

# Plant Nurturing and Disease Detection System

Jaishri Sahebrao Gite<sup>1</sup>, H. V. Dhande<sup>2</sup>, M. N. Patil<sup>3</sup>, H. T. Ingale<sup>4</sup>, A. D. Vishwakarma<sup>5</sup>,  
Shafeeque-Ur-Rehman<sup>5</sup>

<sup>1</sup>PG student, VLSI & ESD. <sup>5</sup>Asso. Prof., <sup>2,3,4,6</sup>Asstt. Professor  
<sup>1,2,3,4,5,6</sup>E&TC Engg dept, GF's Godavari College of Engineering, Jalgaon, India, 425003,

*jayashree.gite@gmail.com*<sup>1</sup>    *hemraj99@gmail.com*<sup>2</sup>    *anil\_karma@yahoo.com*<sup>3</sup>

**Received on:** 20April,2023,

**Revised on:** 21 May,2023

**Published on:** 23May,2023

**Abstract** -This system has developed an automated system 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 plants. An automated disease detection system is developed using sensors like temperature, humidity and color based on plant leaf's health conditions variations. The values based on temperature, humidity and color parameters are used to identify the presence of plant disease.

**Keywords-** Plant, detection, sensor, temperature, humidity, color.

## I- INTRODUCTION

India is a land of agriculture. Two-third of population relies upon agriculture for their livelihood. It is the basic foundation of economic development of the country. The agriculture also provides employment opportunities to very large percentage of population. Plant health condition plays a vital role to earn good profit for the farmers. Proper monitoring of plant health is required at

different stages of plant growth in order to prevent disease affecting plants. Existence of pests and disease affect the estimation of crop cultivation and minimizes crop yield substantially. 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. In the present work, this issue is addressed using sensor based technology. This being the motivation, the problem entitled "Leaf Disease Detection using IoT is proposed to assist the farmers technologically. In the proposed work, focus has been on early detection of disease infection on plant leaves.

## II- LITERATURE REVIEW

The relationship between the plants and the environment is multitudinous and complex. They help in nourishing the atmosphere with diverse elements. The relationship between the plants and the environment is multitudinous and complex. They help in nourishing the atmosphere with diverse elements. Plants are also a substantial element in regulating carbon emission and climate change. But in the past, we have destroyed them without

hesitation. For the reason that not only we have lost a number of species located in them, but also a severe result has also been encountered in the form of climate change. However, if we choose to give them time and space, plants have an astonishing ability to recover and re-cloth the earth with varied plants and species that we have, so recently, stormed. Therefore, a contribution has been made in this article towards the study of plant growth and its management. Twelve economically and environmentally beneficial plants have been selected for this purpose. Leaf images of these plants in healthy and unhealthy conditions have been acquired and alienated among two separate classes. We have collected about 4503 images of which contain 2278 images of healthy leaf and 2225 images of the diseased leaf. Further, we hope that this study can be beneficial for researchers and academicians in developing methods for plant identification, plant classification, plant growth monitoring, leaf disease diagnosis, etc. Finally, the anticipated impression is towards a better understanding of the plants to be planted and their appropriate management [1].

Agricultural productivity has a vital role in the Indian economy, but it is seriously hampered by pests and plant diseases. Neural networks have been a major step forward in the, Agricultural productivity has a vital role in the Indian economy, but it is seriously hampered by pests and plant diseases. Neural networks have been a major step forward in solving this problem in the past two decades. However, the existing systems in place are computation-heavy and costly to implement. Such tasks also ideally require a dataset of leaf images that simulates real environment conditions, which is hard to find. The motivation of this paper therefore is to solve all these issues by building a light-weight and cost efficient deep learning architecture with the proposed DenseNet-121 model that classifies leaf images from a dataset called 'Plant Doc' across 28 classes with 1874 training images and 468 validation images. A separate test dataset is held out only for checking model performance on unknown data. Implementation is done using Fastai framework, because of its faster computational power, easy workflow and unique data cleaning functionalities. Overall, the classification accuracy achieved is 92.5% [2].

