Poly House Monitoring and Plant Disease Detection

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Abstract: Current period has made a major global food inadequacy due to climatic changes in the world. So, in order to overcome this issue, households may need to grow a conservative area of vegetables and other crops using artificial poly houses. Poly house is a controlled area in which plants are grown according to their requirements. Some of the parameters considered during maintaining a poly house are temperature, humidity, soil moisture, air movements etc. This paper describes the technique used to discern the plant disease using NDVI (Normalized Difference Vegetation Index). It is an image processing algorithm, which determine the condition of plants from their appearance. Determining plant disease manually is challenging, so image processing is used.

Keywords: IoT, NDVI, DHT11, Arduino UNO, LDR.

I. INTRODUCTION

The primary occupation of India is agriculture, where most of the people depend on it. Agriculture gives the major contribution for the economic development of India. The aim of agriculture is not only to feed ever growing population, but it is also an important source of energy and a solution to solve the problem of global warming. There are various ways of developing plants. One of them is poly house. Poly house is the strategy which is used to grow the plants under controlled environment for rising yield and quality of the crops. Poly house uses an ultra violet plastic sheet, of thickness 1501m, which lasts for at least 5 years. It is built using iron pipes or bamboos. In general, the length of poly house is 25-30 feet and width is 4-5 feet. The progress of poly house and growth of crops depends on the internal environment of poly house such as humidity, temperature and soil moisture level. Poly house system monitors ecological conditions, to raise plant development with improved production in least conceivable time, which is one of the major objective of the modern cultivation framework. Automation in poly house provides data acquisition. It also majorly reduces the labor or manpower required for its upkeep. Along these lines making the framework helpful for little scale farmer, plants man and horticulture analysts. Poly house is optimal solution for proper plant growth and high production of the crop. This paper mainly concentrates on monitoring the plants in poly house and disease detection of the same, for which we are using NDVI algorithm. This algorithm is used to test the plants as well as the area. It was used by NASA in 1945 for determining the area which was affected by atom bomb attack happened on Hiroshima and Nagasaki.

II. LITERATURE SURVEY:

Table 1. Literature Survey

SR. NO	Title	Author and Year	Methodology	Limitations
1.	Automated monitoring and controlling of poly house environment	Shubhangi Bhosale, S. Sonawane. (8 August 2016)	Collects and control the poly house environment.	It only gives soil nutrient parameters in the green house to solve problems of plant disease.
2.	Controlling and environmental monitoring of poly house farm through internet	Shubhangi Bhosale, S. Sonawane. (3 June 2016)	Collects and automatically controls the condition of poly house environment by using sensors.	It only control and monitor the temp, humidity, soil moisture and not plant disease actually.
3.	Automated poly house using image processing	A. Saranya, P. Vijayalakshmi, K. Sushmita, R. Swetha(3 March 2017)	Poly house makes the farmer's work easy and it can be achieved by using image processing.	It detects the disease of plant only for the limited region.
4.	IOT based poly house monitoring and controlling system	Jayaty, Dhruv Binani, S. Nagadev (2018)	It reduces the direct supervision of humans.	Light is the most important source for photosynthesis but the light intensity is not measure.

III. MODULES:

For monitoring the environment inside the poly house, we are using various sensors like DHT11, soil moisture measuring sensor and LDR, which measures the temperature, humidity, soil moisture level and light intensity respectively.
Following images shows the actual result of the implementation done using this sensors:

