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Plant Disease Recognition using Artificial Intelligence

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Abstract— ***The project Plant Disease recognition using AI is made for the farmers to take care of their farms and fields and to help them by recommending and suggesting them a proper guideline for control measures to be taken. In this Project `Plant Disease Recognition using AI` we have focused on Detecting some plant diseases using Artificial Intelligence by using Various Algorithm like CNN Algorithm. We have used Hardware components like Sensors, Raspberry pi and ADC convertors and created a sort of hand-held device for taking readings from plants and by using face recognition algorithms like CNN and KNN algorithm we detect the disease by comparing the images from the standard images. In This project we have used Thinkspeak which represents the data from IOT in a pure database format so that the data can be easily analyzed by using various DBMS Techniques. After getting the data from Thinkspeak that data will be undergoing through the various algorithm that we have mentioned in the project which is performed at the backend. In the frontend for the results to be displayed for the user, we will be creating a dashboard which will inform the user about the various diseases that the plant/crop is undergoing. For that we will be using app developing methods like react.js, node.js, ML5.js, etc. We have used the TensorFlow which is one of the Machine Learning libraries for performing Machine Learning. IoT using Thinkspeak is used as this way we have combined all the software and the hardware aspects of our project to result into a hardcore product which would be very beneficial for the farmers of our country to take proper care of the crops and to take preventive measures so that there won 't be any loss to farmers. This project is aiming to make the farmer's life easy and better. The Sensor Programming is done in python and uploaded to the firebase.***

Keywords— *Plant Disease Recognition, Artificial Intelligence, CNN Algorithm, Sensor Programming*

1. INTRODUCTION

Plant diseases have turned into larger problems as it causes significant reduction in both quality and quantity of agricultural products eventually leading to loss in food and money. Potato Leaf pests and diseases affect food crops, causing significant losses to farmers and threatening food security. The spread of leaf diseases has increased dramatically in the recent years due to environmental pollution and many other causes. Following the discovery of the causes of plant diseases in the early nineteenth century, growing understanding of the interactions of the pathogen and host has enabled us to develop a wide array of measures for the control of specific plant diseases. From the advent of machine learning techniques, many people have tried and classified plant disease. The common diseases are fungal, Damping-off and root rot, Downy mildew, Fusarium wilt, White rust. They are being caused due to fungi. Disease emergence is favored by very wet weather; spores are spread by splashing water. Symptomatic plants are often found in low-lying areas of the field or garden where water accumulates, disease symptoms are similar to symptoms caused by over watering plants. The symptoms in white rust are due to yellow spots on upper side of leaves, clusters of white, blister-like pustules on underside of leaves which may spread to upper leaf surfaces in advanced stages infection, infected plants show a loss of vigor and collapse if conditions are favorable to rapid disease development The diseases that can be commonly affected in spinach are Downy Mildew, Anthracnose, Cladosporium Leaf spot, Stemphylium leaf spot, Damping off and root rot. The favorable conditions for spinach to be maintained are high humidity, high soil moisture, cloudiness and low temperatures below 24 degree Celsius for a few days are ideal.

2. PROBLEM STATEMENT

Plant diseases have turned into larger problems as it causes significant reduction in both quality and quantity of agricultural product. Different regions of the world are affected by different tomato, potato pathogens, and rates of infection are dependent on many factors, including temperature, humidity, varietal resistance, and plant health, to name just a few. About 30% of the crops die due to disease or due to dire conditions. The basic Idea is to give suggestions to the farmers so what can be done to save the plant.

3. IMPLEMENTATION

- Our Project helps in minimization of plant deaths by:
- Recognition of the plant disease,
- Monitoring the environment conditions around the plant
- Providing feedback to the user as what could be done in order to save the plant.
- All this uploaded on IOT platform and the WEB Application live.

The following figure (1.1) shows the steps the model follows to achieve/suggest plant condition and give feedback.

Figure (1.1)

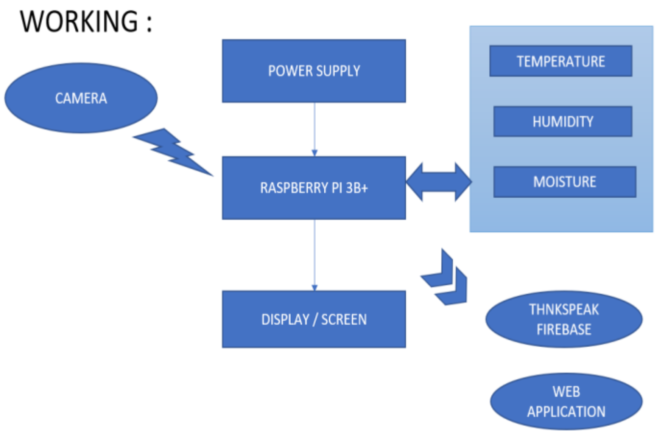


Fig. 3.2. Interfacing of circuit

The basic flow of the circuit connection goes as per the block diagram Though the project is more software oriented the system still has formidable hardware and it also must be rigid and strong enough to work in an industry under severe conditions. Our project involves six major hardware involved in this project which either involves measuring temperature or moisture content of the soil. The first major hardware component is the:

