

Agrobot - The Healthy Farming

Anu Kumari¹, H. Prasanna Kumar²

¹PG Student, Department of Electrical and Electronics Engineering, University Visvesvaraya College of Engineering, Bangalore, India

²Assistant Professor, Department of Electrical and Electronics Engineering, University Visvesvaraya College of Engineering, Bangalore, India

Abstract: In India farmer's faces major difficulties due to unhealthy farming, the disease in the leaves occurred in the plants increases the tremendous losses in the production of the crops in agriculture. In this project, we are using leaf disease detection image processing on the Matlab software and spraying pesticides using Arduino controller. In this process an image of the leaf is captured by camera and by the utility of image processing protocol the disease of the leaf is detected. The moisture sensor checks soil conditions and interface with Arduino and then pesticides are sprayed to the detected plant & the level sensor will check the height of the pesticides in the container.

By designing this system, the diseases in the leaf of the plant will get detected in the early stage which will help the farmers to spray the pesticides in proper amount on the plants. It will also monitor the health of the plants, which will reduce the intensity of damage on the crops due to unnecessary spray of pesticides in the farms. So, the leaf disease detection process helps the farmers to increase the quality and the quantity in the production growth of the agriculture.

Keywords: Agrobot; Image processing; Mat lab software; moisture sensor; level sensors; Arduino UNO.

1. Introduction

Agriculture is the art of cultivating plants and it is the most important sector of our Indian economy. Two- third of Indian population is directly or indirectly dependent on agriculture. Green Revolution is one of the major challenging revolutions of India in agriculture. It provided approximately 50-60 per cent employment in India. The development in agricultural field is one of the significant factors for the economy welfare of the country. Many modern techniques like chemical pest control, irrigation technologies are implemented to increase productivity of crops in agricultural farms.

Plant disease prognosis is critical for crop management and mass production. It can be satisfied through image processing. To observe the disease in the herbs it is very important to identify the conditions like leaf blight, leaf spot in the plants. Disease detection helps the farmers to find disorders in plants at the early stage. It will also help to minimize the spray of excessive pesticides to the healthy plant in the farmland.

Image processing plays a vital role in the production of healthy crops all over India. It also condenses the involvement of working numerous hours in the field. In this project, we are using leaf disease detection image processing on the Matlab

software and spraying pesticides using Arduino controller. In this procedure an image of the leaf is captured by camera and by the utility of image processing protocol the disease of the leaf is detected. Primarily the robot will move in the farm to the fixed distance further the soil moisture will detect either the soil is wet or dry, if the soil is dry hence the pump will on and discharge water to the soil. Likewise the soil is wet equally there is possibility of occurrence of disease in the plant.

2. Literature Review

This section reviews understanding the existing system and methodology and also help for researching on the important elements in developing the leaf disease detection using image processing. Camargo [5] proposes an image processing based method that identifies the visual symptoms of plant diseases from an analysis of coloured images. The processing algorithm of image processing starts by converting RGB image of the diseased plant or leaf into H, I3a, I3b color transformation. The I3a and I3b transformations are developed from a modifications of original color transformations to meet the requirements of the plant disease dataset which is already stored in the system.

B. V. Pawar [1] this paper presented the Mat lab software for classifying the changes in colors of leafs precisely. At first they used K-means clustering algorithm with Euclidean distance and for classification of leafs they used neural network. It is dependable method for the distinguishing of disease for cotton plants.

Plant diseases are caused by bacteria, fungi, virus, nematodes etc.; of which fungi is the main disease causing organism. R. Yakkundimath [2] proposes the fungal disease and their symptoms by using image processing techniques and a study on the image processing techniques used to identify & classify fungal disease symptoms affected on different agriculture crops.

T. S. Bodhe [3] proposes image processing is used for the enhancement of the image. To improve the agriculture product automatic detection, many methods used for segmentation in image processing for the agricultural field. In the image steps like images classification approaches like ANN (Artificial Neural Network), SVM (Support Vector Machine) and the clustering method are used for better frequency and accuracy of the leaf disease detection of the different plant leaf in the

agricultural farms.

