ESW Project

Team-36

Motivation

- **Agricultural Resilience:** Agriculture is highly dependent on climate conditions. Investigating how different plants respond to varying climates can provide insights into developing more resilient crops and optimizing agricultural practices to ensure food security.
- **Biodiversity Conservation:** Climate change can affect the distribution and behavior of plant species. Studying plant reactions to climate conditions can help in predicting changes in biodiversity and implementing conservation strategies to protect endangered species.
- Many medicinal plants are sensitive to climate variations. Understanding how climate affects the growth and medicinal properties of these plants can have implications for traditional medicine and pharmaceutical research.
- Our project could serve as a platform for educating the public about the importance of plants in the environment, the effects of climate change on ecosystems, and the role individuals can play in promoting environmental sustainability.

Introduction

- In a constantly changing world, agriculture plays a crucial role in the global economy and food security. It's essential to improve crop yields and ensure plant health. Our project is driven by a strong desire to contribute to sustainable agriculture. Agriculture faces challenges like unpredictable weather, soil issues, and pests, which threaten crop production. We urgently need data-driven solutions.

- Our main project goal is to **monitor plant health in real time**.

- We believe that by combining modern technology, data insights, and agricultural expertise, we can usher in a new era of sustainable farming practices.

WHAT WE HAVE DONE IN OUR PROJECT-

- Our main aim was to study and research on different plants that how different species of plants vary with external conditions.Also we wanted to observe that how temperature of plant varies with soil moisture and soil pH for different plants.
- So in broader sense we took 4-5 plants for study and using different sensors we measured soil moisture,soil pH and leaf temperature.We sent the data to the thingspeak to plot the graphs and see the variation.
- For long term analysis,we used to collect data from plants daily and stored it.
- We took the average values of temp,moisture and pH for each day and plotted the graph accordingly to show variation in temp,moisture and pH daily.

COMPONENTS USED IN OUR PROJECT-

- pH sensor kit
- DHT11 sensor
- Soil moisture sensor
- ESP32
- We also tried working on webcam.We were having the correct code but arduino was unable to detect the camera module.So we couldn’t use webcam.

PLANTS WHICH WE TOOK FOR STUDY-

- Turmeric
- Golden Eye-Grass Curculigo orchioides
- Creeper
- Lilly

HOW DID WE PROCEED

- We have selected majorly 2 parameters for changing the external conditions of the plant.
- Parameters-Soil moisture and Ph.
- Soil moisture changes shows instant reactions for almost all plants we have worked on but Ph takes time to show changes in the leaf behaviour.
- To observe the leaf behaviour we have use DHT11 sensor to measure the temperature of the leaf.
- The DHT11 sensor work as a leaf temperature sensor when we touch the leaf directly to the thermistor present in the DHT11.
- We observed the changes in temperature and we have drawn a conclusion that temperature is inversely proportional to temperature.

OBSERVATIONS FOR EACH PLANT-

GOLDENEYE PLANT-

- MOISTURE THRESHOLD-

  The critical soil moisture level, where the water absorption capacity diminishes significantly, is observed around Day 8 when the soil moisture level is 18. We can also observe the temperature on day 14 this is did not change vastly from the previous day.This indicates that beyond this point, plants might struggle to absorb adequate water, leading to potential stress.

  Threshold observed- 17.5-18%

- ABSORPTION CAPACITY-

  The absorption capacity of this plant is comparatively high than Turmeric plant.We can observe clear changes in temperature with in a particular span of time.

- TEMPERATURE RESILIENCE-

  Golden Eye-Grass has a high temperature resilience, with the ability to regulate its temperature. The plant is able to maintain a relatively stable temperature despite the changes in soil moisture levels.

- PLANT RESPONSE-

❖ Leaf temperature v/s soil moisture

Here Leaf temperature is inversely proportional to Soil Moisture on observing the ideal moisture levels are 14-16% because it is showing expected changes in temperature.(day 6 and day 7)

❖ Leaf temperature v/s pH

We can clearly see that the Leaf temperature of the this plant is inversely proportional to pH of the soil.Here the plant is able to grow well in the pH range of 5.5 to 5.8 which can be considered as the ideal pH range for this plant.So we can say that this plant prefers slightly acidic soil.

- SOME OTHER POINTS-

❖ **Correlation coefficient between pH and leaf temperature: -0.7867274673342695**

❖ Ideal Moisture range-14-16%

- Ideal pH range- 5.5 to 5.8
- *Days 2 to 6* represent the optimal conditions for Curculigo orchioides, with the ideal moisture range and stable leaf temperature.
- *Day 8* marks a critical point where the soil moisture level reaches 18, potentially leading to decreased water absorption and an impact on temperature regulation.

PISUM SATIVUM-PEA PLANT

- MOISTURE THRESHOLD-

  Here Threshold is observed at 14.2% because the plant is able to absorb water and maintain its temperature.

