AUTOMATIC DETECTION OF DISEASED PLANT USING ROBOTICS AND IMAGE PROCESSING

[1]Sai Krishna P M, [2]Sahana J, [3]Savitha V, [4]Sharan B U and [5]Anitha Suresh
[1]Student, [2]Student, [3]Student, [4]Student and [5]Assistant Professor
[1]8th semester, B.E, Department of Telecommunication, VTU
[1]DSCE, Bengaluru-78

Abstract— Agriculture is one of the vital occupation in the world. A major problem that a farmer is facing is the plants getting affected by diseases. The detection of the leaf disease is very important factor to prevent the losses in the yield. It is very difficult to monitor the diseased plant manually, as it requires tremendous amount of work and found less useful in large farms. Also, farmers are unaware of non -native diseases. Hence with the aid of imaging technology, disease detection can be done automatically. Here this project is divided in to two main steps. Firstly, a hybrid intelligent surveillance robot is designed using Arduino UNO controller which will be able to capture the picture of the diseased plants while wandering automatically on the field or in the green house and secondly, image processing is used for detection of plant disease where it involves image acquisition, image pre-processing, image segmentation, feature extraction and classification where these features are used to identify the type of disease and to increase the quantity of agricultural product.

Index Terms: **Disease detection, Robotics, Image Processing, Feature extraction**

I. INTRODUCTION

India is an agricultural country; Farmers have wide range of diversity to select suitable crops for cultivation. However, the cultivation of these crops for optimum yield and quality product is difficult. It can be improved with the aid of technological support. The management of perennial crops requires close monitoring especially for the managing of diseases that can affect production significantly.

In today's modern digital world research are continuously trying to increase the yield of crops. They have achieved by using developing the higher breed seeds and plants. But one problem still exist which is a major concern of the cultivation of crop and that is crop diseases and the pesticides problem. Due to these problems, the cultivation decreases and hence all the farmers and in turn the country suffers the loss. Many of the time disease need to be prevented at early stage, but if it does not happen then it damages the plants. Due to that whatever the investment needed to be done is in loss, to avoid all these we need to detect disease at early stages. In olden days, detection and recognition of plant diseases was based on naked eye observation, which is very slow method also gives less accuracy. Automatic detection of plant diseases is essential to detect the symptoms of diseases in early stages when they appear on the growing leaf of the plant. This method introduces a surveillance robot to identify a diseased plant and a MATLAB based system in which we focus on leaf diseased area and use image processing technique for accurate detection and identification of plant diseases. The MATLAB image processing starts with capturing of digital high-resolution images. Healthy and unhealthy images are captured and stored in database for experiment. Then images are applied for pre-processing for image enhancement.

A. THE IMAGE ANALYSIS IN AGRICULTURE

Image analysis can be applied for the following purposes:

1. To detect diseased leaf.
2. To quantify affected area by disease.
3. To find the boundaries of the affected area.

4. To determine the color of the affected area
5. To determine size & shape of leaf

This work develops the advance computing system to identify the diseases using infected images of various leaf spots. Images are captured by digital camera mobile and processed using image processing. Then the infected part of the leaf spot has been used for the classification purpose of the train and test the proposed SVM Algorithm. This technique evolved into the system is both Image processing techniques and advanced computing techniques.

B. THE MAJOR TARGET OF THIS RESEARCH WORK

This Research mainly focuses on the following:

- To build a surveillance robot.
- Early crop disease detection.
- Proposes an image pattern classification to identify different disease in leaf.
- Images to be classified by support vector machine classifier.

II. LITERATURE REVIEW

Agriculture has always been the field which requires more of technological aid. There have been many research works done on different areas of agriculture. One of the important factor is preventing the leaf diseases. There are many projects which aims at assisting this problem with the help of technology.