Bani Ahmed [7] proposes a software solution for automatic detection and classification of the plant diseases, this method is based on K-means as a clustering procedure and ANN's as a classifier tool using some texture feature set. Machine learning based detection and recognition of plant diseases can provide clues to identify and treat the disease in the early stages. Visually identifying plant diseases is very expensive, inefficient and difficult.

3. Process operation

In this proposed system, the leaf image is 1st captured by webcam then by using image processing various steps we will detect the leaf disease i.e. leaf spot and leaf blight. From the pesticide tanks pesticide will be sprayed to the leaf disease plant in the farms. The block diagram is explained as follows,

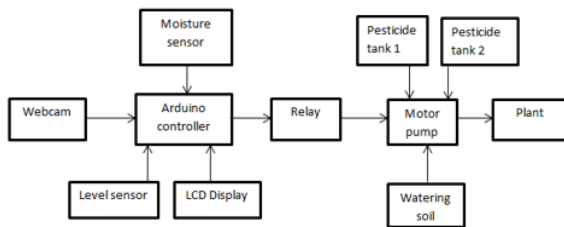


Fig. 1. Block Diagram

- **Camera:** It is continuously captures the images of the plants in the agricultural farm.
- **Arduino controller:** The Arduino Uno board is a microcontroller based on the AT mega 328. It is a low-cost, open source, community-supported development platform.
- **Relay:** A relay is an electronically operated switch. It is used to control a high powered circuit using a low power signal. For operating motor, we are using 2 relay switches as a circuit.
- **LCD:** It is used to display the message based on the soil condition i.e., wet or normal accordingly the type of disease will be displayed on the LCD screen.
- **Pesticide tanks:** If the disease is detected on the leaf then motor will turn on and pesticide will be sprayed on defected areas of the plant on the agricultural farms.
- **Moisture sensor:** The moisture sensor is having a capacitance to measure the water content in the soil. Here the soil sensor is interfaced with Arduino controller if the soil is dry then turn on the motor otherwise turn off the motor.



Fig. 2. Moisture Sensor

- **Level sensor:** Level sensors detect the level of liquids present in the container. It can be either continuous or point values. Continuous level sensors measure level for a specified range & determine the exact amount present in a certain place whereas the point level sensors only indicate the substance or the liquid is below or above the particular specified range or value.



Fig. 3. Level Sensor

- **H-Bridge:** An H-bridge is an electronic circuit that allows the polarity of the voltage applied to the load. An H-bridge is built with four switches i.e. s1, s2, s3 & s4. When s1 & s4 are closed then s2 & s3 are opened then the +ve voltage is applied to motor. Similarly when s2 & s3 are closed then s1 & s4 are opened then the -ve voltage is applied to the motor. These circuits are used in robotics to allow the dc motor to run forward & backward direction.



Fig. 4. L293D H-Bridge

A. Image Processing

In this the image is captured by the camera i.e., image acquisition then the unwanted noise is removed by the adaptive filtering.

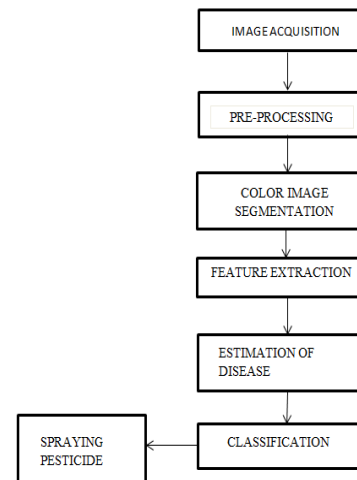


Fig. 5. Flow chart of Image Processing

- In pre-processing the resizing, the smoothing filter is done for the captured image of the leaf then the RGB (Red, Green, Blue) to Grey color conversion of the image take place.
- In the image segmentation again the RGB to HSV (Hue,

saturation, value) conversion of the captured image take place i.e., image with low intensity is converted into large intensity value i.e., images between 0-255 values by using K-means clustering algorithm. HSV is always used for the color descriptor.

