International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 02 | Feb 2020 www.irjet.net p-ISSN: 2395-0072

AUTOMATED SYSTEM FOR PLANT HEALTH MONITORING AND DISEASE DETECTION WITH ANDROID APP

Mayuresh Dalvi[1], Bhushan Belwalkar [2], Prof. Smita Pawar[3], Liyakat Shaikh[4], Sanjit Bhanga[5]

[3]Professor, Dept. of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India
[1,2,4,5]Student, Dept. of Electronics and Telecommunication, Xavier Institute of Engineering, Mumbai, Maharashtra, India

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Abstract – A subset of the hydro culture called as Hydroponics is a soilless approach towards the growth of plants. With the help of organic ingredients and nutrient solution a new approach to increase the yield has been developed. Sand, gravel, rock wool and coco peat are some mediums used as a replacement of soil used in conventional farming. Identification of the plant diseases is the key to prevent the yield losses and agricultural product quantity. The studies of the plant diseases means studying the visually observable patterns that are seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. Monitoring the plant diseases manually is very difficult . It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, for the detection of plant diseases image processing is used . Detection of disease involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. Thus in this paper discussed the methods used for the detection of plant diseases using their leaves images.

Key Words: **Hydroponics, plants, nutrient's, disease, detection**

1. INTRODUCTION

Humans require air, food, water, and shelter in order to survive. Humans are dependent upon the optimization of land area and the preservation of biodiversity. An ever increasing value for food species is implied, and it is estimated that food production will have to be doubled in order to compensate and provide availability to all. The word "Hydroponic" defines as any means to grow plants via a medium that does not include the use of soil but involves nutrients Solution or inorganic nutrients.[1]

The main objective of hydroponics is to supply the ideal nutritional environment for optimum plant performance. Plant performance may be further optimized by controlling the lighting and climate.

2. LITERATURE SURVEY

The usage of image processing technology for plant disease degree grading eliminates the subjectivity of human induced errors methods and traditional classification.

The classification and detection of the plant disease is very important for the successful cultivation of the crop and this can be done by using image processing. The basic steps for disease detection using image processing include image pre processing, image acquisition, feature extraction, detection and classification of plant disease. Enhanced images have clarity and high quality than the original image. Detection of plant disease through some automatic technique is beneficial as it reduces a man work of monitoring in big farms of crops and at very early stage itself detects the symptoms of the disease. They have presented a survey on various classification techniques[14]

The detection and classification of the plant disease is very important for the successful cultivation of the crops, this can be done using digital image processing[15]. In this project, the detection as wells the precautions for curing it is achieved. In this work, a system is developed to determine to the quality of the leaves[16]. The image processing technique that detect the kind of the disease the leaf is affected with and classifies the different diseases among the leaves. 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.

2.1 Information on Tomato plant disease and Treatment

a. Disease: Late blight

It is a widely spread and harmful disease that causes serious problems to tomato. Initially the disease expends on potato leaves, but if it is grown not far from tomato than, in just a couple of weeks, the infection spreads on tomato as well. [6]

Fig.1 Late blight[6]

Treatment :Spraying in the vegetation period. Consumption norm of 1% Bordeaux mixture is 6,0-8,0 litres of copper sulphate mixed in 400-600 litres of water.

b. Disease: Top rot of a fruit

This disease develops itself in wet weather conditions that mostly attacks big fruit variety with a sensitive skin.

Fig.2 Top root of a fruit [7]

Treatment :Carry out spraying of calcium chloride mixture of 0,3-0,4% concentration.For preparing 1% concentration of the mixture one needs to stir 1 gram of manganese in 100 milligrams of water (1/2 glass)[7].

c. Disease: Brown leaf blight

The exciter of the disease is a fungus that attacks leaves, stems, but seldom fruits. [8]

Treatment: Spraying is carried out during a vegetation period. To carry out initial spraying as a preventative measure, and further spraying activities with 7-10 days interval.

Fig.3 Brown leaf blight[8]

d. Disease: Dry spotting of macrosporiosis

Brown, round-shaped with contrasted cycle spots appear on leaves. Gradually cycles merge together and the infected leaf dies. [9]

Fig.4 Dry spotting of macrosporiosis

Treatment : Ditan M-45,Spraying in the vegetation period. Consumption norm per 1 hectare is 1,2-1,6 litres of remedy mixed in 600-800 litres of water. Spraying is achieved in a cool time of a day or night.[9]

2.2 Information on Chilli plant disease and Treatment

a. Disease: Anthracnose Die Back

The pathogen cause two different type of symptoms on different parts of the host. Die back fruit rot and Anthracnose Die Back. The Entire branch of the plant wilts away.