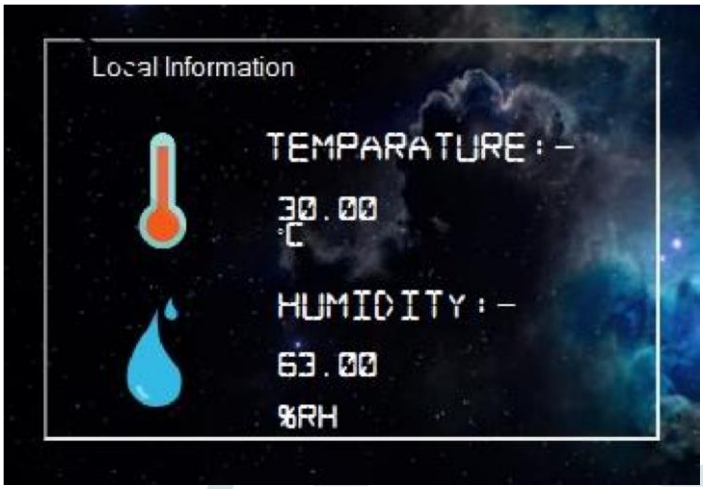

Figure 1. Temperature and Humidity sensors

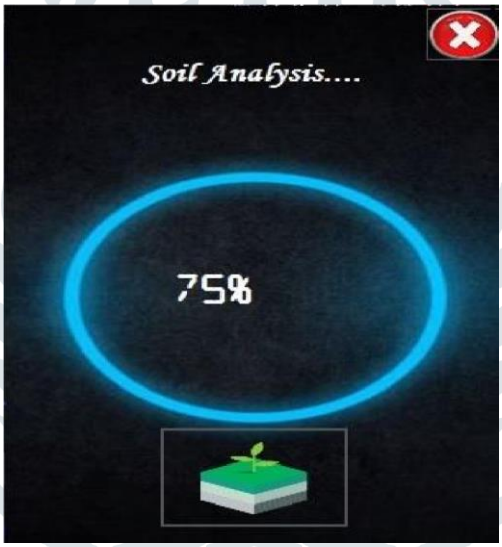

Figure 2. Soil Analysis

IV. WORKING OF NDVI:

For detecting the diseases happened to plants, we are using NDVI algorithm. Normalized Difference Vegetation Index (NDVI) works by estimating the distinction between close infrared (which vegetation emphatically reflects) and red light (which vegetation ingests). NVDI dependably goes from - 1 to +1. But there isn't particular limit for each sort of land spread. For example, when you have negative qualities almost certainly, it's water. Then again, on the off chance that you have a NDVI esteems near +1, there's a high plausibility that it's thick green leaves. But when NDVI is near zero, there isn't green leaves and it could even be a metropolitan territory.

How do you figure NDVI?

As shown below, Normalized Difference Vegetation Index(NDVI) uses the NIR and red channel in formula.

$$NDVI = \frac{(NIR-RGB)}{(NIR+RGB)}$$

Solid vegetation (chlorophyll) reflects increasingly close infrared (NIR) and green light contrasted with other wavelengths. But it assimilates progressively red and blue light. This is the reason our eyes consider vegetation to be shading green. In the event that you could see close infrared, at that point it would be solid for vegetation as well. Satellite sensors like Landsat and Sentinel-2 both have the fundamental groups with NIR and red.

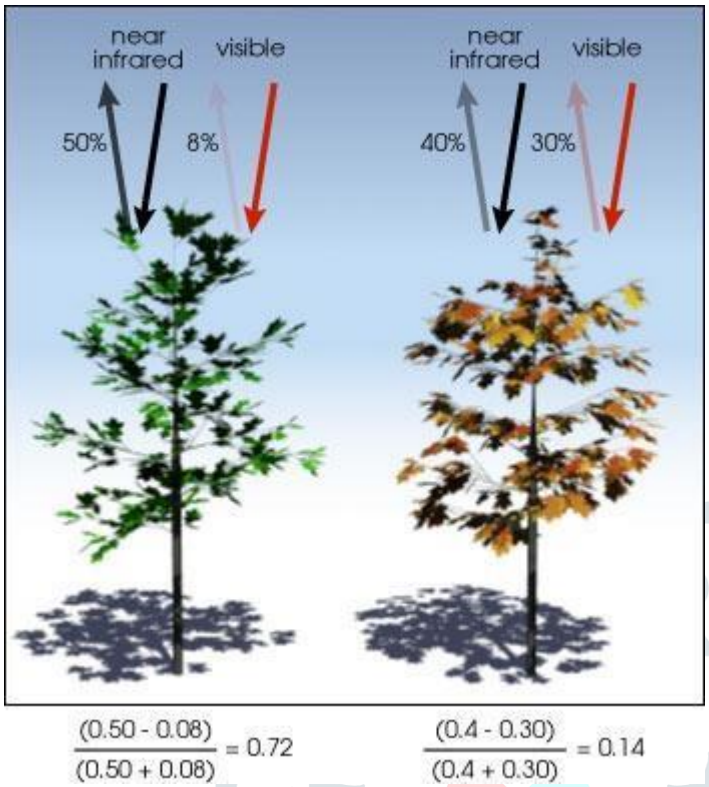

Figure 3. NIR

The aftereffect of equation produces an incentive between - 1 and +1. On the off chance that you have low reflectance (or low qualities) in the NIR channel, this will deliver a high NDVI qualities and vice versa. Overall NDVI is perfect approach to quantify solid vegetation. When you have high NDVI values you have more advantageous vegetation.
When you have low NDVI, you have less or no vegetation.
Following diagram shows the color ratio for different kind of leaves:

