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CROPCARE – AN ITELEEGENT BASED REAL TIME SUBSTAINABLE IOT SYSTEM BASED FOR CROP DISEASE DETECTION USING MOBILE VISION

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Abstract—

For the detection and prevention of disease of plants from getting spread, this paper proposed a system using raspberry PI. For the image analysis, Conventional Neural Networks was used. It has many advantages for the use in big farms of crops and thus it automatically detects signs of disease whenever they appear on leaves of the plant. In pharmaceutical research of leaf disease detection is necessary and important topic for research because it has advantages in monitoring crops in field at the form and thus it automatically detect symptoms of disease by image processing by CNN algorithm. The term disease means the type of damage to the plants. This paper provides the best method for detection of plant diseases using image processing and alerting about the disease caused by sending to IoT Server and displaying the name of the disease and precautions on the monitor display of the owner of the system.. It will reduce the cost required for the pesticides and other products. This will lead to increase in productivity of the farming.in parallel proposed system also monitor the environment parameters in the field and also controls the watering based on moisture content.

. Index Terms—Image Processing, IoT, Raspberry Pi, Sensors, Python.

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1. INTRODUCTION

Agriculture is the mainstay of the Indian economy. Immense commercialization of an agriculture has creates a very negative effect on our environment. The use of chemical pesticides has led to enormous levels of chemical buildup in our environment, in soil, water, air, in animals and even in our own bodies. Artificial fertilizers gives on a short-term effect on productivity but a longer-term negative effect on the environment, where they remain for years after leaching and running off, contaminating ground water. Another negative effect of this trend has been on the fortunes of the farming communities worldwide. Despite this so-called increased productivity, farmers in practically every country around the world have seen a downturn in their fortunes. This is where organic farming comes in. Organic farming has the capability to take care of each of these problems. The central activity of organic farming relies on fertilization, pest and disease control.

Plant disease detection through naked eye observation of the symptoms on plant leaves, incorporate rapidly increasing of complexity. Due to this complexity and to the large number of cultivated Crops and their existing psychopathological problems, even experienced agricultural experts and plant pathologists may often fail to successfully diagnose specific diseases, and are consequently led to mistaken conclusions and concern solutions. An automated system designed to help identify plant diseases by the plant's appearance and visual symptoms could be of great help to amateurs in the agricultural process. This will be prove as useful technique for farmers and will alert them at the right time before spreading of the disease over large area.

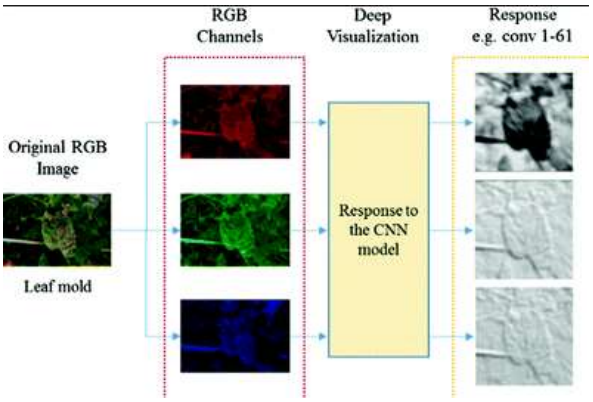

Fig.1 Analysis of CNN algorithm

Deep learning constitutes a recent, modern technique for image processing and data analysis, with accurate results and large potential. As deep learning has been successfully applied in various domains, it has recently entered also the domain of agriculture. So we will apply deep learning to create an algorithm for automated

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detection and classification of plant leaf diseases. Nowadays, Convolutional Neural Networks are considered as the leading method for object detection. In this paper, we considered detectors namely Faster Region-Based Convolutional Neural Network (Faster R-CNN), Region-based Fully Convolutional Networks (R-FCN) and Single Shot Multi box Detector (SSD). Each of the architecture should be able to be merged with any feature extractor depending on the application or need. We consider some of the commercial/cash crops, cereal crops, and vegetable crops and fruit plants such as sugarcane, cotton, potato, carrot, chilly, brinjal, rice, wheat, banana and guava, these leaves images are selected for our purpose. Fig. 1 shows images of the diseased affected leaves on various crops. The early detection of plant leaf diseases could be a valuable source of information for executing proper diseases detection, plant growth management strategies and disease control measures to prevent the development and the spread of diseases.