Fig.5 Anthracnose Die Back[10]

Treatment : Seed Treatment With Thiram Or Dithane M-45 @ 2g/Kg Seed. Spray Dithane M-45 0.25% Or Blitox 0.1% Or Bavistin0.1.[10]

b. Disease: Ripe fruit rot

Necrosis of the tender twigs from the tip backwards. Flowers drop and dry up. The twigs are water soaked to brown, become grayish white or straw colored in advance stage of the disease[10]

Fig.6 Ripe fruit rot[10]

Treatment : Spray Dithane M-45 0.25% OrBlitox 0.1% OrBavistin 0.1

c. Disease: Damping Off

Seeds fail to germinate. The disease infected seedlings rot at ground level and then the plants fall over ground

Fig.7 Damping Off[10]

Treatment: Seed Treatment With Captan Or Thiram @ 2g/Kg Seed. Nursery Bed Treatment With Formalin. Drenching Nursery Bed With Mixture Of DithaneM- 45 0.25%AndBavistin0.1%Soil Drenching With Captan Or Thiram @ 0.2-0.5%.[10]

d. Disease: Leafspot

This is a serious bacterial disease, spread by the bacteria xanthomonascampestrispvvesicatoria. The disease cannot survive in the soil for long and is spread though plants, seeds and dead plant material. The bacterial disease spreads very quickly.

Fig .8 Leafspot

Treatment : Seed Treatment With Thiram @ 2g/Kg Seed. spraybordeaux Mixture 1% Or Bavistin 0.1% At 15 days Interval. Blight (Alternaria Solani):- Dark and Leathery Spots appear on the Leaves and Defoliation Occur.[10]

2.3 Information on Brinjal plant disease and Treatment

a. Disease: Damping off

The disease infected seedlings rot at ground level and then the plants fall over ground[5]

Treatment : Drench the beds with Capton or Thiram at 0.4% at 5-7 days after germination. Fumigate the soil with Formalin (7%) bydrenching 10-15 cm deep soil.

Fig.9 Damping off

b. Disease: Bacterial wilt

The wilting is characterized by dropping and slight yellowing of leaves and vascular discoloration.

Fig.10 Bacterial wilt

Treatment :Seed treatment with Streptocycline (150 ppm) for 90 min.

c. Disease: Mosaic

The leaves of infected plants are deformed, small and leathery.

Fig.11 Mosaic

Treatment: Sprays of Phosphamidon (0.05%) at an interval of 10 days. Spraying Phosphamidon (0.05%) at 10 days

2.4 Information on Rice plant disease and Treatment

a. Disease: Ricetungro disease

Their leaves become yellow or orange-yellow, may also have rust-colored spots.[4].

Fig.13 Rice Tungro disease

Treatment : Spray Two rounds of any one of the following insecticides Thiamethoxam 25 WDG 100g/ha Imidacloprid 17.8 SL 100ml/haat 15 and 30 days after transplanting.

b. Disease: Leaf streak of rice

Initially, small, dark-green, water-soaked translucent streaks on veins from tillering to booting stage.

Treatment : Spray fresh cowdung water extract 20%Copper hydroxide 77WP@1.25kg/ha is also recommended.

Fig14. Leaf streak of rice

3. DESIGN IMPLEMENTATION

Our project is to detect the plants leaf diseases and provide the solutions to recover from the leaf diseases. In our proposed system we are providing a solution to recover from the leaf diseases by automatically sprinkling the required fertilizer's and also show the affected part of the leaf by image processing technique. Our expected outcome is, we are willing to detect a leaf disease and to take precautions by using light spectrum and sprinkler and by using the chemicals required to the plant. we also intend to have an website link in which we can check the growth and the health of the plant.

Fig.16 System Design Overview

4. PROPOSED MODEL

a. Temperature& Humidity Monitoring

Temperature (both high and low) easily affects plant growth. A lower temperature makes them prone to frost, while a high temperature can lead to scorching, moisture drainage and much more. Hence, we are using a DHT11 sensor to detect temperature and humidity..[3]

