SMART FARMING

Project for Monitoring the Environment conditions of crop field and predicting Onset of pathogen attack on crops/plants.

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Motivation

The Future of Agriculture

- Smart farming, the fusion of traditional agriculture with cutting-edge IoT technology, represents the future of agriculture.

Quality and Efficiency

- Its primary objective is to enhance the quality of agricultural products while minimizing human intervention.

Addressing Farmer Challenges

In response to the challenges faced by farmers today, we are dedicated to improving agricultural quality and quantity through intelligence calling it "smart farming".

Data-Driven Agriculture

•IoT technology, driven by data, empowers farmers with comprehensive crop monitoring capabilities.

Precision Farming

•Smart farming tracks every aspect of crop production, issuing real-time alerts regarding crop health, soil conditions, and temperature requirements, accessible through interconnected smart devices.

Problem Statement

Develop an IoT-based system for prediction of pathogen attacks on plants by monitoring and analyzing changes in environmental conditions.

Challenges

- **Pathogen Threats:** Plants are vulnerable to various diseases, and early detection is crucial to prevent crop loss.
- **Environmental Stressors:** Changes in temperature, humidity, and VOC (Volatile Organic Compounds) levels can indicate stress in plants, potentially linked to pathogen attacks.
- **Data Integration:** Integrating multiple sensors (VOC, temperature, humidity, light, O2/CO2) to create a cohesive system for real-time monitoring.

Proposed Solution

- Deploy a network of sensors on an experimental farm to collect data on VOC levels, temperature, humidity (soil), light, and O2/CO2 levels and Utilize data analysis techniques, including Python-based analytics, to process and analyze sensor data and to intimate the conditions and stats to the user by a dashboard.

Implementation Overview

IoT-Enabled Smart Farming

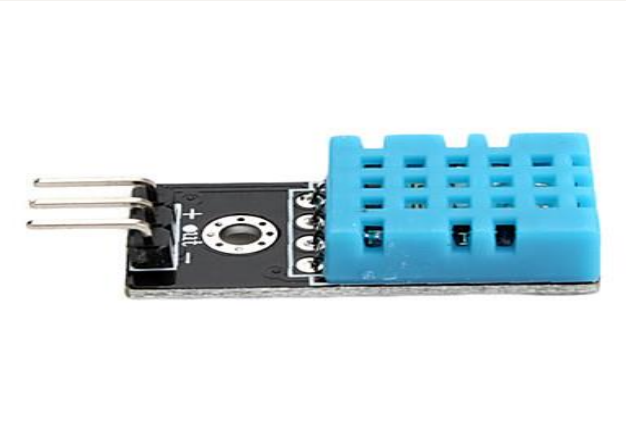
- IoT devices installed on the farm continuously collect and process data, enabling remote monitoring and real-time access from anywhere in the world.

Implementation

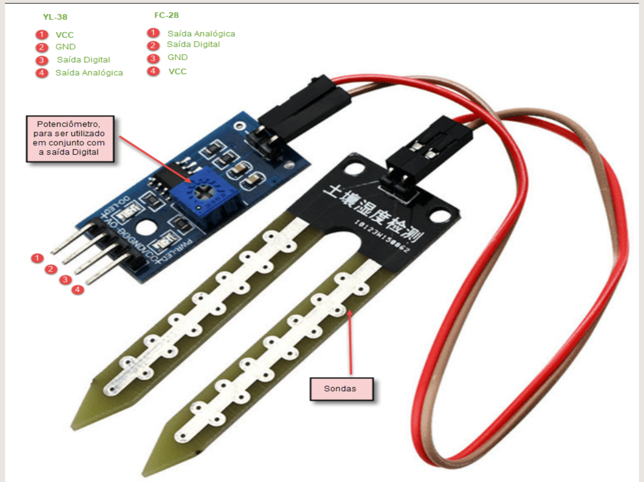
- **Observation:** Sensors record data from soil and the atmosphere to monitor live weather conditions and plant status.
- **Diagnostics:** Sensor values are sent to a cloud-hosted IoT platform with predefined decision rules and models, simultaneously updating the database.
- **Data Storage:** Collected data from the past month is stored in a data collection middleware like MongoDB for further analysis.
- **Data Analysis:** An interactive dashboard allows for the analysis of plant data, predicting optimal conditions for plant growth and recommending suitable plant types for specific weather conditions.