A paper titled "Detection and Classification of Plant Leaf Diseases Using Image Processing Techniques: A Review" studied the use of different classification techniques like k-Nearest Neighbour Classifier, Probabilistic Neural Network, Genetic Algorithm, Support Vector Machine(SVM), and Principal Component Analysis, Artificial neural network, Fuzzy logic. They conclude that k-NN method is simplest but the disadvantage is the time complexity of making decisions. Neural networks are tolerant to noisy inputs but to understand the structure of an algorithm is difficult in neural networks. SVM is the best machine learning algorithm to classify high-dimensional data sets but it is more complex to understand and implement.

D. A. Shaikh, Ghorale Akshay G, Chaudhari Prashant A, Kale Parmeshwar L summarized in their paper titled "Intelligent Autonomous Farming Robot with Plant Disease Detection using Image Processing" to develop an agri-robo system to monitor crops and for identifications and monitoring of diseases & pesticides. This agri-robo identifies diseases on various infected leaves. This agri-robo not only detects disease but also sprays pesticides to protect them from disease. The robot helps the farmer in taking further decisions.

A. Existing Algorithms

- k-Nearest Neighbor Classifier
- Probabilistic Neural Network
- Genetic Algorithm
- Principal Component Analysis
- Artificial neural network
- Fuzzy logic

III. HARDWARE AND SOFTWARE REQUIREMENTS

- Arduino UNO controller
- Power supply

- DC motors, L293D motor driver circuit
- IP camera
- LCD
- Wireless communication (ZigBee)
- USB UART
- GSM
- Ultra-sonic sensor, IR sensor
- Water pump relay
- MATLAB R2014a

IV. PROPOSED METHOD

The digital images are acquired from the circumstances using a digital mobile camera held by surveillance robot. Then image processing techniques are applied to the acquired images to extract RGB Pixel counting features that are necessary for further analysis. The proposed system consists of various stages. Initially, we begin with collection of images of agricultural leaves for creating database. Features of segmented images are stored in database with respective image of agricultural leaves. Using support vector machine classifier, we would be finding out the type of disease present in captured image and give suitable remedies to control it.

Support Vector Machine (SVM):
"Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for classification of different classes of objects.