- In the feature extraction the images are extracted based on the features i.e., texture, size & shapes using histogram equalisation method types of diseases like leaf spot, leaf blight can be identify and classified into healthy and diseased leaf by comparing with the database images which are already stored in the system with the training images by KNN (K-Nearest Neighbour) method.
- Then the pesticides are sprayed on the respective infected leaf of plant on the agricultural farm.

B. Processing Module

The Arduino Uno board is a microcontroller based on the AT mega 328. It is a low-cost, open source, community-supported development platform. It has 14 digital inputs/ output pins 6 analog inputs, 16MHz crystal oscillator, USB connection, a power jack, an ICSP header and a reset button. These can support the microcontroller for operation to the computer. It has modified Harvard architecture 8-bit RISC processor core. Arduino Uno is used for the development of automation system and also for the designing of basic circuit designs. The Arduino Uno offers UART TTL-serial communication & it is accessible on the digital pins i.e. TX (1) & RX (0).

4. Process Flow

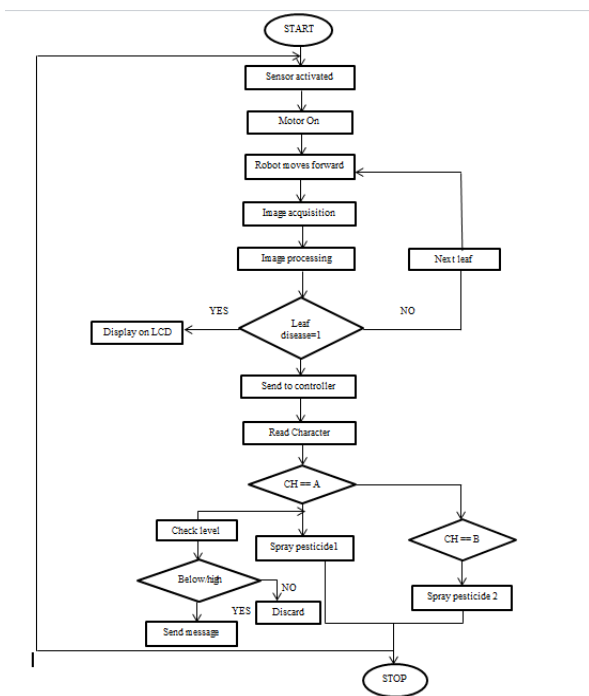


Fig. 6. Flow chart of leaf disease

Algorithm:

- Step-1: Go to start & then activate components.

- Step-2: Read the moisture sensor.
- Step-3: If the soil = 0(wet) then display on LCD Screen.
- Step-4: Image is captured i.e.; image acquisition then through image Processing disease is detected in the given leaf.
- Step-5: If disease is detected then display message on LCD Otherwise discard it.
- Step-6: Once the disease is detected then sends the signal to Arduino controller then the read character A or B.
- Step-7: Character A for leaf spot disease & character B for leaf blight disease so with respect to disease sprinkle 1 or sprinkle 2 will open & spray the pesticides from pesticide tanks.
- Step-8: Check the level of pesticide tanks if it below, middle or high then display on LCD screen.
- Step-9: Stop the process & again check for other leaf.

5. Experimental Setup

In this system, the robot will forward or backward direction with fixed distance then stops. After robot will stop the soil sensor will get activated, check the soil condition if the soil is wet then robot will move forward or backward to check the leaf disease of the plant, when the disease gets detected then pump will on& spray the pesticide from the tanks &also level sensor will check the level of the two respective tanks, display on the LCD screen. If the soil is dry, then pump will on & pour water to soil.