Sensors Required

VOC sensor



DHT Sensor

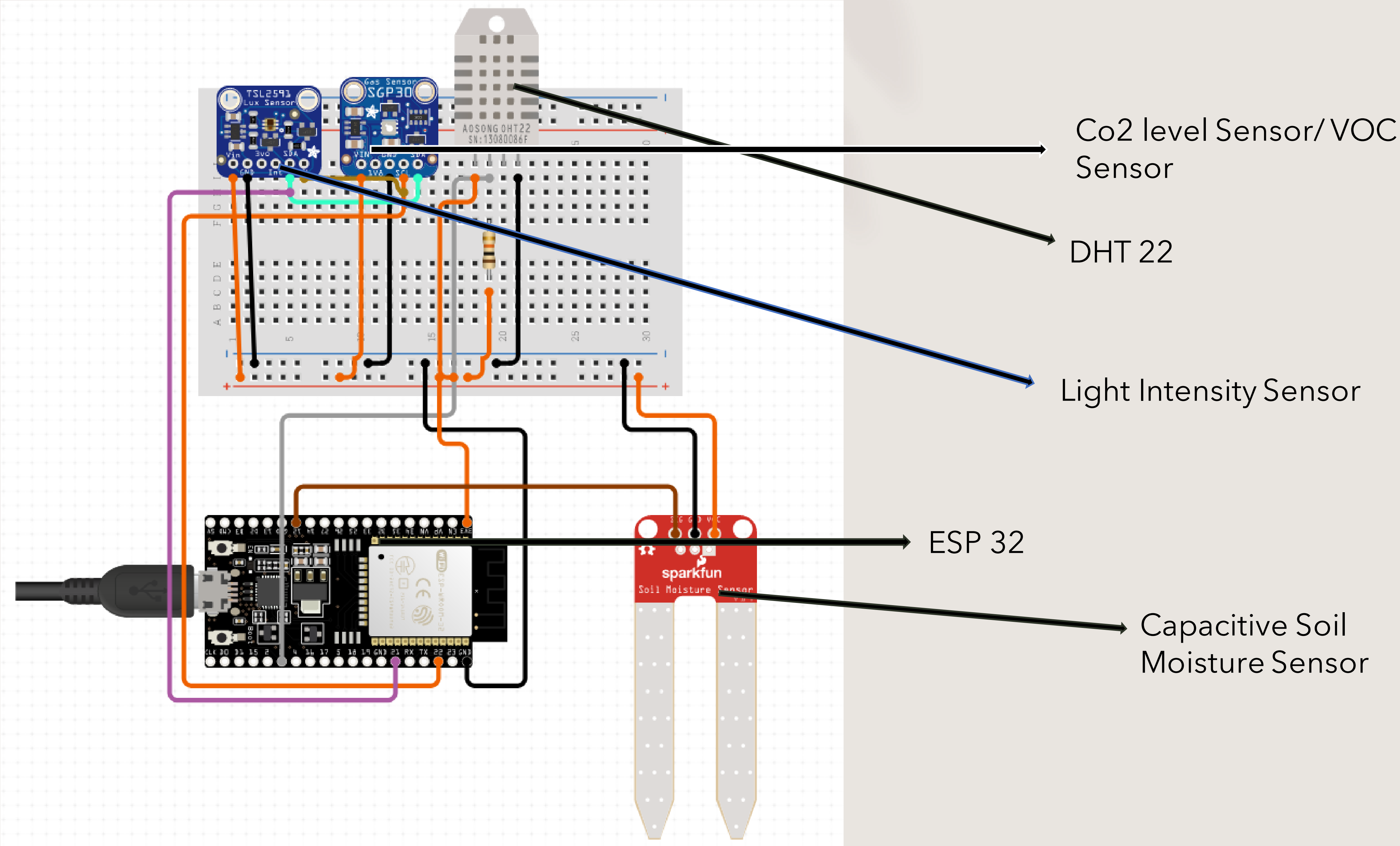


Capacitive soil moisture Sensor

Light Intensity Sensor

Carbon Dioxide Sensors

Circuit

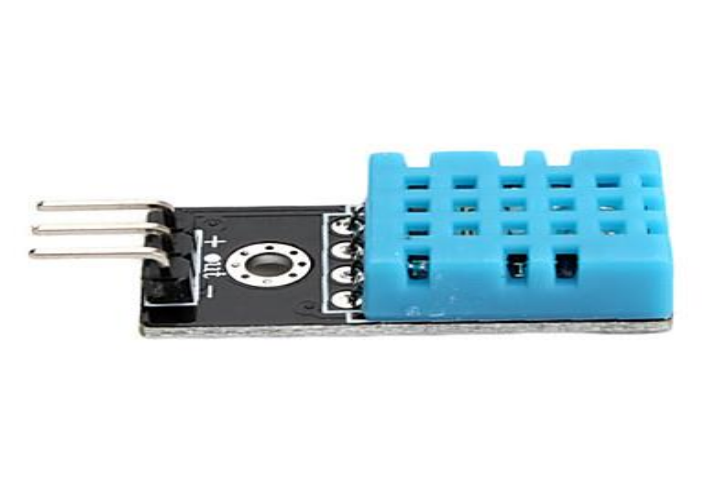


Co2 level Sensor/ VOC Sensor
DHT 22
Light Intensity Sensor
ESP 32
Capacitive Soil Moisture Sensor
TSL2591 Lux Sensor
Gas Sensor SGP30
AOSONG DHT22
sparkfun
Soil Moisture Sensor

