# A Smart Solution for Plant Disease Detection Based on IoT

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***Abstract* — In human life, agriculture plays a key role. Nearly 60% of the population engages in certain agricultural practices directly or indirectly. Nowadays, however, farmers have stopped farming and migrated to other sectors because of less automation adoption and other factors such as increased demand for farm jobs. Farmers are therefore now increasingly dependent on the introduction of cognitive alternatives to take advantage of technological change. In the field of smart accurate farming, Arduino and the Internet of Things together build new dimensions. This proposed approach aims to develop a method of detecting plant conditions based on a TCS3200 colour sensor, Temperature and Humidity by DHT11 sensor as well as a Soil Moisture sensor for the application of soil. The method blends IoT with Arduino, considering various features such as colour, soil humidity, temperature, and various sensors to help recognize leaf disease in plants.**

***Keywords — Arduino, IoT, Plant leaf disease detection***

## I. INTRODUCTION

From the advancement of agriculture to the improvement of yields, mechanical and compound advances have been made to recognize, examines, and data about the plant infections and condition in the cultivation area. Be that as it may, digitization in this field has been pretty much the equivalent. With the ascent of IoT, it is planned to make a computerized framework for agribusiness that will empower the rancher to make informed current condition information regarding his farm and to determine wrong circumstances ahead of time. Hence, it will help improve the nature of the plant and will likewise profit the farmers. Early recognition of sicknesses and condition measure is a significant test in the farming area.

Plant disease identification is very important for the normal state of a plant that interrupts or modifies its vital functions. Plant disease identification of affected plants is one of the first steps in diagnosing a plant's disease. Agriculture productivity and economy mostly depend on identifying plant diseases. Plant disease identification roles are a very important role in the agriculture field. If proper care is not taken in this plant or area it causes serious effects on plants and due to which respective product quality or productivity is affected. And detection of plant disease beneficial as it reduces a large work of monitoring in big farms of crops, and at a very early stage itself, it detects the symptoms of diseases.

Much difficult to analyze and inform the farmer regarding the plant conditions Thus, this process is not known to every farmer and the specialists must bear a huge cost and it takes a long time. In one of the researcher, has [1] introduced IoT application to checking plant illnesses and creepy crawly bothers. IoT innovation to percept data, and the function of the IoT innovation in horticultural sickness and bug control, which incorporates farming illness and creepy crawly bother checking framework, gathering infection and bug data utilizing sensor hubs, information preparing and mining. The current study also focused on integrating sensor monitoring methods with IoT.

The scientist [2] proposed philosophy includes decreased computational unpredictability and focuses on bother discovery in a nursery climate as well as in a ranch climate also. The whitefly, a bio-attacker which represents a danger to a huge number of yields, was picked as the bug of interest. Another researcher[3] introduced bug control in agrarian estates utilizing picture handling methods in MATLAB.

This is achieved by interconnecting various sensors to the Arduino module. Various sensors are used to measure parameters such as soil moisture, temperature, and humidity to prevent severe loss in agriculture and contribute to the productivity of the farm. The website is designed to identify the current condition. However, mordent agricultural technology mainly focuses and hopes to achieve a profitable economy, and a better harvest [1].

The paper is organized in five sections II gives the project objectives. III mentioned the proposed methodology. Section IV describes results and discussions. Finally, Section V gives conclusions of the work.

## II. OBJECTIVES

This research focuses on identifying current cultivation and smart greenhouse conditions detection mechanism using IoT. Variety of soil condition and crop infections and the changing temperature and humidity condition tend to reduce the healthy plants. Hence, the proposed system presents a method to detect the condition in the early stage and warn the farmers on the same.

## III. METHODOLOGY

The proposed system will be trying to detect conditions from plant and greenhouse. The information gathers from plant and greenhouse cultivation current ecologic variables like temperature, soil moisture, Humidity, and Plant color [4].

- Temperature, Humidity values are detected by a DHT11 sensor. DHT11 is ultra-simplicity propelled suddenness sensor. Soil Moisture detected to use Soil Moisture sensor. The TCS3200 color sensor used to detect Plant leaves colors. The sensor consists of a solitary solid CMOS incorporated circuit.
- All sensors and Programs are installed in NodeMCU Module. It is work as a Wi-Fi shield to send the information cloud stage to detect and analysis plant condition.



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- Finally, sensor data values retrieve VB.Net plant disease application.

