Smart Farming

Project for Accurately Monitoring the Current Environment Conditions and the Factors which affect Plant Growth and Yield

Team Details

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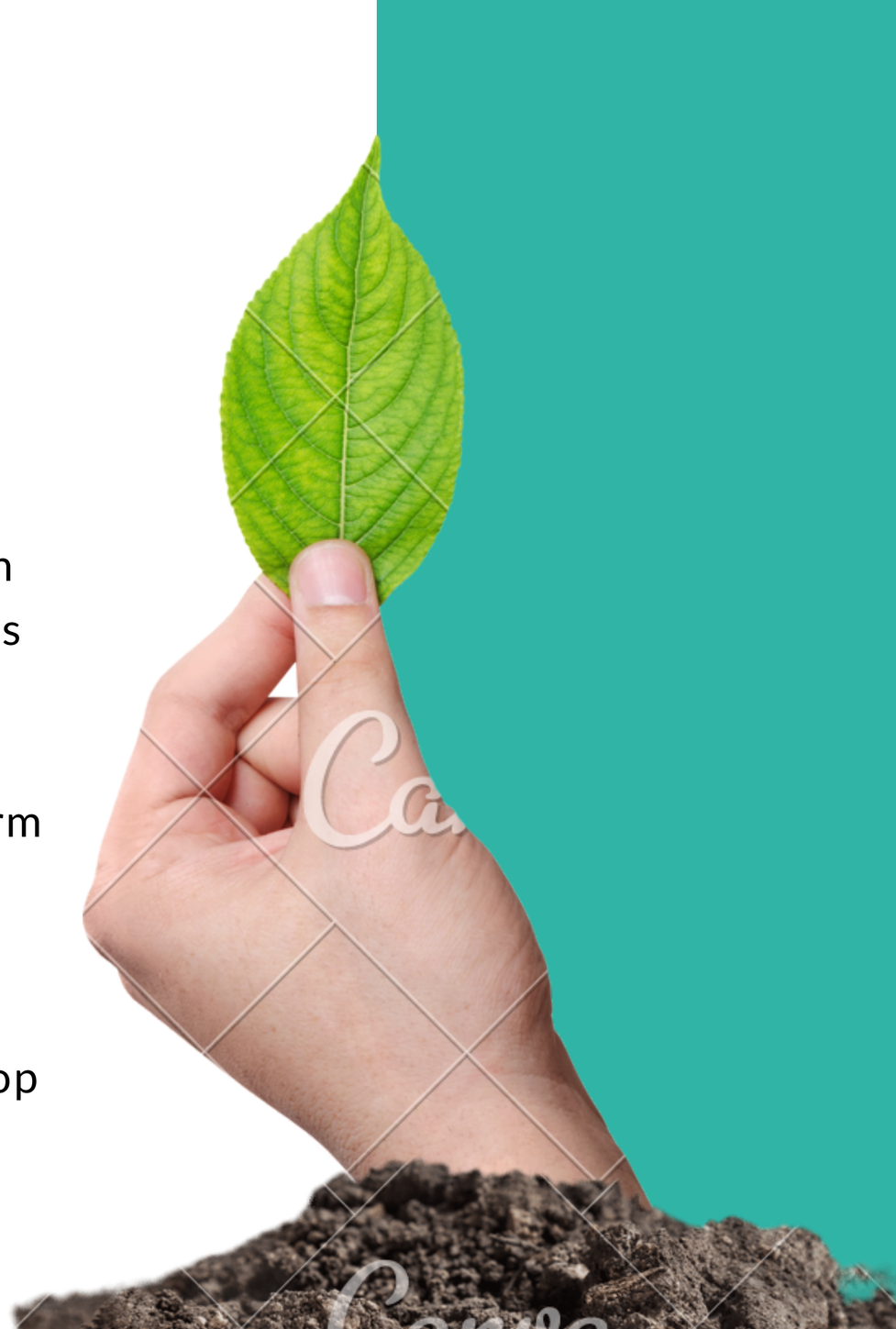
Motivation

- Smart farming refers to an upcoming concept that combines conventional farms with new technologies such as IoT. The purpose of Smart farms is to increase the quality of agricultural products whilst optimising human intervention.
- To address the challenges of farmers, efforts and research are in place to improve the quality and quantity of agriculture products by making them ‘connected’ and ‘intelligent’ through “smart farming”.
- The IoT technology uses a data-driven approach and enables farm managers to keep a detailed check on their crops. It helps the farmers take appropriate actions against unwanted pests and protect their crops from various diseases.
- The smart farming solution keeps an eye on every activity of crop production, which triggers instant alerts about its health, condition, and temperature requirement, and displays all the details on the interconnected smart gadgets.



