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Identification of Plant Condition Using Arduino

[1]K.Kalyani, [2]Y.Madhubala, [3]Vavitikalva Palakonda Rayudu, [4]M.Srinivasulu, [5]Pulagam Venu Gopal Reddy
[1]Assistant Professor, Department of ECE, Annamacharya Institute of Technology and Sciences, Tirupati, A.P.
[2,3,4,5]B.Tech Student, Department of ECE,Annamacharya Institute of Technology and Sciences, Tirupati, A.P.

Abstract- In this paper an automated system has been developed to determine whether the plant is normal or diseased. The normal growth of the plants, yield and quality of agricultural products is seriously affected by plant disease. This paper attempts to develop an automated system that detects the presence of disease in the plants. An automated disease detection system is developed using sensors like temperature, humidity and colour based on variation in plant leaf health condition. The values based on temperature, humidity and colour parameters are used to identify presence of plant disease.
***Keywords**:* Arduino, DHT11 Sensor ,ESP8266

I. INTRODUCTION

India is a land of agriculture. Two-third of population depends upon agriculture for their livelihood. It is the basic foundation of economic development of the country. Plant health condition plays a vital role to earn good yield for the farmers. Often monitoring of plant condition is required at different stages of plant growth in order to prevent infections affecting plants. Present day system depends on naked eye observation which is a time consuming process.
Automatic detection of plant disease can be adopted to detect plant disease at early stages. Various disease management strategies have been used by farmers at regular intervals in order to prevent plant diseases. Some of the sample images of disease affecting plant leaves are shown in the Figure.1.

Fig 1:Plant Infection

The Internet of Things (IoT) is the connectivity of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors. The demand for more food has to be met against the challenges such as intense weather conditions and exhaustive farming practices. Smart farming based on IoT technologies enhances crop production in farming industry. Detection of diseases in the plant is utmost need for farmers and agricultural experts. The main aim of the proposed system is to detect plant diseases using IoT. Hence, in the proposed work we have considered detection of plant disease present on leaves. The discrimination of normal and affected plant leaf can be measured based on variation in temperature, humidity and colour.

II. LITERATURE REVIEW

The following papers have been cited during the literature survey to understand the different applications of computer systems in allied areas of the present work carried out.[2] (Mark Seelye et al., 2011) have presented low cost colour sensors for monitoring plant growth in a laboratory. An automated system for measuring plant leaf colour is developed to check plant health status. (Sushma R. Huddar et al., 2012) have presented novel algorithm for segmentation and automatic identification of pests on plants using image processing. The proposed methodology involves reduced computational complexity and aims at pest detection not only in a greenhouse environment but also

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in a farm environment as well. The whitefly, a bio-aggressor which poses a threat to a multitude of crops, was chosen as the pest of interest in this paper. The algorithm was tested for several whiteflies affecting different leaves and an accuracy of 96% of whitefly detection was achieved. [7](Murali Krishnan and Jabert.G, 2013) have presented pest control in agricultural plantations using image processing techniques in MATLAB. Images are then subjected to pre-processing, transformation and clustering. [1](Prof. S. G. Galande, et al., 2015) have presented IoT Implementation for wireless monitoring of agricultural parameters. Wireless system is developed to monitor environmental conditions in agriculture field like temperature, soil pH, soil wet level and humidness beside leaf diseases detection. (Yun Shi et al., 2015) have presented IoT application to monitoring plant diseases and insect pests. IoT technology to percept information, and the role of the IoT technology in agricultural disease and insect pest control, which includes agricultural disease and insect pest monitoring system, collecting disease and insect pest information using sensor nodes, data processing and mining, etc have been described in this paper. [9](Nimish Gopal, 2016) have presented micro-controller based auto-irrigation and pest detection using image processing. The technique of image analysis is extensively applied to agriculture science to provide maximum protection to crops which can ultimately lead to better crop management and production. [8](S. Gavaskar and A. Sumitra, 2017) have presented design and development of pest monitoring system for implementing precision agriculture using IoT.

III. PROPOSED METHOD

The proposed system consists of temperature, humidity, and colour sensors for collecting data from plant leaves based on variation in temperature, humidity and colour of plant leaves. The data collected from the leaves consists of current environmental factors like temperature, humidity and colour. The changes that a plant undergoes are captured by the temperature humidity and colour sensors and analysed with the Arduino software. The data collected from temperature, humidity and colour sensors are given to Arduino UNO kit from which the information is communicated to the farmers. The system makes use of Wi-Fi shield in order to send the data from the host system to the cloud platform for analysis. The cloud platform that we have used is the www.thingspeak.com. The collected data in the cloud platform is then compared with the dataset in order to detect whether the leaf under consideration is normal or affected. The Figure.2 shows schematic diagram of the proposed work.

- Data acquisition: Here we take samples of different leaves as the input. These leaves are then sensed by the sensors to determine different parameters based on which it is recognized to be healthy or diseased.
- Temperature sensors: The DHT11 is a basic, ultra low-cost digital temperature sensor. It 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). We use the DHT11 to sense the temperature on the surface of leaf to determine whether it is healthy or diseased. • Humidity sensor: The DHT11 is a basic, ultra low-cost digital humidity sensor. It 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). We use the DHT11 to sense the humidity on the surface of leaf to determine whether it is healthy or diseased.