  Observed threshold- 14.2%

- ABSORPTION CAPACITY-

Pea plant has a dynamic water absorption capacity, responding to changes in environmental conditions. The absorption capacity of this plant is comparatively high than Turmeric plant and lower than the golden eye.We can observe clear changes in temperature with in a particular span of time.

- TEMPERATURE RESILIENCE-

  The Pea Plant exhibits high temperature resilience, maintaining a relatively stable temperature despite changes in soil moisture levels.

- PLANT RESPONSE-

❖ Leaf moisture v/s soil temperature

Here Leaf temperature is inversely proportional to Soil Moisture. Ideal moisture conditions are 13-13.5 % because plant is able to absorb water and maintain its temperature. (day 2 ,day 3 and 7 , day 8)(since there are more points around 26 degrees celsius) .

❖ Leaf temperature v/s pH

We can clearly see that the Leaf temperature of the this plant is inversely proportional to pH of the soil.Here the plant is able to grow well in the pH range of 5.5 to 5.8 which can be considered as the ideal pH range for this plant. So this plant prefers slightly acidic soil.

- SOME OTHER POINTS-

❖ Ideal moisture range- 13.5-14%

❖ Ideal pH range- 6-7.5

❖ *Day 8* marks a critical point where the soil moisture level reaches 14.2, potentially leading to decreased water absorption and an impact on temperature regulation.

LILLY-

- MOISTURE THRESHOLD-

  The critical soil moisture level, where the water absorption capacity diminishes significantly, is observed around Day 4 and 7 when the soil moisture level is 17.2. We can observe that after certain amount of increase in soil moisture the temperature decrease is not that much.

  Observed threshold- 17-17.7%

- ABSORPTION CAPACITY-

lilly has a dynamic water absorption capacity, responding to changes in environmental conditions.But it is not as dynamic as Golden Eye-Grass. The absorption capacity of this plant is comparatively high than Turmeric plant and lower than Golden Eye-Grass.We can observe changes in temperature with in a particular span of time.

- TEMPERATURE RESILIENCE-

  Lilly has a average temperature resilience, with the ability to regulate its temperature. Unlike from Golden Eye-Grass it is not that much able to stabilize its temperature but it has some range which it so not cross for any amount of change in soil moisture.

- PLANT RESPONSE-

❖ Leaf temperature v/s soil moisture

Here Leaf temperature is inversely proportional to Soil Moisture on observing the ideal moisture levels are 14-16% because it is showing expected changes in temperature.

❖ Leaf temperature v/s pH

We can clearly see that the Leaf temperature of the this plant is inversely proportional to pH of the soil.Here the plant is able to grow well in the pH range of 5.5 to 5.8 which can be considered as the ideal pH range for this plant.So this plant prefers slightly acidic soil.

- SOME OTHER POINTS-

❖ Ideal Moisture range- 14-16%

❖ Ideal pH range- 5.5-5.8

❖ *Day 8* marks a critical point where the soil moisture level reaches 18, potentially leading to decreased water absorption and an impact on temperature regulation.

FAILURE ANALYSIS FOR TURMERIC-

For turmeric,we stopped collecting the data after two days.Because what we observed was that temperature was changing by a very less amount(almost negligible)for instant soil moisture change also.This indicates that water absorption capacity of turmeric is very low as there was no change in temperature on increasing soil moisture by a significant amount.

APPLICATIONS OF THE PROJECT

- **Climate-Smart Agriculture:** Insights gained from the project can be applied to develop climate-smart agricultural practices. Farmers can use this knowledge to optimize crop selection, planting times, and irrigation strategies based on the specific climate conditions of their region, enhancing overall agricultural productivity and sustainability.
- **Conservation and Ecosystem Management:** Understanding how different plant species respond to climate changes is crucial for conservation efforts. Conservationists can use this information to identify vulnerable species, design protected areas, and implement strategies to preserve biodiversity in the face of shifting climate patterns.
- **Educational Programs and Outreach:** The project's outcomes can be used to develop educational programs that raise awareness about the importance of plants in the ecosystem and the effects of climate change. This knowledge can be disseminated through outreach activities to schools, communities, and other stakeholders.

WORK DISTRIBUTION:

K.Neha Varshitha - Data analysis,Drawing conclusions,Sending data to thingspeak,DHT11,Ph,Long term analysis goldeneye,lilly

N.Harshitha - Data Analysis,Storing data points, Scraping from thingspeak,Soil moisture,DHT11,Website,long term analysis lilly,creeper

Navdha Bansal-Short Term Analysis,Turmeric Failure Analysis,Worked on Camera,presentation,CSS

Aditi singh-Short Term Analysis,Worked on Camera,turmeric failure analysis,CSS