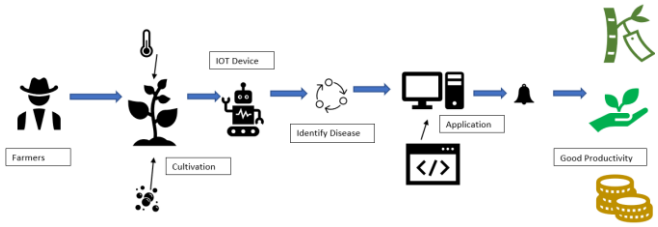


Fig. 1 Block Diagram of Proposed Approach

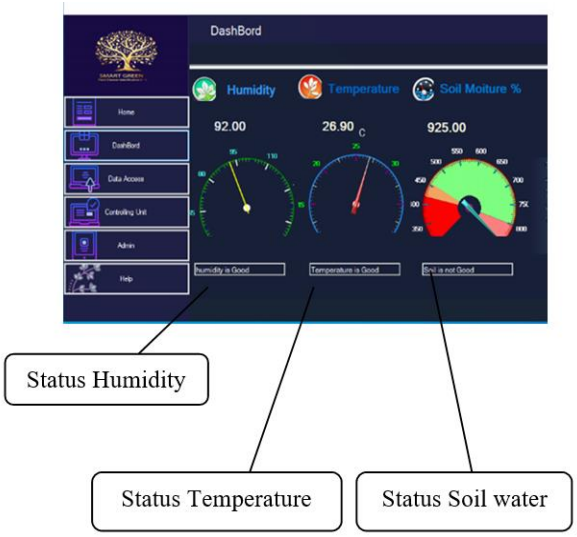


Fig. 2 UI of Web Application

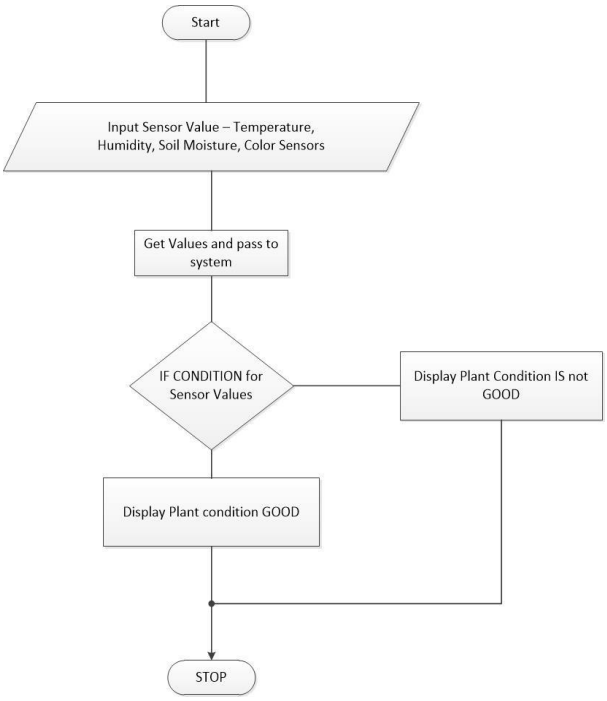


Fig. 3 Identify Cultivation Humidity, Temperature, and Soil Moisture

## IV. RESULTS AND DISCUSSION

The proposed system we have taken into consideration the identification of plant conditions in cultivation. It is easy to see the difference between normal and affected foliage based on temperature, humidity and Soil Moisture. Table 1 shows the ranges of sensor values related to identifying healthy plants.

We have collected 100 sample leaves out of which 50 samples are normal and 50 samples are diseased. Initially, the standard values of healthy leaves are stored in the database. Then we took the healthy leaves from the samples and tested them in the software to check the system accuracy.

Table 1 Sensor Values

| | |
|---|---|
| Temperature sensor values | 40c Up = Diseased |
| | 40c Low = Healthy |
| Humidity Sensor Values | 90% Up = Diseased |
| | 90% Low = Healthy |
| Soil Moisture | 450 ≥ Moisture ≥ 800 = Diseased |
| | 450 ≤ Moisture ≤ 800 = Healthy |

CP-Correct Predicted UP -Unexpected Predicted

$$\text{Accuracy} = \frac{CP}{CP + UP}$$

Equation 1 Formular of Accuracy

In our system, we considered two values for the analysis of the result, namely CP (Correct Predicted) and UP (Unexpected Predicted). Using the temperature sensor gives an accuracy of 88%, using a humidity sensor 82% and 85 % using a soil moisture sensor, respectively.

Fig. 4 Laboratory Testing

The Concept of identification of plant disease on plant leaves by utilizing temperature sensors is provided in Algorithm 1.

*Start*

*Input temperature and Humidity*

*Input Color sensor value*

*If (min humidity<humidity<max humidity)*

*Display "plant is Normal"*

*Else*

*Display "plant is Diseased"*

*If (min Temperature<Temperature<max Temperature)*


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*Display " plant is Normal"*

*Else*

*Display "Plant is Diseased"*

*Stop*

The notion of identification of plant disease on plant leaves to use the Humidity sensor is given in Algorithm 2.

```
Input Soil Moisture
  if (450 ≤ Moisture ≤ 800)
  {
    Display "Plant is Normal"
  } else
    {
      Display "Plant is Diseased"

    }
```

## V. CONCLUSION

A framework for monitoring the efficiency of the sheets is established throughout this work. The proposed methodology uses sensor devices to detect temperature, humidity, and soil moisture parameters of the leaves, which are then compared with a data set to verify that the collected values fall within the range defined in the dataset. Farmers, industrialists, botanists, food engineers and physicians will use the proposed model in various fields.

Future enhancements regarding our proposed system will be implementing the scheme using appropriate IoT devices, hardware, and cloud. It is also planned to develop an advance web app to convey information about the plant condition to the farmers, in their local language (Sinhala). This system will benefit the farmers to increase their profit and improve their living condition.

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