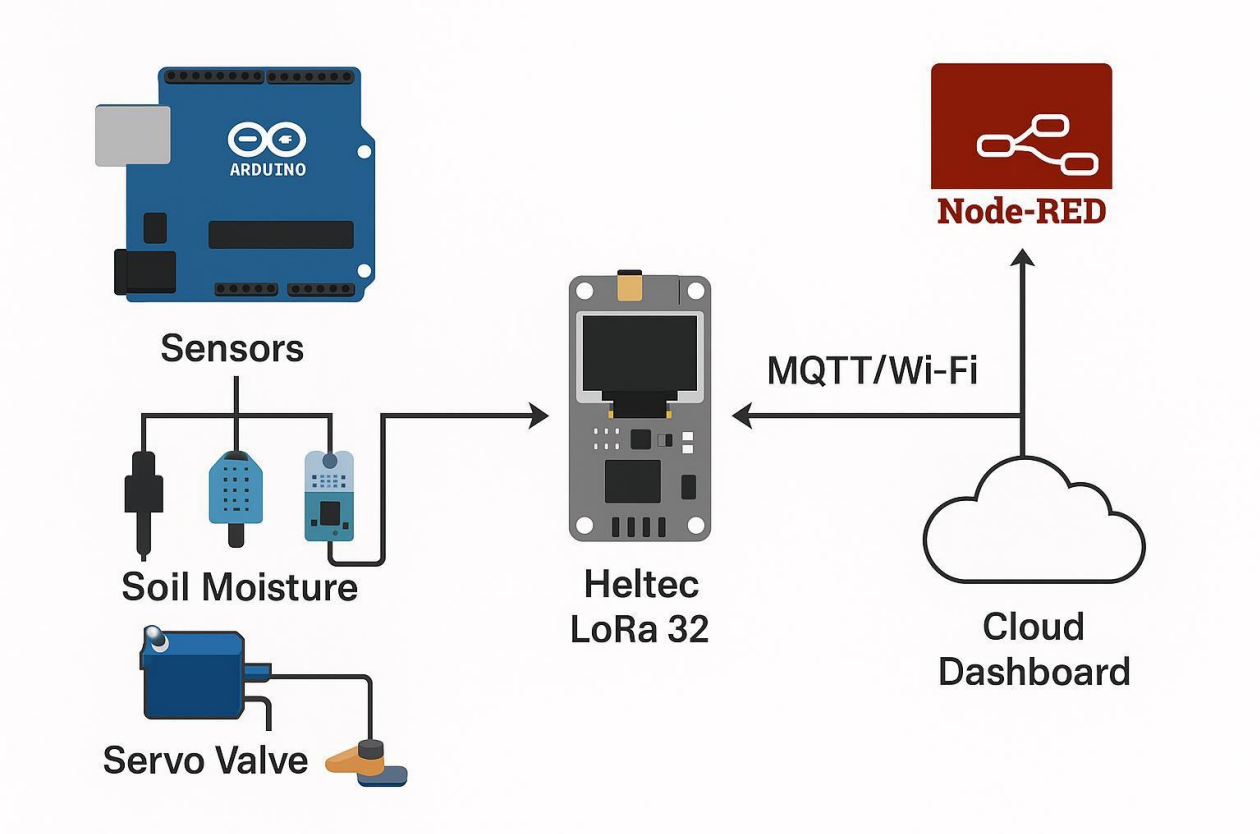
  – **MQTT Bridge:** Publishes parsed readings to distinct MQTT topics.

- **Cloud Dashboard (Node-RED)**

  – **Visualization:** A dedicated “Remote Field” tab displays live temperature, humidity, soil moisture, and valve status.

  – **Two-Way Control:** Dashboard switches or sliders publish MQTT commands.

2. System Architecture Diagram



- **Field Node**: Arduino UNO + Sensors + LoRa Transmitter
- **LoRa Gateway**: Heltec LoRa ESP32
- **MQTT Broker** (Mosquitto)
- **Node-RED Dashboard** (subscriber & UI)

3. Hardware Components

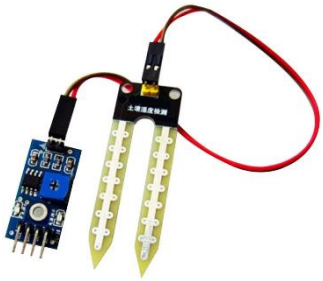
Component	Description
Arduino UNO	Microcontroller for field sensor node
SX1278 LoRa Module	Sends sensor data from field to gateway
Heltec ESP32 (LoRa board)	Acts as LoRa receiver and MQTT gateway
DHT11	Measures temperature and humidity
Soil Moisture Sensor	Measures soil water content
Rain Sensor	Detects rainfall
LDR	Measures ambient light (optional)