2. PROPOSED METHODOLOGY

Plants are susceptible to several disorders and attacks caused by diseases. There are several reasons that can be characterizable to the effects on the plants, disorders due to the environmental conditions, such as temperature, humidity, nutritional excess or losses, light and the most common diseases that include bacterial, virus, and fungal diseases. Those diseases along with the plants may shows different physical characteristics on the leaves, such as a changes in shapes, colors etc. Due to similar patterns, those above changes are difficult to be distinguished, which makes their recognition a challenge, and an earlier detection and treatment can avoid several losses in the whole plant. In this paper, we are discussed to use recent detectors such as Faster Region-Based Convolutional Neural Network (Faster R-CNN), Region-based Fully Convolutional Networks (R-FCN) and Single Shot Multibox Detector to detection and classification of plant leaf diseases that affect in various plants. The challenging part of our approach is not only deal with disease detection, and also known the infection status of the disease in leaves and tries to give solution (i.e., name of the suitable organic fertilizers) for those concern diseases. The block diagram of proposed system is as shown in the fig2.

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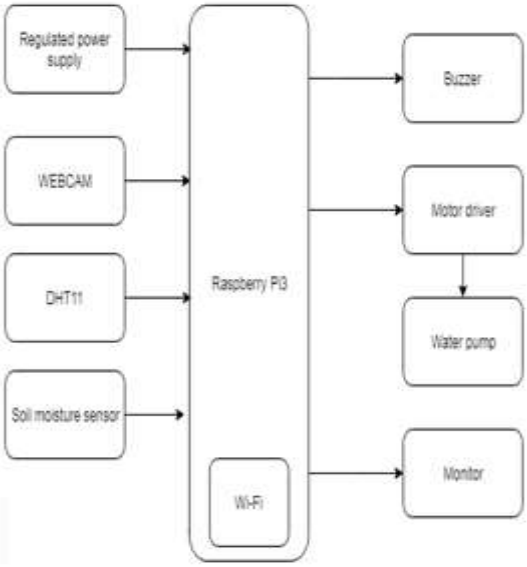

Fig.2 Block diagram of IoT based Smart Agriculture forming system

2.2 DISEASES

Leaf miners are the insect family at larval stage. They feed between upper and lower part of the leaf.

Fig3: Leaf miner disease

Due to insect on very much amount in plant, it is severely damaged. On a single leaf the number of maggots can be six. Therefore, it can severely damage the leaf of plant. It can restrict plantgrowth, leads to reduced yields.

Fig 4: Yellow Spot Disease

Hence we can develop a technique using image processing to detect the disease, to classify it. This will avoid human interference and hence lead to précised unprejudiced decision. Generally , whatever our observation about the disease is just used for the decision of the disease. A symptom of plant disease is a visible effect of disease on the plant. Symptoms can be change in color, change in the shape or functional changes of the plant as per its response to the pathogens, insects etc. Leaf wilting is a characteristic symptom of verticilium wilt. It is caused due to the fungal plant pathogens V. dahliaeand Verticillium alboatrum. General common bacterial disease symptoms are brown, necrotic lesions which gets surrounded by a bright light yellow halo at the edge of the leaf of the plant or at inner part of the leaf on the bean plants. You are not actually

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seeing the disease pathogen, but rather a symptom that is being caused by the pathogen.

2. 3 Block Diagram Description

1. Power Supply

This system requires 5V, 1A power supply. The raspberry pi model B has the special connection provided. Using that USB connection the power supply can be provided.