Implementation Overview

IoT devices installed on a Farm collects and processes data in a repetitive cycle that enables farmers to monitor the emerging issues and changes in the ambient conditions. The Way they can remotely access the Farm's Live Condition from Anywhere in the World.

The driving force of smart farming is IoT—connecting machines and sensors integrated on farms to make farming processes data-driven and automated and much more Efficient.

Observation

Sensors Record Observational data from the Soil and the Atmosphere to Monitor the Live Weather Conditions and Status of the Plants.

Diagnostics

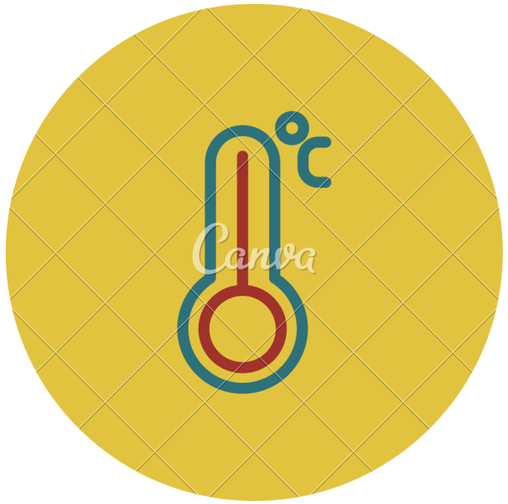
The Sensor Values are Fed to a cloud-hosted IoT platform with predefined decision rules and models. The Data is Simultaneously is updated in the Data Base.

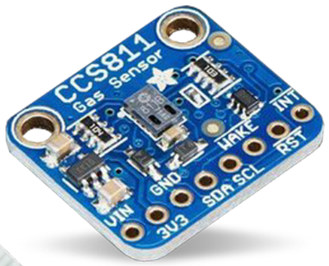
Data Storage

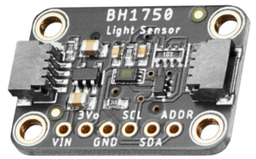
Data collected over the past 1 or 2 month will be stored in a Data Collection Middleware (like MongoDb) for further Analysis of Growth of plant and previous " Medical History "

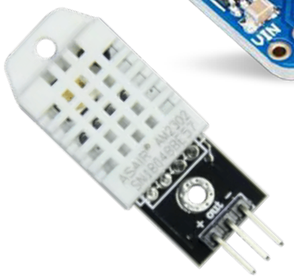
Data Analysis

There will be an interactive Filter - Included dashboard to Analyse the data collected from plant to predict which Plant Flourishes is which Conditions and which type of Plants are optimal for this type of Weather Conditions.









Observation

Sensors Used

1) Capacitive Soil Moisture Sensor
2) CCS 811 (C02 level in air)
3) BH 1750 (Light intensity Sensor)
4) SGP - 40 (Alternative to CCS 811)
5) DHT - 11/22 (Temperature and Humidity Sensor)

Positioning and Placement

- Soil Moisture Sensor will be placed near the Roots of the Plant.
- Rest all the sensors will be soldered and placed in a protective container near the plant to detect atmosphere attributes like Sunlight , CO2 levels , etc.

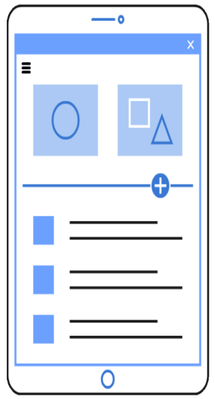
Diagnostics

- The Data Recorded by the Sensors is Updated Live to the Things Speak Channel , OneM2m Server and the Data Base hosted Locally.This Data is Also Updated live in the Dashboard.
- The Predefined Decision Making rules are Implemented here which tell us the Remedy or the Solution to the Current Stress that the Plant may be Experiencing due to various Environmental Factors.
- These Rules are already Pre-defined based on the Crop currently under Observation and the Prevailing Weather Conditions. For Example :- The Plant Growth gets hampered when the Plant Experiences High or Low Temperature Stress.