- Not yet tested
- Specifications Of SPG30(VOC):
  - Measurement Range(CO_2) : 0 –1000 ppm
  - Supply Voltage : 1.62 - 1.98V
  - Sensor Output: Digital

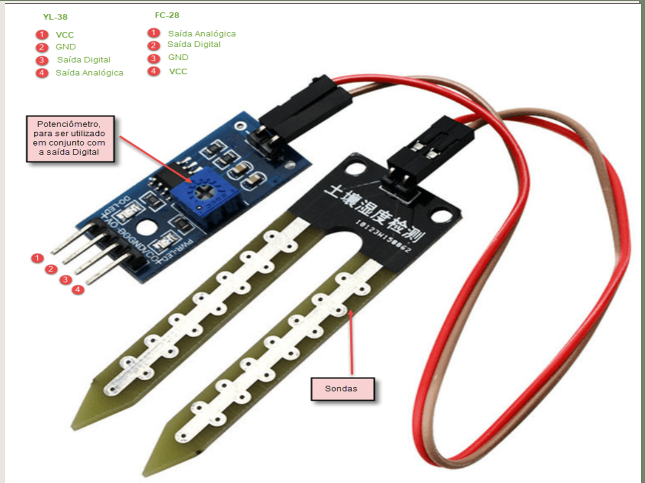
VOC Sensor

DHT Sensor



- Tested Data:
  - Fluctuating between : 25-30 C
- Specifications Of DTH(Temperature):
  - Measurement Range(CO_2) : 0 –50 C
  - Accuracy : ±2 C
  - Sensor Output: Analog

- Tested Data:
  - Avg. Soil moisture:40 – 50 %
- Specifications Of Soil Moisture Sensor :
  - Measurement Range : 0 –1023
  - Supply Voltage : 3.3 - 5 V
  - Sensor Output: Analog



Capacitive soil moisture Sensor

Light Intensity Sensor

- Tested Data:
  - Irregular behaviour (0,4095 values)
  - Avg. Light Intensity :35 – 45 %
- Specifications Of Light Intensity Sensor :
  - Measurement Range : 10 –1000
  - Supply Voltage : 3.3 - 5 V
  - Sensor Output: Analog

Plan of Data Analysis

Data Collection

•VOC (Volatile Organic Compounds) sensor records air quality data.
•Temperature and soil humidity sensors monitor soil conditions.
•Light sensor measures ambient light levels.
•O2/CO2 sensors track oxygen and carbon dioxide levels.

Data Storage

- Storing data securely for analysis.

Analysis Objectives

- **Air Quality Assessment:** Analyzing VOC sensor data to assess air quality and detect any anomalies that could affect plant health.
- **Soil Health Monitoring:** Evaluating temperature and soil humidity data to assess soil conditions, ensuring they are optimal for plant growth.
- **Light Exposure Analysis:** Examining light sensor data to determine the amount of light plants are receiving and optimizing their exposure.
- **Gas Level Tracking:** Tracking O2 and CO2 levels to ensure proper environmental conditions for plant respiration.

Python-Based Analysis

- Utilizing Python's data analysis libraries (e.g., Pandas, NumPy) for processing and manipulating sensor data.

Visualization

- Creating graphs and visualizations to make data patterns and trends more accessible.

Alerts

•Implementing alert mechanisms to notify users of unfavorable conditions based on sensor data thresholds.

Timeline

The Expected time to complete the project is about 50 days as in the order of the following tasks:

Project Planning and Conceptualisation

Sensors Integration and Wireless Communication

Alerting System & Managing Remote Access

Task1	Task2	Task 3	Task 4	Task 5	Task 6

Testing & Debugging

Hardware Setup with ESP32 & Dashboard Design

Data Collection & Processing

Documentation & Presentation

Individual Contributions:

1. MQTT & Sensor integration – Adari Dileepkumar
2. Testing of Soil Moisture Sensor – Revanth
3. Testing of DHT Sensor – Gajawada Bharath
4. Testing of LDR Sensor – Chaganti Venkata Karthikeya
5. Web Design Started

Summary

- **Data Analysis Framework:** Development of a simplified data analysis framework to process sensor data and trigger alerts.
- **IoT-Based Early Warning System:** Implementation of a functional EWS utilizing basic sensors for real-time monitoring of soil and weather conditions.
- **Alert Mechanism:** Creation of an alert mechanism to notify users of adverse environmental conditions.
- **User Interface:** Design of an intuitive user interface for data visualization and system control.
- **Documentation:** Comprehensive documentation including project plans, sensor data analysis procedures, and user guides.


Thank you