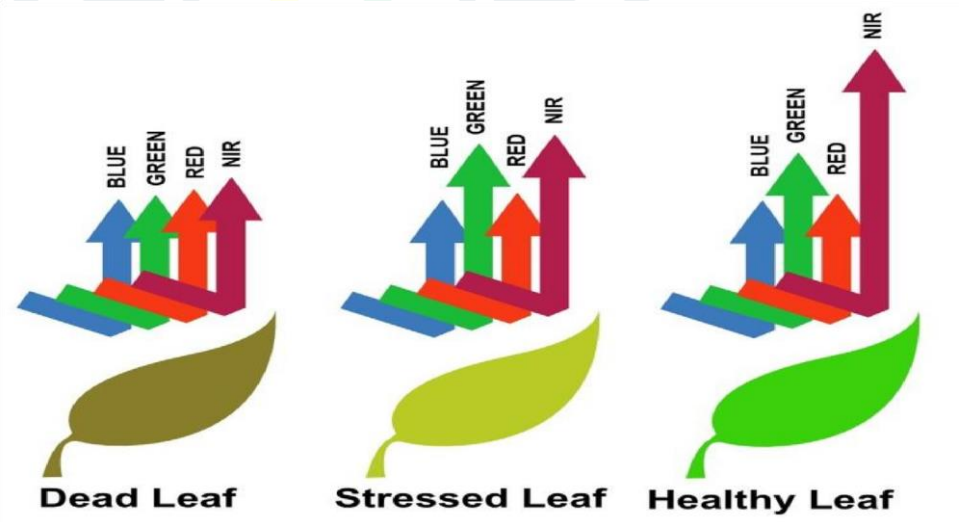

Figure 4. Color Ratio

NDVI EXAMPLE FOR AGRICULTURE

Let`s inspect NDVI for horticultural zone with focus turn water system. Turn water system pivots on a point making a roundabout yield design

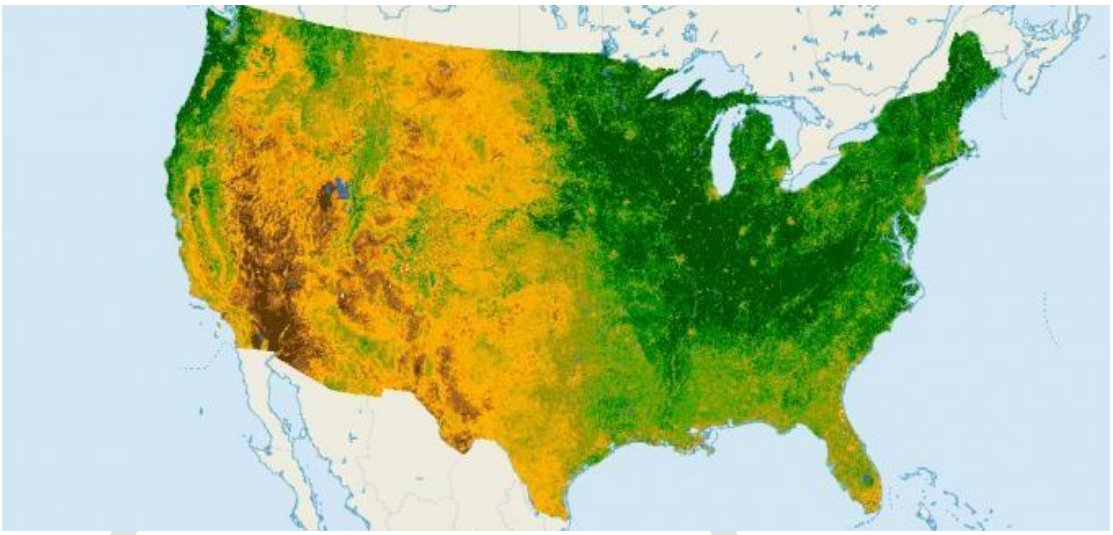

Figure 5. Affected Area

V. CONCLUSION AND FUTURE WORK

Using automation in poly house helps in various ways to farmers. It reduces the time, manpower and work complexity to minimum. Using NDVI for plant disease detection, helps to find the diseases effectively. It helps in improving the cultivation technique, and also reduces the loss.
In future, we aim to develop android application for the same. So that it will be convenient for the user to monitor the poly house.

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