(a) Raspberry Pi is a series of small single-board computers we had the 3B+ Model with specifications of 1GB RAM, and internal Wi-Fi on board low in energy BCM43438 with full HDMI support to get the output on screen.

(b) ADC: This is mainly done to convert the analog to digital output form the Raspberry pi board to the digital values we use the MCP3008 which has a single supply operation: 2.7V - 5.5V and 200 ksps max. sampling rate at VDD = 5V also 75 ksps max. sampling rate at VDD = 2.7V made by Low power CMOS technology.

(c) Soil moisture sensors measure the volumetric water content in soil FC-28. Since the direct gravimetric measurement of free-soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

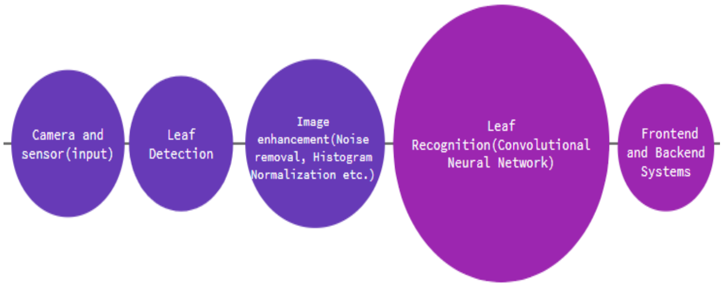
(d) Temperature Sensor: A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. We used the DHT11 /DHT22 which has Humidity Range: 20% to 90%and its Resolution is Temperature and Humidity both are 16-bitand most important is its Accuracy 1°C and ±1% and so.

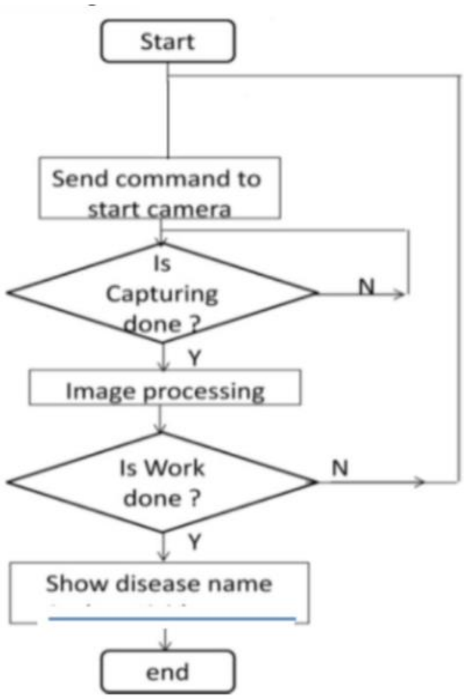
(e) As a final step of preprocessing the data we will split it into train and test set: The evaluation of a model skill on the training dataset would result in a biased score. Therefore, the model is evaluated on the held-out sample to give an unbiased estimate of model skill. This is typically called a train-test split approach to algorithm evaluation.

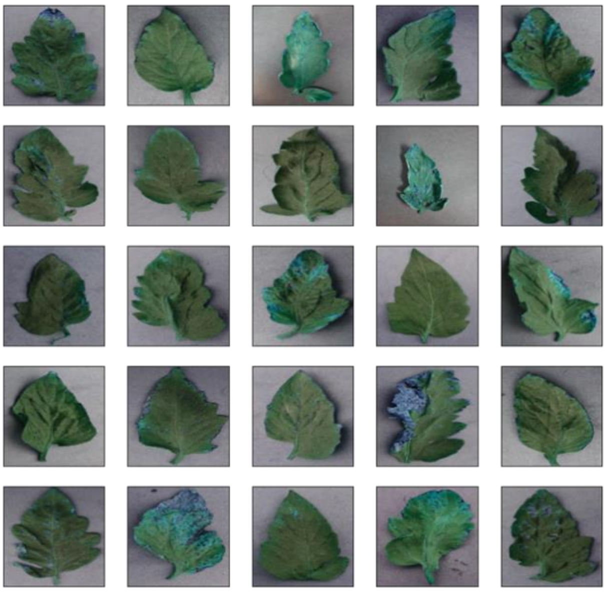
(f) Using Convolutional Neural Network: We have made use of the SciKit learn and the Keras library in our project of Plant Disease Recognition Using AI. We have considered the classification of 12 different diseases which are as follows:

- Pepper Bell Bacterial Spot
- Potato Early Blight
- Potato Late Blight
- Tomato Bacterial Spot
- Tomato Early Blight
- Tomato Late Blight

4. FLOWCHART







Training Model Leaves

5. RESULTS

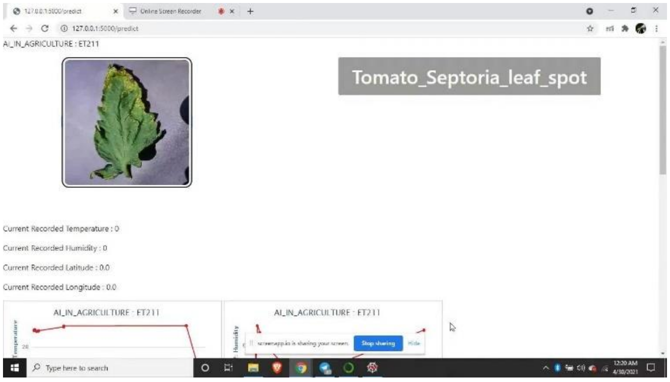


Fig 6.1 Plant Disease Identified

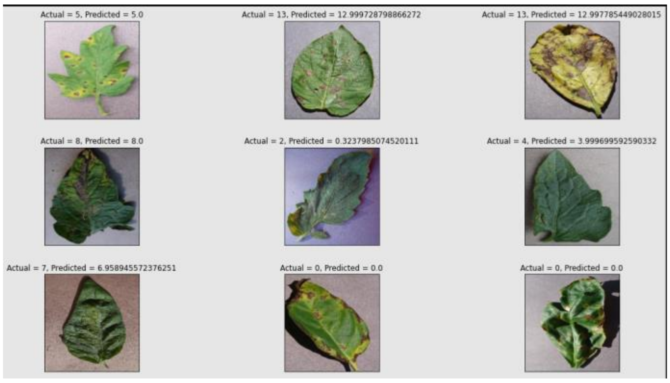


Fig 6.2 Prediction Model

Fig 6.3 Dashboard of The Application

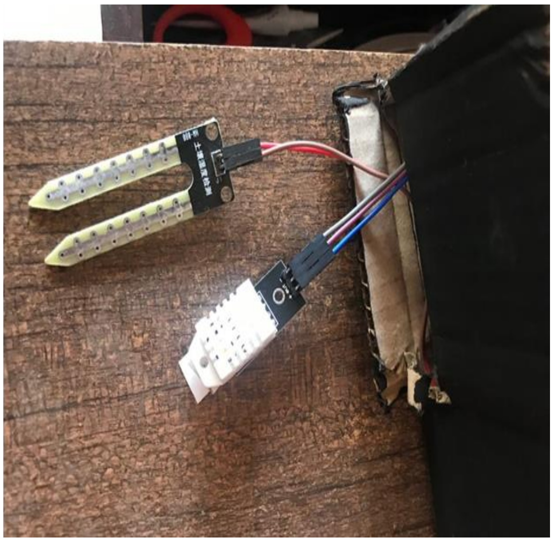


Fig 6.4 Mounted Raspberry Pi with Sensors.

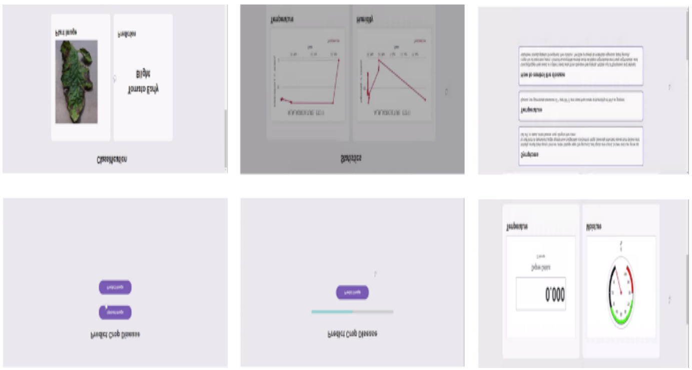
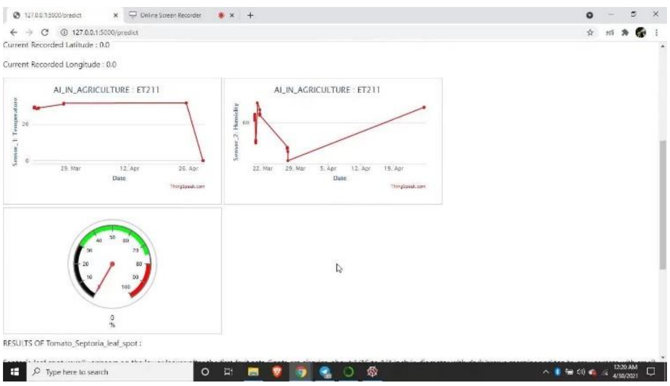