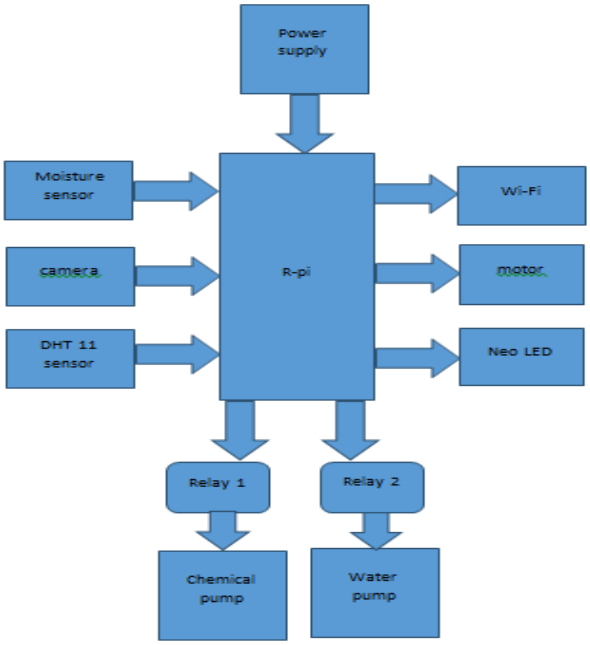

Fig.17 Proposed Model

b. LED Grow Lights

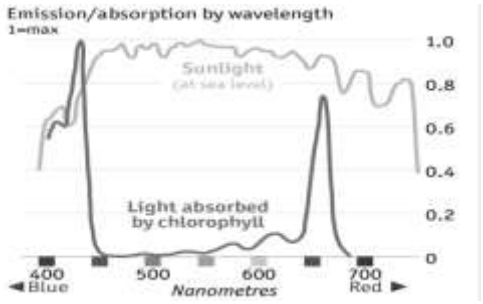

Fig.18 Spectrum Absorbed by Plants[13]

A red light spectrum promotes growth of flowers, stem, nodes, fruits, and chlorophyll while a blue spectrum aids in vegetative growth. The most absorbed spectral ranges a red and blue; however, green and yellow spectrums contribute in the process too. These two spectrums play a role in the photosynthesis process [5]. From the morning to evening, the LED grow lights remain ON in the automatic mode and OFF after this duration.

Fig.19 Neo pixel LED strip

c. Pi camera

Fig.20 RPI 3 Camera

The v2 Camera Module has a Sony IMX219 8-megapixel sensor (compared to the 5-megapixel Omni Vision OV5647 sensor of the original camera).The Camera Module can be used to take high-definition video, as well as stills photographs The camera works with all models of Raspberry Pi 1, 2, and 3. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Pi camera Python library.

d. Sprinkler

Sprinkler irrigation is the method of applying water in a controlled manner in way similar to rainfall. The water is distributed through a network that may consist of pumps, valves, pipes, and sprinklers.

Fig.21 Sprinkler

5. RESULTS

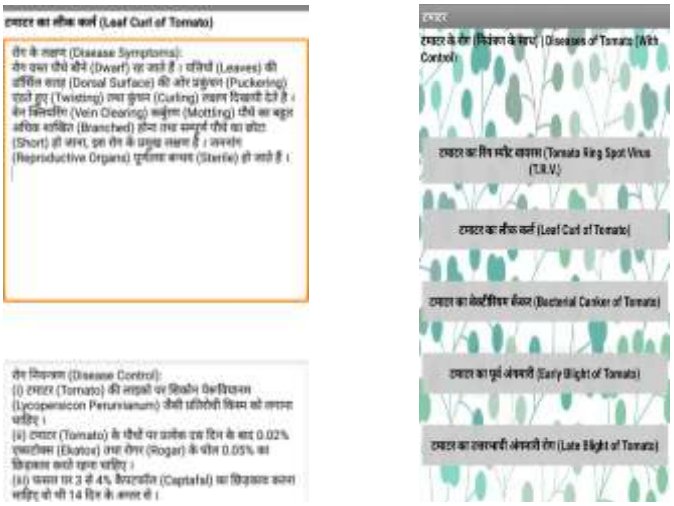

Fig.22 Android Application Screenshots

We have created an android application as illustrated in fig.22 Android application screenshots, which describes tomato, chilli , brinjal and rice plant diseases and related precautions which needed to be taken on it. The application consists of three major parts in which screen 1 contains name of the plant for example , chilli. Screen 2 contains chilli disease and screen3 gives description of related disease and treatment which needs to be taken. The Application contains information in hindi which will be very helpful for Indian farmers

6. CONCLUSION

Our aim was to detect the plant's health and to take precautions on its disease. Our expected outcome is, to detect a leaf disease and to take precautions by using light spectrum and sprinkler and by using the chemicals required to the plant

7. ACKNOWLEDGEMENT

We would like to thank our project guide Professor. Smita Pawar who has been a source of inspiration. We are also grateful the authorities, faculties of Xavier Institute of Engineering who have helped us to be better acquainted with recent trends in the technology.

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