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Plant Pests and Disease Detection and Targeted Spraying using Drone

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ABSTRACT: Agriculture has become a key factor for the stability of the world economy. Plant diseases have turned in to a major problem as it can cause significant reduction in both quality and quantity of production and it in turn leads to the death of farmers, due to poverty .pest and disease invasion is the most challenging task for the experts and the farmers. The existing traditional method for controlling the pest and disease invasion is labour intensive and is time consuming. The spreading of different diseases in the field is difficult to control. Our paper proposed a new adaptive approach for controlling the pest and disease invasion. Machine learning and artificial intelligence technique are employed to identify the disease and for targeted spraying of pesticide as well as fertilizer for efficient spraying. A remote controlled UAV(Unmanned Aerial Vehicle) is used to spray pesticide, this method is helps to spray the pesticide according to the disease identified and helps to check whether the disease spread or not. This paper introduces a new method for disease detection, which provides faster result and greater accuracy. The diseased part is segmented by FCM clustering.

KEYWORDS: Automatic recognition, FCM clustering, SVM, Targeted spraying.

I. INTRODUCTION

Agriculture is the one of the important pillar of the Indian economy and more than half of the Indian population is dependent on agriculture for its subsistence's .There are different technologies are evolved for the spraying and managing crops in agricultural field. In the proposed system UAV method is used to increase the crop productivity by the efficient spraying of pesticide, after detecting the region of diseases and thus reduces the uncontrolled use of pesticides. UAV's are rapidly upcoming method for cultivation production and protection process [1]. According to WHO, the inappropriate use of pesticides leads to more than one lack death in each year, especially in developing countries. Also the natural disasters, flood that occur in Kerala destroy the agricultural field. In order to rebuild Kerala, the use of technology has a greater importance.

In large fields like paddy, it is difficult to monitoring. In order to control these diseases, terrestrial applications were developed, the limitation is that spraying not reaches everywhere and at will lead to destruction of healthy plan. The remote controlled UAV is used to spray the organic pesticide to avoid the human from pesticide poison and it will help to prevent damage of healthier plants. The proposed technique uses imaged techniques and SVM (support vector machine) algorithm for detection and classification of plant diseases. The diseased part is segmented by FCM clustering. Leaf and crop disease part were segmented and then shape and are extracted using colour correlogram, gray level co-occurrence matrix (GLCM) colour correlogram is used to extract the colour feature, GLCM is used to extract the texture feature like contrast, energy, local homogeneity and correlation and computed[2].

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The spreading of different diseases in the field is difficult to control. In the system, spraying can be controlled manually and automatically. The spraying system is designed with two chambers contains different type of pesticide, so that pesticide can be sprayed accordingly. Targeted spraying of pesticide after detecting the diseases reduced the unwanted usage of pesticide and ill effects to the organisms. The continuous monitoring diseases require higher expenditure in large farm. To cope up the various problems, in agricultural fields, automated disease identification and spraying system is essential as it proved beneficial in monitoring large fields of crops and thus automatically detect the presence of disease as they appear on paddy field.

In the paper proposed by Sabah Bashir and Navadeep Sharma, they detect the disease in cucumber crop based on the texture and colour features. The image analysis technique used for their study is CCM method. In texture analysis K-means Clustering Technique has been used. The K-means clustering algorithm used to classify pixels based on a set of features into K number of classes. The classification is done by minimizing the sum of squares of distances between the objects and the corresponding cluster or class centroid. However, in this work K-means clustering has been used to partition the leaf image into four clusters in which one or more clusters contain the disease in case when the leaf shows the symptoms that is has been infected by more than one disease.[3]

In the work of Johney L etal, the authors developed a sticky trap to capture the insects. Video recording of insects using wireless camera that continuously observe the installed sticky trap in the paddy fields. After that image processing techniques and neural network algorithm is applied on it to identify the insects [4]

II. RELATED WORK

The present technique uses the imaged techniques and support vector machine algorithm for detecting the plant diseases. The existing method uses k means clustering method for segmentation. Firstly the acquired images are pre processed to remove the noise content from the images and segmented using k means clustering methods, after that features are extracted. K means clustering is an unsupervised clustering algorithm, identifies k number of centroids and then allocates or classifies every data point to the nearest cluster, while keeping the centroid small as possible.