2.Camera

It is used to capture an image of crops, it is directly connected to the raspberry Pi 3 Model B. There are two ways to connect camera to raspberry Pi 3 model B. First one is through USB port and second is 15 pin header provided for camera interface of raspberry Pi3.

3. **Raspberry PI**

   Raspberry Pi is small size module like a small computer. The image captured by camera is sent to the Raspberry Pi. Using open CV library, the image is processed and detected by the Raspberry Pi.

4. **IoT**

   It is used to send the alert to the owner of the system, this message consists of name of the disease detected by the processor and solution.

5. **Monitor as display**

   The monitor is used to display the detected disease name and also the pesticide name.

3. FLOW CHART

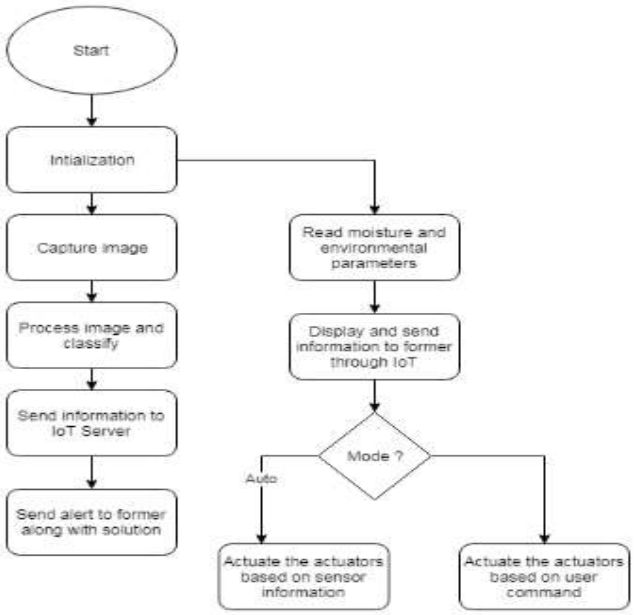

Fig5. Working flow of proposed system

4. IMAGE PROCESSING ALGORITHM

1. Capture the image in RGB format.

2. Generate color transformation structure.

3. Convert color values from RGB to the space specified in that structure.

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4. Apply K means clustering for image segmentation.

5. Masking of green pixels (masking green channel).

6. Eliminate the masked cells present inside the edges of the infected cluster.

7. Convert the infected cluster from RGB to HIS.

8. Generation of SGDM matrix for H and S.

9. Calling GLCM function in order to calculate the features of it.

10. Computation of texture statistics

11. Configure cnn (classifier) for recognition

5. SOFTWARE TECHNOLOGIES

1. **OpenCV**

OpenCV stands for Open Source Computer Vision. It is machine learning software library. It contains library of programming functions. Open CV is required for real time applications related with image processing. OpenCV is mostly written in C,C++ languages and its major interface is in C++ language, however it still retains a less widespread though very much wide interface with C language.

2. Python

Python is modest, easy to learn. It is required for the programming of code related to raspberry Pi. Python is a language that supports modules as well as packages. Also it has a Python interpreter along with the standard library. They are available in both source as well as binary form for free to all platforms, and can be freely distributed to all. Python is a scripting Language that means it allows to execute the code line by line.

3. Thing speak server

There are two types of servers. 1. Application server 2. Web server It is an open source web server that is developed MATLAB Foundation. In our system the database contains images of the infected and healthy leaves taken from various angles. This data base is large. Also for image processing, some processes need java based systems.

6. RESULT

For the detection, leaves of diseases are selected. The database of healthy leaves and diseased leaves is created at the server. This is necessary to compare the images with diseased and healthy leaves. Hence by comparison, the disease type is classified.

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Figure 6, figure 7, figure 8 shows the output screenshots of proposed system.