Focusing on the effect of universal food insecurity, over 60% of sub-Saharan countries are predicted to be in a state of malnourishment and yet several farming places are under drought state. The climatic condition is

believed to be biannual dry seasons which is very difficult for farmers to cultivate crops due to shortage of water and poor soil fertility. Yet heavy rainfall is still a great threat for the farmers since it devastates cash crops. The use of a smart greenhouse with Artificial Intelligence to grow and protect plants in both dry and wet seasons and reduce labor-intensive human tasks and automate pervasive data analytics of daily plant status can surprisingly boost food security. Here we present a fully automated greenhouse system with artificial intelligence embedded in it that uses around 10,000 plant images in it that initially nurture plants under optimum atmospheric conditions by taking real-time decisions, detecting any kind of illness, and interestingly notifying the stage of fruit ripeness. By implementing a neural network-based computer vision approach we were able to keep track of the health status of the plants caused by several microorganisms. The obtained predictions and results accurately verify how machine learning can be used to increase gross national food security by implementing such systems in multiple farming areas without prior human involvement [3].

The impact of rice plant diseases has led to a 37% annual drop in rice production. It may happen basically due to the lack of knowledge in identifying and controlling rice plant diseases, but still there isn't any proper application has been developed which is capable enough to identify these rice plant diseases accurately and control those diseases. In order to identify rice plant disease by an application itself, Convolutional Neural Networks (CNN) can be used. Many of researchers have used CNNs for plant disease identification because of their accuracy in image identification and classification. But, there's still a handful researches have been conducted regarding the identification of rice plant diseases. This study provides a comprehensive understanding of current rice plant illnesses as well as the Deep Learning approaches used to detect such diseases. It also analyzes several kinds of techniques that have been employed in the literature by analyzing all of them with their benefits and drawbacks. It has discovered the most accurate ways in all levels of the image identification procedure as a consequence of this research, that will be valuable in recognizing rice plant illnesses [4].

Crop cultivation is one of the prime sources which determines a nation's prosperity and economic growth. But most of the farmers face difficulties to survive due to lack Crop cultivation is one of the prime sources which determines a nation's prosperity and economic

growth. But most of the farmers face difficulties to survive due to lack of enough labors, inappropriate and traditional methods followed to monitor agricultural fields and plant growth etc. As technology has evolved, it is possible to automate the various phases of farming activities. There are many standard sensors available to remotely monitor the soil moisture content, pH content, fire detection in the field, intruder detection etc. All these sensors sense the information and is fed to a central coordinator which will process the data and initiate necessary actions. All these are done over internet and thus the concept can be called as Smart farming using Internet of Things. It is also possible to analyse the image of plant leaf to identify the various plant dis-eases with the help of Machine Vision. Our model thus reduces the farmer's overhead using IoT and computational intelligence [5].

In India agriculture is the main source of income for generating the economy. Diseases in plants are a major unavoidable problem, and hence detecting the diseases is the necessity of the day in the domain of agriculture. The main diseases found in tomato plants are viral, fungus and bacterial diseases. The detection will help improve the quantity and quality of the products with an optimum yield. In this paper a comparative analysis is carried out for the algorithms Support Vector Machine, Convolution Neural Networks, Decision tree classifier, and k-Nearest Neighbour (k-NN) with the result of 97%,97%,90% and 80% respectively[6].

The Food and Agriculture Organization of the United Nations (FAO) reports that up to 40% of global crop production is lost annually due to weeds, pests, and diseases, and these losses could worsen without proper pest and disease management (OECD/FAO, 2012). Conventional approaches to pest monitoring and management are insufficient in meeting present demands in terms of efficiency, coverage, and cost-effectiveness. (Wolff et al., 2016). To address this issue, the development of smart pest control technology (Kanwal et al., 2022), the improvement of agricultural pest control systems, and stronger regulation of foreign species are demanded to collect pest outbreak data in a timely, accurate, and comprehensive manner. In the future, the focus of agricultural pest control will be on developing the fundamental theories, key technologies, and major products and equipment of "preventable," "controllable," "treatable," and "green" pest control throughout the process [7].

Powdery mildew is one of the major diseases of facilities vegetables, In order to achieve Early, fast, and accurate diagnosis of powdery mildew, with TCS3200 color sensor and Infrared sensor as detecting port and 12864 dot matrix LCD as display, the system explores the external change such as the color change of the blade in health and disease Stage and change of reflection spectra. Through tracking experiment of different stages of cucumber leaves infected, the results show that the system can identify change of optical frequency values and the RGB values in the health cucumber leaves and infected Cucumber leaves and thus provides effective warning alarm for controlling early disease occurrence[8].