4. Sensor Details and Datasheets

4.1 DHT11 – Temperature and Humidity Sensor

- Operating Principle
  A digital one-wire sensor: the chip measures ambient temperature and relative humidity, then sends serial-timed pulses on its data line.
- Digital output (Connected to D4 pin)
- Accuracy: ±2°C (temp), ±5% RH
- Datasheet: https://www.mouser.com/datasheet/2/758/DHT11-Technical-Data-Sheet-Translated-Version-1143054.pdf?srsltid=AfmBOookQzES4RAm9RFWxBA0tXAIsrHH1363NmjTL08wJhwpGhtQunlt

4.2 Soil Moisture Sensor

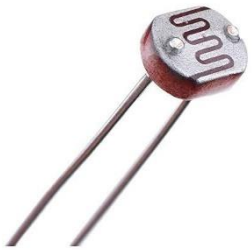


- Operating principle
  A resistive (or capacitive) probe whose analog output voltage varies with soil water content: wetter soil → higher conductivity → lower resistance (or, in capacitive types, higher capacitance → voltage change).
- Analog output (resistive type, connected to A1 pin)
- Range: 0 (wet) – 1023 (dry)
- Needs calibration per soil type
- Datasheet: https://components101.com/modules/soil-moisture-sensor-module

4.3 Rain Sensor Module

- Operating principle
  A simple resistive moisture strip: when water bridges its traces, resistance drops and the analog output voltage falls.
- Analog and digital outputs (connected to A0 pin)
- Detects presence and amount of rain
- Datasheet: https://components101.com/sensors/rain-drop-sensor-module

4.4 LDR (Light Dependent Resistor)

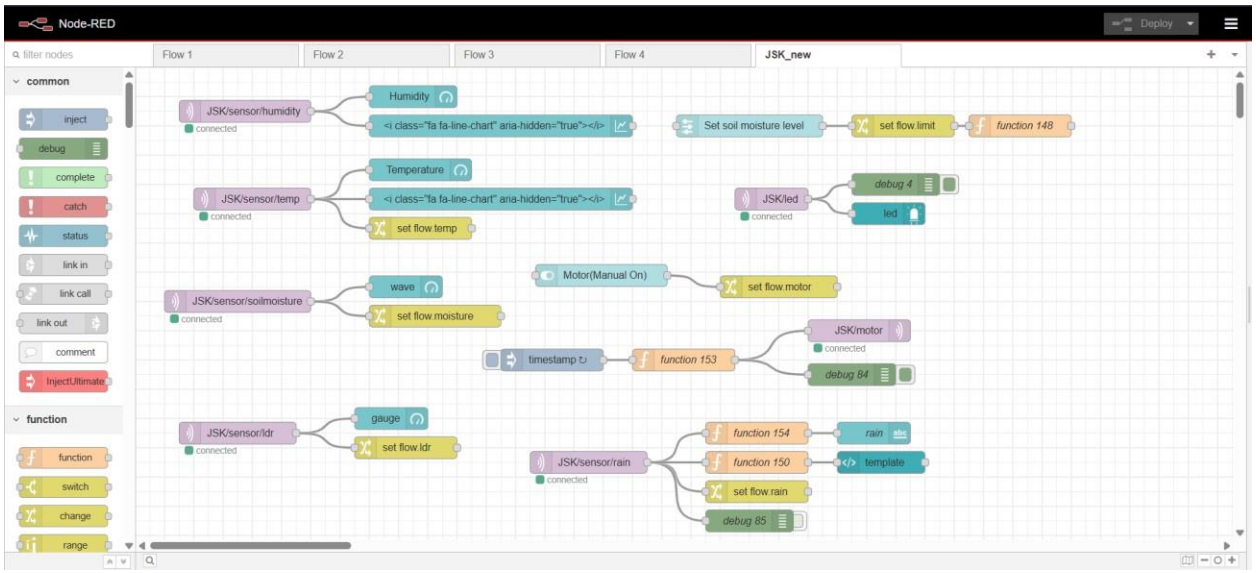


- Operating principle
  In a voltage-divider, the LDR's resistance decreases under brighter light, raising the divider's output voltage.
- Used in a voltage divider (connected to A2 pin)
- Resistance decreases with increasing light
- Datasheet:https://components101.com/sites/default/files/component_datasheet/LDR%20Datasheet.pdf

5. Software Components

Component	Description
Arduino Code	For field node – reads sensors, sends via LoRa
ESP32 Code	For gateway – receives LoRa, publishes via MQTT
Node-RED Flow	Visualizes data and allows remote control
MQTT Broker	Mosquitto or public broker (test.mosquitto.org)

Node-RED Flow Diagram



6. System Setup Instructions

Field Node (Arduino UNO)