mongoDB

Data Storage

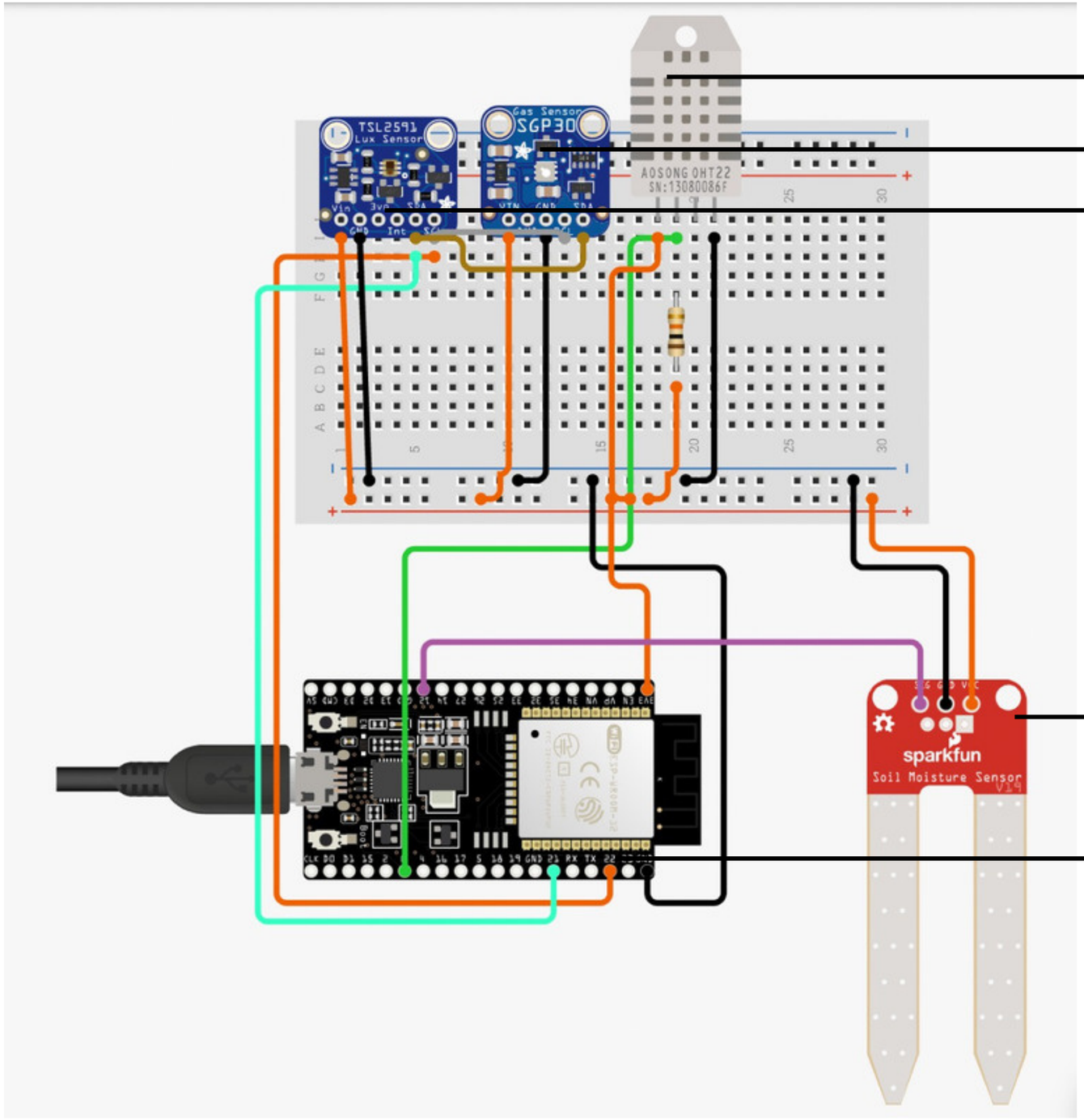
- MiddleWare Used - MongoDb
- Data for the Past 1 or 2 months is Stored for Analysis in the Long Term.
- Provides Medical History of the Farm.
- Used to Simulate conditions as required for the experiment.
- Extremely Useful in Diagnosis
- An Extra "Feature" for the User.



Data Analysis

- This will include an interactive filter - enabled dashboard to form graphs and charts about a plant's behaviour under varied conditions to find its optimal habitat or most Favourable Conditions for it's Growth.
- Data will be accessed from ThingSpeak REST API's and MongoDb database middleware
- Data collected over a long enough period of time will be analysed so as to compensate for any abnormalities in sensor reading and error handling.