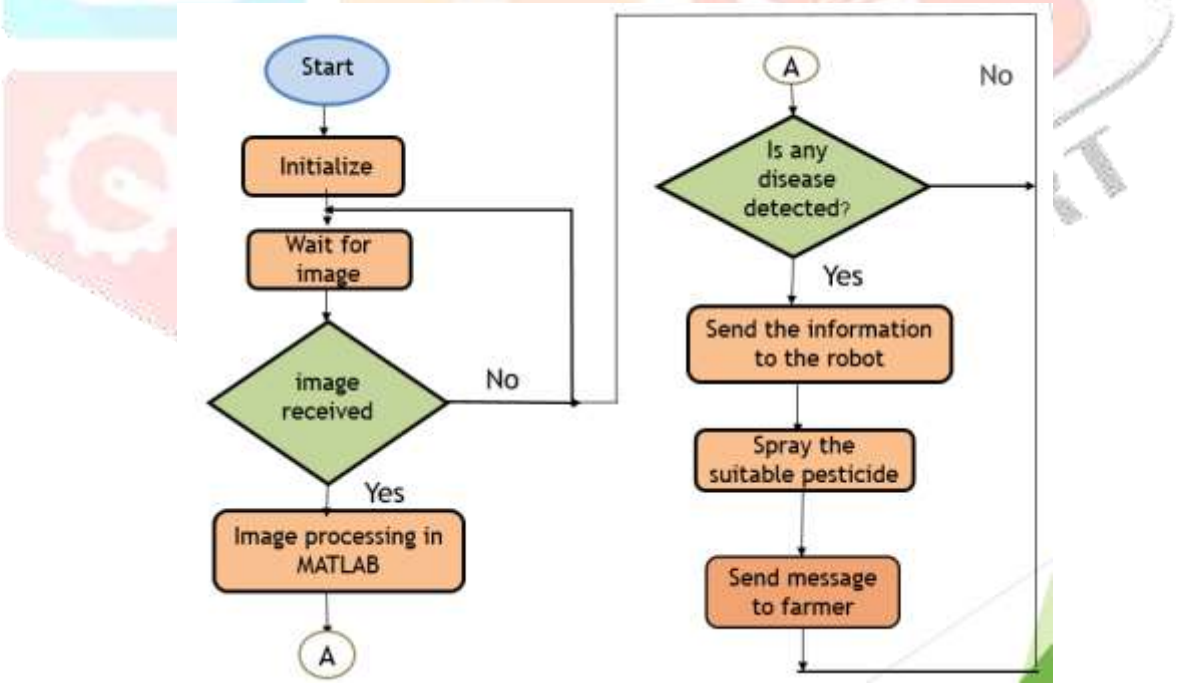

Fig 4.1: General flowchart

Training sample in multi support vector machine is separable by a hyperplane. This hyperplane is computed according to the decision function, where w is a weight vector and b is a threshold cut-off . i.e. sorting can be done into more than two groups.

There are 3 types of classifier are used to which classifier gives the better result. The back propagation and feed forward classifiers are not detecting some pests in an image. But SVM gives better result. SVM is a non-linear classifier and is a newer trend in machine learning algorithm.

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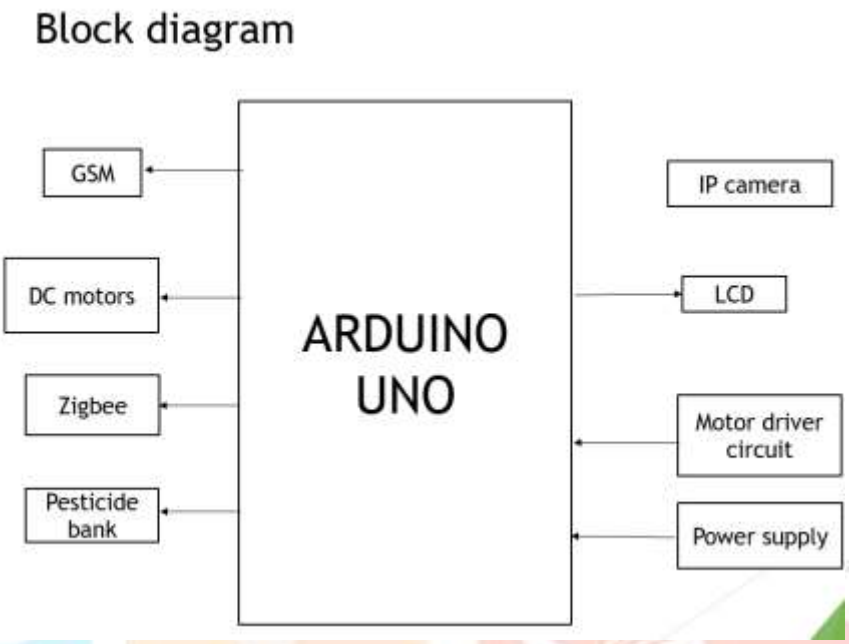