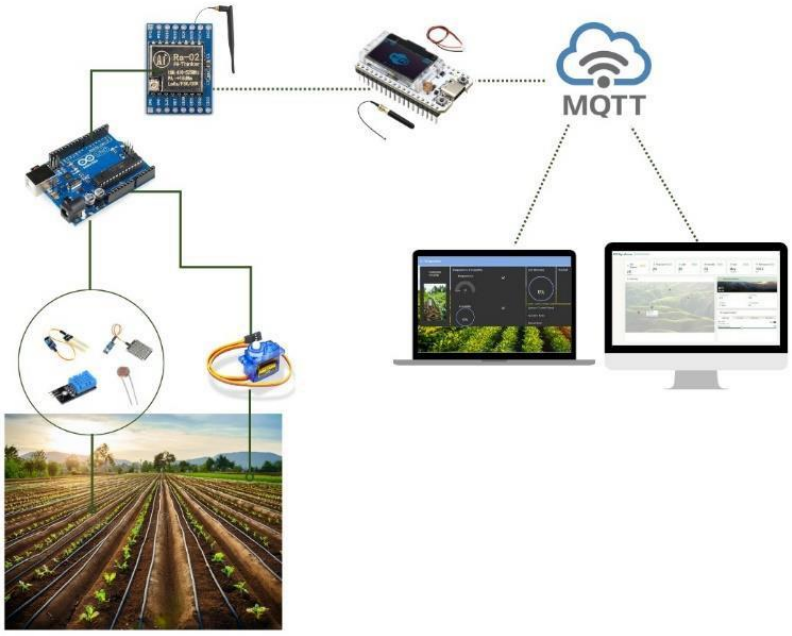
1. Connect sensors to analog/digital pins.
2. Upload the Arduino sketch that reads sensor data and sends via LoRa.
3. Format data as a comma-separated string.

Gateway Node (Heltec ESP32)

1. Connect to Wi-Fi.
2. Initialize LoRa receiver and MQTT client.
3. Parse LoRa message and publish values to MQTT topics.

Node-RED

1. Install Node-RED and MQTT nodes.
2. Import the flow JSON file.
3. Set the same MQTT broker as the ESP32.
4. Open Dashboard URL to view real-time data.



Troubleshooting and Notes

- LoRa communication range may vary based on obstacles and antenna placement.
- Ensure correct MQTT topic matching across devices.
- Add retry logic in case of MQTT or Wi-Fi disconnects.

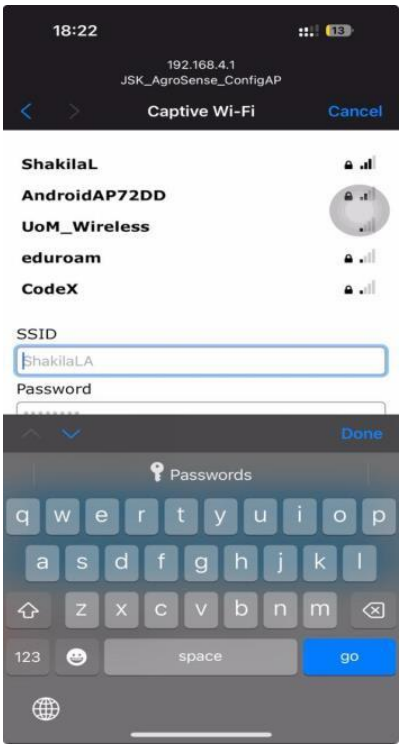
10. Wifi Configuration Steps

1. **Power on and join the Access Point**

- The ESP32 will start with its own access point named **JSK_AgroSense_ConfigAP**.
- On your phone or laptop, open Wi-Fi settings and connect to **JSK_AgroSense_ConfigAP.**

2. **Enter "Configure Wi-Fi" portal**

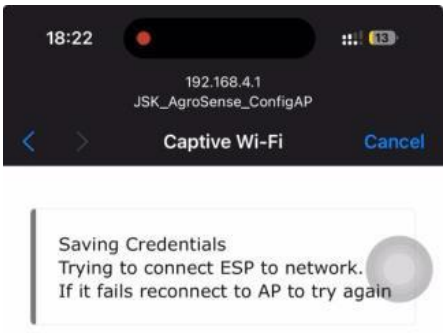
- In that portal, tap **Configure WiFi**.
- The ESP32 will scan and list all nearby SSIDs.



3. Pick your network and supply credentials

- Tap the SSID you want.
- If you don't see your network, tap **Refresh** to re-scan.
- Enter the matching **Password**.
- Tap **Save**.

4. Wait for the ESP32 to connect



- After hitting **Save**, you'll see a "Saving Credentials… Trying to connect ESP to a network…" message.
- The module attempts to join your AP.

Thank You for Choosing JSK AgroSense

Support & Feedback
For inquiries, troubleshooting, or feedback, contact us at:
Email: support@jskagrosense.com
Website: www.jskagrosense.com

Stay connected for updates, tips, and new features.

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