Agriculture plays a vital role in the economic growth of any country. With the increase of population, frequent changes in climatic conditions and limited resources, agriculture plays a vital role in the economic growth of any country. With the increase of population, frequent changes in climatic conditions and limited resources, it becomes a challenging task to fulfil the food requirement of the present population. Precision agriculture also known as smart farming have emerged as an innovative tool to address current challenges in agricultural sustainability. The mechanism that drives this cutting edge technology is machine learning (ML). It gives the machine ability to learn without being explicitly programmed. ML together with IoT (Internet of Things) enabled farm machinery are key components of the next agriculture revolution. In this article, authors present a systematic review of ML applications in the field of agriculture. The areas that are focused are prediction of soil parameters such as organic carbon and moisture content, crop yield prediction, disease and weed detection in crops and species detection. ML with computer vision are reviewed for the classification of a different set of crop images in order to monitor the crop quality and yield assessment. This approach can be integrated for enhanced livestock production by predicting fertility patterns, diagnosing eating disorders, cattle behavior based on ML models using data collected by collar sensors, etc. Intelligent irrigation which includes drip irrigation and intelligent harvesting techniques are also reviewed that reduces human labor to a great extent. This article demonstrates how knowledge-based agriculture can improve the sustainable productivity and quality of the product 9].

Cassava is an important Thai industrial crop. Thailand is a leader in cassava production; therefore, the large

volume of cassava has been produced and exported from Thailand. However, cassava disease is the main factor to reduce cassava production and directly affects farmers' income. In this study, we aimed to introduce a novel method to automatic cassava disease classification by using deep learning algorithms. An input data was a collection of cassava leaves images containing five different classes, i.e., healthy, Cassava brown streak virus disease (cbsd), Cassava Bacterial Blight (cbb), Cassava green mite (cgm) and Cassava mosaic disease (cmd). Notwithstanding, we focused on the cbsd only in this study forasmuch as this disease has a high impact on the production. We conducted an experiment to evaluate method performance. Our system provided reasonable performance. The accuracy and Fmeasure of the system were 0.96. This is evidence that our system is applicable to efficiently classify the cassava diseases automatically. In future works, we will investigate an appropriate solution to classify other diseases of cassava [10].

Indian economy is dependent on Agriculture, which includes growing certain plants for food and numerous other wanted items as well as nurturing of domestic animals. Nutrients have a significant job in crop production and farming. Harvest yields is decreasing continuously. There are number of explanations behind this diminishing of harvest yield. Nutrient deficiency is one such factor included. The proper and timely finding of nutrient insufficiency and suitable fertilizer for that insufficiency are the serious issues looked by growers. Subsequently, so as to improve productivity, a consistent checking framework for following the nutrient status in plants is required for increasing the quality pf yield as well as production. Different frameworks using digital image processing, computer vision, IOT are used to analyze the deficiency side effects a lot sooner than natural eyes could perceive. This empowers the farmers to implement remedial activity in time. This paper concentrates on the review of different techniques for diagnosing nutrient deficiency in plants [11].

**2.1 Problem Statement**

Plant diseases seriously affect the normal growth of plants, the yield and quality of agricultural products. In recent years, with the dramatic changes in climate, the natural environment of the plant growth has been damaged by pollution, frequent natural disasters, as well as the development of agricultural production. From the literature survey presented above, it is observed that the work on plant disease detection using IoT reported in the literature is scarce.