Fig6Accesing image

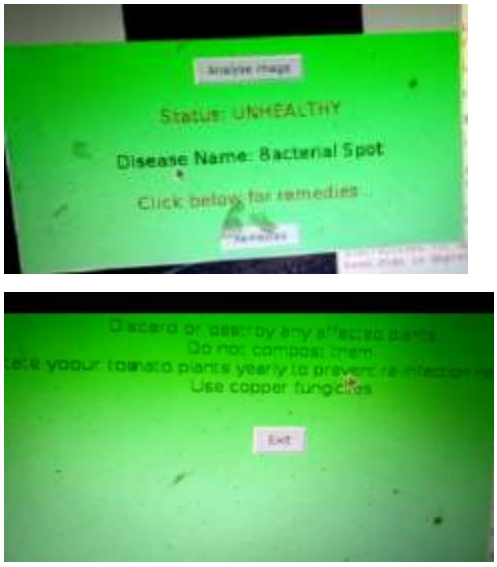

Fig7 . Displaying disease details
Fig8. Displaying Solutions

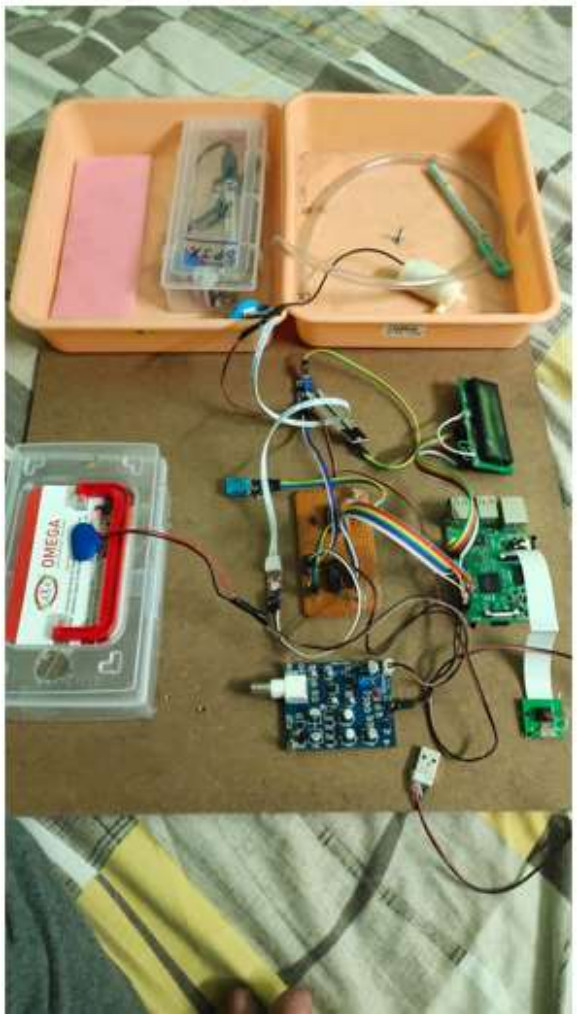

Fig.8 prototype of proposed system

7. CONCLUSION

Basically there are three main types of Leaf disease, they are Bacterial, Fungal and Viral. It is important in plant disease detection to have the accuracy in the plant disease detection but at the same time the process should be of high speed. Work can be extended by the use of quad copter for the capturing of images of leaves of the different plants

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in the farm at field level. This system can be connected to the server for further processing. The objective of this work is the detection, classification of leaf diseases using image processing tools and all information about the disease is sent to the farmer's mobile phone through the internet. To increase the speed and accuracy of detection as well as classification of leaf diseases we using Raspberry pi 3 model B module. One more important benefit of this system is that it gives the name of the pesticide required to use in order to prevent the disease form spreading. It providing exact name of pesticide as per the disease, to save labor price by eliminating need of labor for regular observation of plants to check whether it is affected by any disease or not . This system will largely contribute in growth in the yield of the farms.

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