Fig 4.2: Block diagram showing hardware components

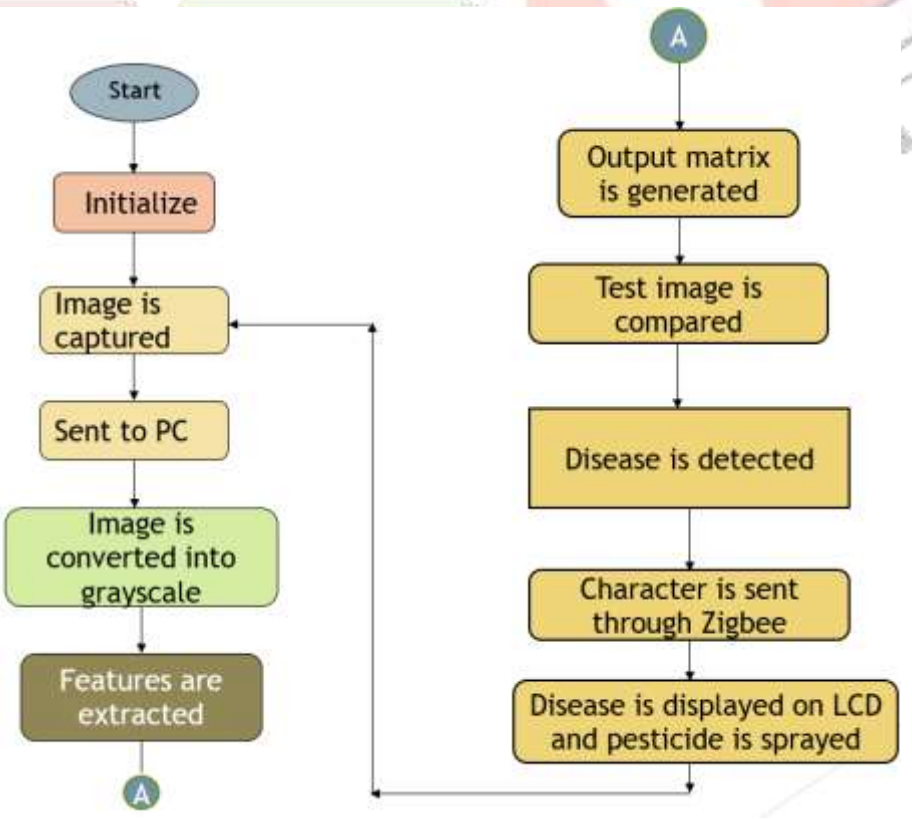

Fig 4.3: Flowchart showing image processing in MATLAB system

V. EXPERIMENTAL RESULTS

Take the image a leaf as an input image and convert into a grayscale image, next use adaptive histogram equalization method to increase the contrast of the grey scale image. Use built-in MATLAB functions to obtain grey-level co-occurrence matrix and enhance different features out of it. Compare the features of the test image with the matrix generated for the database of diseased leaves available.

Variables - dataset

dataset | collNames | diseasetype

16x13 double

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	0.7020	0.8025	0.1148	0.8044	137.0255	36.4835	7.1005	15.9564	740.4933	1.0000	3.9507	-0.3712	255	
2	0.8778	0.8513	0.0577	0.7445	84.5016	63.1420	7.5369	14.5233	2.9119e+03	1.0000	1.8369	0.2495	255	
3	0.8780	0.7890	0.0748	0.7638	118.2507	41.1963	7.3377	15.9422	773.6109	1.0000	2.4004	0.1234	255	
4	0.4489	0.9022	0.0977	0.8400	120.8917	66.5872	7.4538	15.8655	2.3714e+03	1.0000	1.6883	0.0434	255	
5	0.5686	0.8936	0.0766	0.8082	117.6671	55.5753	7.7265	15.8457	1.1124e+03	1.0000	1.9987	-0.1343	255	
6	0.5177	0.9061	0.0766	0.8037	77.8553	66.2661	7.4925	14.5759	2.5610e+03	1.0000	2.2681	0.7289	255	
7	0.8370	0.8267	0.0738	0.7732	84.7403	51.4282	7.5576	15.3601	1.5632e+03	1.0000	2.4359	0.3183	255	
8	0.9820	0.8196	0.0569	0.7339	105.9527	55.4266	7.7408	15.6130	1.3029e+03	1.0000	2.2038	0.0173	255	
9	0.9245	0.8235	0.0606	0.7429	89.4952	36.5711	7.2099	15.8445	766.9842	1.0000	2.6495	0.0167	255	
10	1.0523	0.7664	0.0716	0.7493	134.6223	60.3630	7.8306	15.9114	1.7738e+03	1.0000	2.0803	-0.1851	255	
11	0.2918	0.9359	0.1393	0.8997	104.6903	75.5479	7.6562	15.2390	2.3047e+03	1.0000	1.5658	0.2525	255	
12	1.0106	0.8122	0.0644	0.7471	91.7819	65.4535	7.4224	14.7467	1.6102e+03	1.0000	1.4941	0.0558	255	
13	0.7763	0.8529	0.0658	0.7639	109.3488	34.2282	7.0907	15.9668	769.1822	1.0000	3.0965	0.5029	255	
14	0.7915	0.8554	0.0629	0.7546	83.1806	68.8440	7.6922	14.7485	2.6351e+03	1.0000	2.3209	0.6832	255	
15	1.5006	0.8256	0.0772	0.7022	117.0825	93.3563	6.6378	14.9405	5.6756e+03	1.0000	1.6860	0.4326	255	
16	0.6679	0.8709	0.0707	0.7856	127.5850	46.1388	7.4940	15.9645	1.1490e+03	1.0000	2.1877	0.1982	255	
17														