Fig 6.5 Overall application setup



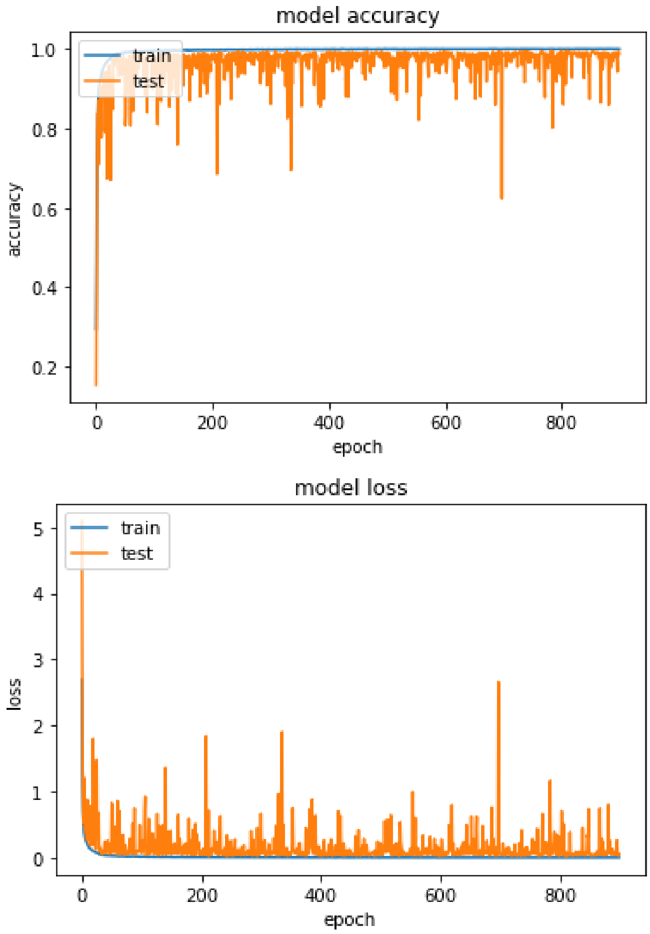


Fig 6.6 Accuracy Achieved in CNN algorithm

6. RESULT AND SENSOR OUTPUTS

https://drive.google.com/drive/u/0/folders/18Mvb4skNNiJvXKDyPAsed01-36qII3t8

7. CONCLUSION

The proposed system has been introduced to monitor the plants and detect the disease of the plant leaves by CNN algorithm the system also provides recommendation based on the disease that what should be done in order to save the plant. The process consists of a camera that clicks the plants photo by every angle in specified time and simultaneously upload to the firebase. Also, the soil conditions i.e., moisture, temperature, humidity the plants' condition through it are also uploaded on Thinkspeak and can be viewed by the farmer. If the system detects any spots, then respective pesticide or preventive method is suggested and therefore the overall information is displayed on the web.

8 FUTUTRE SCOPE OF PROJECT

Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency. Providing some of these solutions as a service like chatbot or other conversational platform to all the farmers will help them keep pace with technological advancements as well as apply the same in their daily farming to reap the benefits of this service. Currently, Microsoft is working with 175 farmers in Andhra Pradesh, India to provide advisory services for sowing, land, fertilizer and so on. This initiative has already resulted in 30% higher yield per hectare on an average compared to last year. Below are top five areas where the use of cognitive solutions can benefit agriculture.

9. APPLICATIONS

The proposed system has been introduced to monitor the plants and detect the disease of the plant leaves by CNN algorithm the system also provides recommendation on the basis of the disease that what should be done in order to save the plant. The process consists of a camera that clicks the plants photo by every angle in specified time and simultaneously upload to the firebase. Also, the soil conditions i.e., moisture, temperature, humidity the plants' condition through it are also uploaded on Thinkspeak and can be viewed by the farmer.

10. REFERENCES

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