**III -METHODOLOGY**

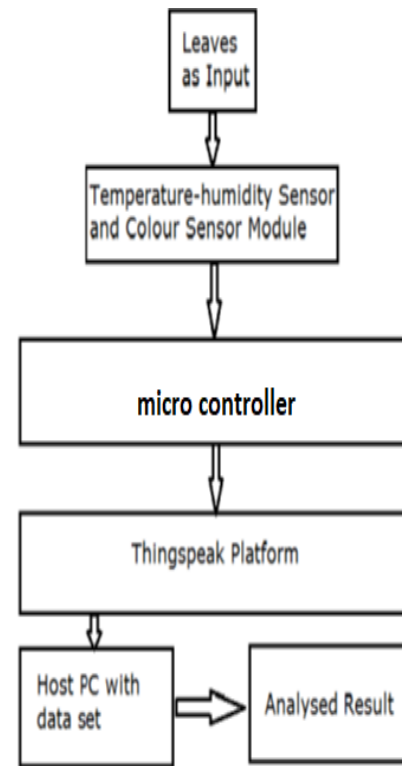


Fig (3.1.1) System block diagram

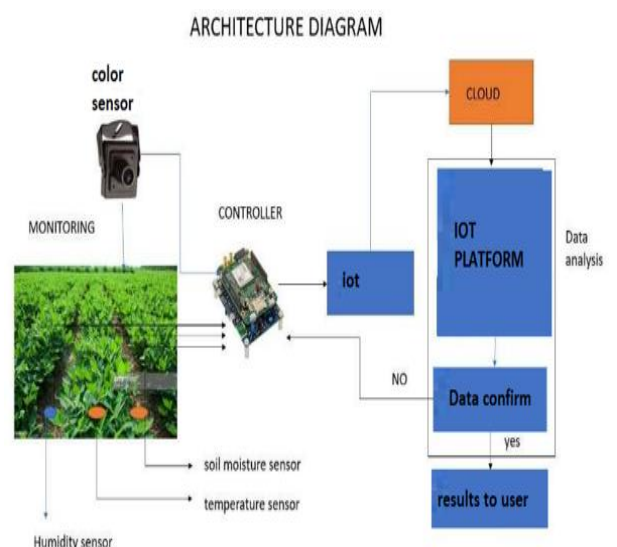


Fig (3.1.2) Architecture of the system

### 3.1.1 Temperature and Humidity 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 analogue input pins needed). We use the DHT11 to sense the temperature on the surface of leaf to determine whether it is healthy or diseased.

### 3.1.2 Colour Sensor:

The TCS3200 is a 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.

### 3.1.3 Microprocessor:

Raspberry Pi is a series of small single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools and in developing countries. The original model became more popular than anticipated, selling outside its target market for uses such as robotics. It is widely used in many areas, such as for weather monitoring,<sup>[19]</sup> because of its low cost, modularity, and open design. It is typically used by computer and electronic hobbyists, due to its adoption of the HDMI and USB standards.

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 1GB, 2GB, 4GB or 8GB LPDDR4-3200 SDRAM (depending on model)
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
- Gigabit Ethernet
- 2 USB 3.0 ports; 2 USB 2.0 ports.
- Raspberry Pi standard 40 pin GPIO header (fully backwards compatible with previous boards)

### 3.1.4 Power Supply:

For our all IC we require 5V D.C. supply which can be generated by step down transformer, full wave bridge rectifier, filter condenser & voltage regulator IC7805. 12V supply for relay is generated separately using the same procedure as above. This supply requirement can be fulfilled in our case using the battery back up and providing recharge facility to it.

## IV-RESULT & DISCUSSION

In this work, it is been concluded that plant disease detection is the technique to detect infected portion from the leaf. The plant disease detection consist of two steps, in the first step the image segmentation is done and in the second step technique of feature extraction and classification is applied which will classify diseases and normal portion in the image. In this paper, various techniques of plant disease detection is reviewed and discussed in terms of various parameters. Improvement in accuracy level for detecting plant diseases from images was achieved by applying this proposed technique The best average accuracy of 83.7% was achieved using the SURF features in the proposed work. Successful classification is achieved for different cases Algorithm was tested on five diseases on the plants- Early scorch, Cottony mold, ashen mold, late scorch, tiny whiteness. Precision between 83% and 94%, is achieved, The experimental results indicate that proposed Approach significantly enhances accuracy in automatic detection of normal and affected product. In this method different disease spots are detected accurately and results are not affected by background, type of leaf, type of disease spot and camera.

## VI. CONCLUSION

As we have studied recent development in the agriculture sector a good promising technologies are emerging in this segment in through a long evolvment. By reading and studying we have we come to a conclusion that we have explore this subject to help the farmers which directly and indirectly guide about the crop needs. Also, the early detection of any severe disease which harm the entire crop.

#### REFERENCES

- [1] *“A Data Repository of Leaf Images: Practice towards Plant Conservation with Plant Pathology”* by Siddharth Singh Chouhan ,Uday Pratap Singh, Ajay Kaul, Sanjeev Jain
- [2] *“Rice plant disease diagnosing using machine learning techniques: a comprehensive review”*by G. K. V. L. Udayananda, Chathurangi Shyalika & P. P. N. V. Kumara
- [3] *“an integrated framework for crop cultivation using Internet of things and computational Intelligence ”*by Pramod Mathew Jacob, Jeni Moni, Renju Rachel Varghese, K Akhila Sreenivas, D Saleema.
- [4] *” Machine Learning Applications for Precision Agriculture: A Comprehensive Review”*by Abhinav Sharma, Arpit Jain, Prateek Gupta, Vinay Chowdary
- [5] *”Editorial: Precision control technology and application in agricultural pest and disease control”* by yunchao tang, chao chen, Antonio candeia leite and ya xiong.