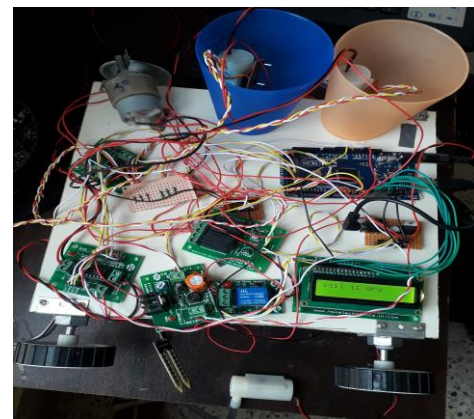


Fig. 7. Experimental setup

6. Results

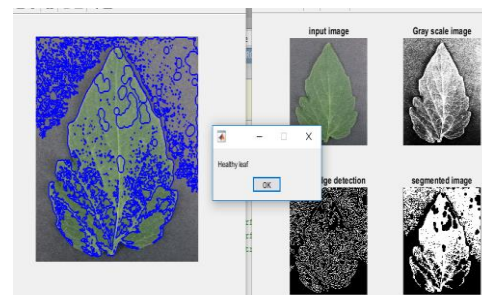


Fig. 8. Result of healthy leaf

Table 1

Result of extraction features of healthy leaf

Parameter	Value
Area of segmented region	43494
Total leaf area	270000
Total segmented region	16.1089%
Mean	0.5094
Standard deviation	0.4999
Entropy	0.9997
RMS	0.7038

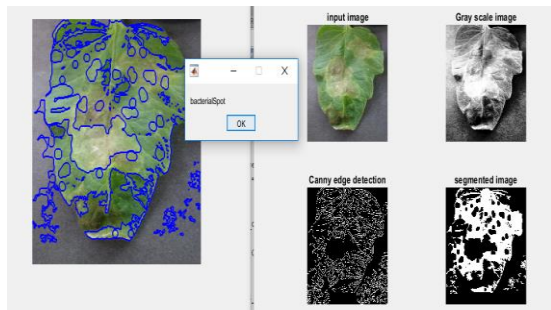


Fig. 9. Result of bacterial spot disease

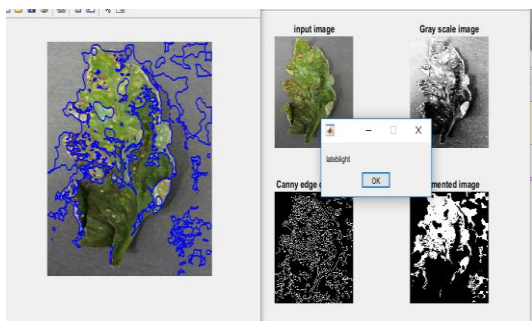


Fig. 10. Result of late blight disease

7. Conclusion and Future Scope

We have built a system for leaf disease detection and spraying pesticide. Leaf disease detection using image processing is very useful for the farmers in the agricultural field. This system helps in early detection of disease in the plants which also reduce to spraying of pesticides in the field. It also gives the proper diagnosis of the disease properly. In this system we have used the level sensor which will check level of the pesticide tanks & moisture sensor which will detect whether the soil is dry or wet.

In future, this system can be extended to make an Agrobot which can detect disease and spray the pesticide automatically to the plants. An algorithm can be developed to process the image and disease can be detected using raspberry pi controller so that robot can move based on the controller programming, find the disease and will able to spray the proper amount of pesticide to the infected plants. In this way it helps the farmers to reduce their efforts, work pressure as well as manpower.

References

- [1] P. B. V. Pawar et al., "Study and Analysis of cotton leaf disease detection using image processing," International Journal of Advanced Research in Science, Engineering and Technology vol. 3, no. 2, pp. 1447-1454, 2016.
- [2] R. Yakkundimath et. al., "Identification & Classification of fungal disease affected in agriculture crops using image processing Techniques", International conference computer intelligence research, vol. 978, no.1, pp. 31-34, 2014.
- [3] T. S. Bodhe, "Selection of color space for image segmentation in pest detection", International conference advance technology engineering, ICATE, 2013.
- [4] Camargo, "An image processing based algorithm to the automatically identify plant disease visual symptoms," Bio systems engineering, vol. 102, pp. 9-21, 2009.
- [5] S. Bani Ahmed et. al., "Detection and classification of leaf disease using K-means based segmentation & neural networks based classification," Information technology, pp. 267- 275, 2010.