Circuit Diagram



DHT 22

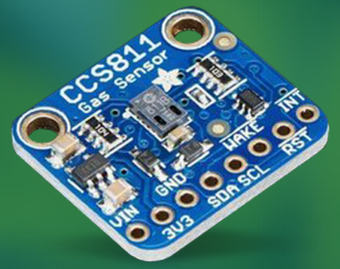
CO2 Level Sensor

Light Intensity Sensor

Capacitive Soil Moisture Sensor

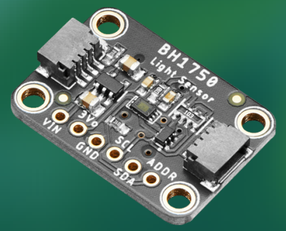
ESP 32

Sensors required

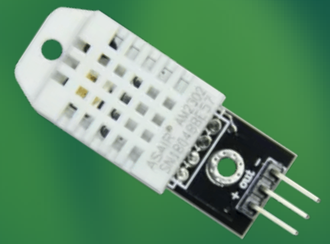


Carbon Dioxide Sensors
CCS 811 / SGP 40 Sensors

Capacitive soil moisture
Sensor v1.2



Light intensity Sensor
BH 1750 Sensor



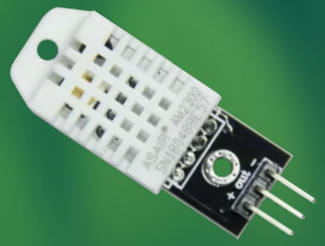
Temperature and humidity sensors
DHT - 11/ 22

Working of Sensors

A capacitive moisture sensor works by measuring capacitance changes caused by the changes in the dielectric. It does not measure soil moisture directly (as pure water does not conduct electricity well), instead it measures the ions that are dissolved in the moisture

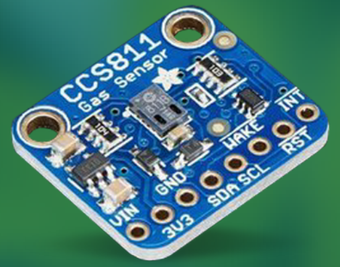
Capacitive soil moisture Sensor v1.2

DHT -11/22 uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).



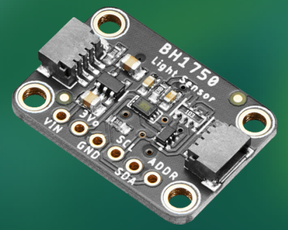
Temperature and humidity sensors DHT - 11/ 22

Working of Sensors



Carbon Dioxide Sensors
CCS 811 / SGP 40 Sensors

CCS 811 sensor uses a metal oxide sensor (MOX) paired with a microcontroller unit (MCU), with an analog to digital converter (ADC) and an I2C interface



Light intensity Sensor
BH 1750 Sensor

BH 1750 sensor has an ADC to convert analog light intensity to digital LUX values. This sensor uses the I2C communication protocol to send data to the microprocessor

Smart Farming

Smart farming and IoT-driven agriculture are paving the way for what can be called a Third Green Revolution.

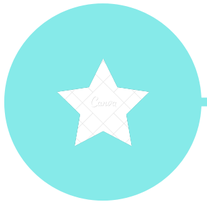
Summary

Precision farming, or precision agriculture, is an umbrella concept for IoT-based approaches that make farming more controlled and accurate. In simple words, plants get precisely the treatment they need, determined by machines with superhuman accuracy. The biggest difference from classical approach is that each plant gets "special treatment" from these machines . By precisely measuring variations within a field, farmers can boost the effectiveness of pesticides and fertilizers, or use them selectively.

Our Project also holds the capability to intelligently monitor the climate, eliminating the need for manual intervention. Various sensors are deployed to measure the environmental parameters according to the specific requirements of the crop. That data is stored in a cloud-based platform for further processing and control with minimal manual intervention.

EXPECTED TIMELINE

WEEK 0



- Collecting information about the project and the sensors to be used.
- All team members will start working on hardware.

WEEK 1

- Division of tasks among the teammates i.e. in two sub group one will continue with hardware and other will start the software part of project.

WEEK 2

- Will try to complete hardware part by now and also basic codes of each of the sensors.
- Integrating the respective codes into one.

WEEK 3

- All will do software part each assigned a specific task to do.
- Bringing together all the codes in one and final code for project.

WEEK 4

- Implementing the project in real life and collecting the data given by the sensors.
- This is done several times and then this data is fed to the data analysis algorithms implemented by us.

PRESENT

- Presenting the data on a dashboard (on web) along with the analysis done on the data and the results obtained from analysis about the crop.