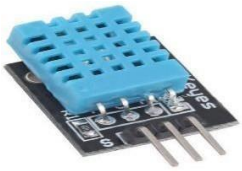

Fig2:DHT11 SENSOR

- Colour Sensor: The TCS3200 is a

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programmable colour light-to-frequency converter/sensor. The sensor is a single monolithic CMOS integrated circuit that combines a configurable silicon photodiode and a current-to frequency converter. The output is a square wave (50% duty cycle) with frequency directly proportional to light intensity (irradiance). We use the DHT11 to sense the colour of leaf to determine whether it is healthy or diseased.

Fig3:TCS3200 Sensor

• Arduino: The Arduino UNO is a widely used open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.] The board features 14 Digital pins and 6 Analog pins.

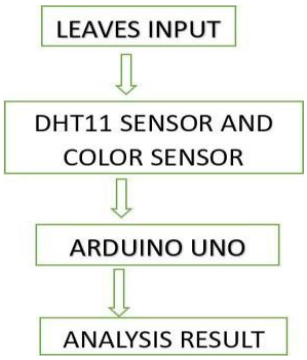

Fig 4:Proposed work

3.1 Identification of Plant Disease Using Temperature Sensor

The pigments in leaves are responsible for the colour changes in the fall. Temperature, sunlight and soil moisture all play a role in how the leaves will look in the fall. Abundant sunlight and low temperatures after the abscission layer forms cause the chlorophyll to be destroyed more rapidly. We have used DHT11 temperature sensor. The DHT11 sensor senses the temperature of the leaf under consideration. The parameters that are collected from the sensor are sent to the Application interface through the Wi-Fi shield connected to the Arduino UNO board. We initially record the range of the temperature of a healthy leaf. Later, if the temperature of the leaf under consideration does not fall into that range, then the leaf is said to be diseased.

3.2 Identification of Plant Disease Using Humidity Sensor:

As plants transpire, the humidity around saturates leaves with water vapour. When relative humidity levels are too high or there is a lack of air circulation, a plant cannot make water evaporate (part of the transpiration process) or draw nutrients from the soil. When this occurs for a prolonged period, a plant eventually rots. When surrounded by warm temperatures in low relative humidity levels, transpiration rates in a plant increase, reducing the need for a grower to fertilize it. We have used DHT11 humidity sensor. We have considered samples of both normal and affected leaves. The concept of identification of plant disease on plant leaves using Humidity sensor .

3.3 Identification of Plant Disease Using Colour Sensor:

Changes in the colour of plant tissue are a common symptom of plant disease. Often these colour changes are brought about by the yellowing of normal green tissue due to the destruction of chlorophyll or a failure to form chlorophyll. Such repression of leaf colour may be complete or partial.

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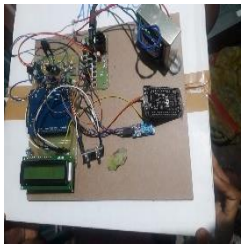
The colour sensor senses the colour of the leaf under consideration which is another parameter that is being used to determine whether the leaf is either diseased or healthy. The sensor records values for, "RED", "Green" and "Blue" value of the leaf. We have used TCS3200 RGB colour sensor. The colour values that are recorded for the leaf are then sent to the cloud platform by the Arduino board for analysis. Later the obtained values of RGB are compared with the threshold value in dataset to determine whether the leaf is healthy or diseased. The concept of identification of plant disease on plant leaves using colour sensor.

IV RESULTS AND DISCUSSIONS

We have collected 10 sample leaves out of which 50 samples are normal and 5 samples are diseased. The images of the leaves collected are presented in the report. Then we took the healthy leaves from the samples and tested them in the software to check the system accuracy. The Table.1 gives values obtained using temperature sensor based on which healthy or diseased leaves are identified.

Table 1: Temperature Sensor Values

Leaf	Minimum Temperature in Degree Celsius	Maximum Temperature in Degree Celsius	Obtained Temperature in Degree Celsius	Healthy Or Diseased
1	20	30	47	Diseased
2	20	35	31	Healthy
3	23	35	49	Diseased
4	22	36	56	Diseased
5	21	35	26	Healthy



V CONCLUSION

In this work, a system is developed to determine to the quality of the leaves. The proposed method uses the sensor devices to detect the parameters like temperature, humidity and colour of the leaves, which are then compared with the dataset to check whether the collected values falls in to the range specified in the dataset. The proposed model can be used in different areas by farmers, industrialists, botanists, food engineers and physicians. Here we can build an automated system so that it is useful for the large scale production and also helps in early detection of the diseases that helps the clients for the better performance and enhances the crop yield. The proposed system is limited to only detect whether the leaf under consideration is healthy or diseased. This can be further carried out for even recognizing the kind of diseases in the leaves and classification of those diseases. We have limited our work to only to the temperature, humidity and colour parameters of the leaves. This can be further enhanced by applying other sensors and combining with image processing concepts. The other

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limitation is that the determined values for the considered parameters are not precise. We have taken the range of values for those parameters and the range may vary based on the climatic conditions.

VI FUTURE SCOPE

The Future scope is that device has constrained our work to just to the temperature, mugginess and shading parameters of the leaves. This can be additionally upgraded by applying different sensors and consolidating with picture preparing ideas. The other confinement is that the decided qualities for the considered parameters are not exact. We have taken the scope of qualities for those parameters and the range may fluctuate dependent on the climatic conditions.

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