Fig 5.1: Matrix output after processing in MATLAB

rgb image

Fig 5.2: RGB image

gray image

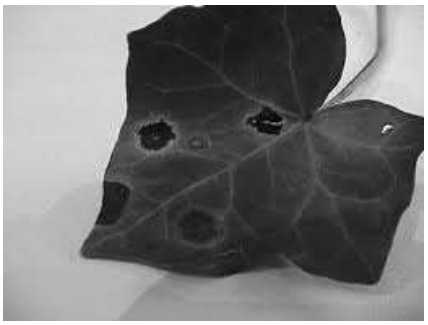

Fig 5.3: Grayscale image

adaptive histogram equalization image

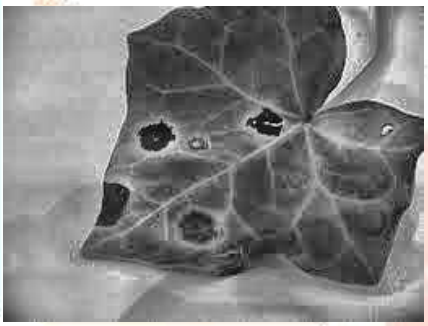

Fig 5.4: ADHE image

Use the multi-svm classifier which is the latest among different machine learning algorithms, svm compares the test image with the database and classifies the disease to the best suited class. First the image is captured through IP camera which is carried by the surveillance robot. The captured image is sent to the system through wireless communication. The image is processed and once the disease type is detected, pesticide is sprayed and farmer is informed through GSM.

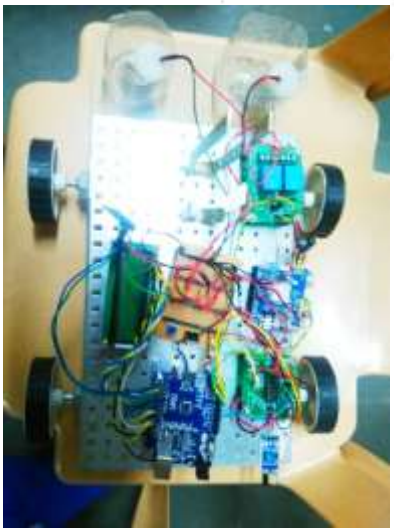

Fig 5.5: Surveillance robot

VI. CONCLUSION AND FUTURE WORK

This work consists of two phases to identify the affected part of the disease. Initially Edge, colour, shape feature extraction-based Image segmentation is done, and finally image analysis and classification of diseases is performed using our proposed SVM technique. The goal of this work is to develop a surveillance robot that can identify the disease affected part of a leaf spot by using the image analysis technique. Prediction of the diseases and pesticide spraying is done. The producers can amend the yield and reduce the loss. Through this proposed system the farmers' burden has been reduced and improves their life. There is further scope for this work. More features can be added in future to increase the efficiency and accuracy of the model. The proposed work can also be made use in those places where maintaining healthy plants is necessary.

VII. REFERENCES

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