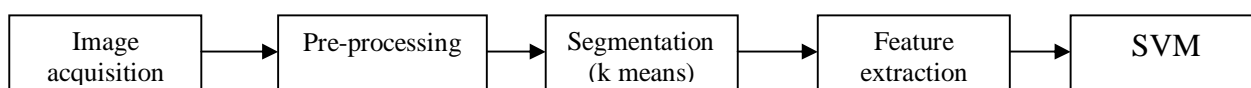


Fig.2.1 Existing system. Figure shows steps proceeded in the training and testing phase. K means clustering is used for segmenting the images. Flaw architecture has following steps. Firstly the infected plant image goes through the image pre processing phase for enhancing and removing noise from the image. Second the pre-processed image passed to the segmentation for partitioning into clusters. For segmentation, here k means clustering is used. From segmented image extracts the features of image such as colour feature and shape feature. Colour feature is used to simplify the object extraction and identification. For that they used various colour models such as RGB, HSI and HSV. Support vector machine algorithm is employed to classify the plant diseases.

III. PROBLEM STATEMENT

The major problem faced by the farmers is reduction in productivity, due to the inefficient use of pesticide and inefficient workers in the agricultural field. The demand of larger agricultural production reflected in the production and amount of use of pesticide. This leads to the uncontrolled and inappropriate use of pesticides affect the environmental adversely. The common diseases that found in paddy field are bacterial and viral diseases. In large field it is difficult to control. There are different methods are evolved for spraying and managing crops in agricultural field. Terrestrial spraying using workers and machines decrease the production area and can damage healthy plants, as it has direct contact with the ground. In large fields such as paddy fields, it is difficult to monitor. In contrast the aerial spraying allows faster spraying without the need for paths inside the crop field. Plant diseases have turned into a major problem as it can cause significant reduction and loses in both quality and quantity of agricultural products.

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IV. SOLUTION

Early detection and treatment for pest and diseases in the agricultural field is off prime importance. UAV method for detection and treatment of disease using machine learning technique helps the farmers to increase the quality and quantity of agricultural products. Detection and classification of plant diseases is done by image processing (FCM) clustering technique. The disease identified and classified based on the features such as texture, color and shape. Figure 4.1 shows the basic flow diagram of the system. The sprayer module contains two chambers carrying two types of pesticide, corresponding to the disease. The system works both automatically and of manual control. The farmers can view the entire field using video transmission module (VTM) and can analyze the productivity and vastness of disease. The machine learning support vector machine (SVM) algorithm is used to train the disease. The targeted spraying of pesticide based on the disease reduces the environmental pollution and unwanted wastage of pesticide. The implementation of this paper uses relay driver. The commands are send to the controller and finally to the relay driver.

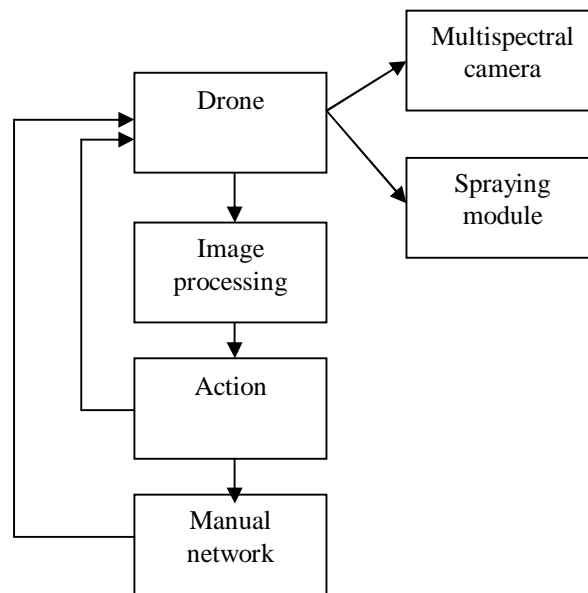


Fig 4.1: Flow diagram of basic system

When the relay is ON the nozzle will spray the pesticide and when it is OFF the nozzle will be closed and spraying is done based on the detected disease. The machine learning support vector machine (SVM) algorithm is used to train the disease. GPS driver is used for the auto navigation of the system and multispectral camera is used to capture the remote sensing image.

V. PROPOSED METHODOLOGY

Hardware Description

1. BLDC (Brush less DC) Motor

Brushless DC electric motor also known as electronically commutated motors are synchronous motors that are powered by a DC electric source via integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. A BLDC motors for quad copter is constructed with a permanent magnet rotor and wire wound stator poles

2. ESC (Electronic Speed Controller)

ESC is used to control BLDC motor. It takes signal from microcontroller and breaks into 3 parts and sends it to the BLDC motor. We would require 4 ESCs as we are using 4 BLDC motor. The ESC is an inexpensive motor controller board that has a battery input and a three phase output for the motor. Each ESC is controlled independently by a PPM signal (similar to PWM). The frequency of

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the signals vary, but for a Quad copter it is recommended the controller should support high enough frequency signal, so the motor speeds can be adjusted quick enough for optimal stability.

3. LIPO Battery

Lithium batteries are the preferred power sources for most electric modelers today. They offer high discharge rates and a high energy storage/weight ratio. However, using them properly and charging them correctly is no trivial task.

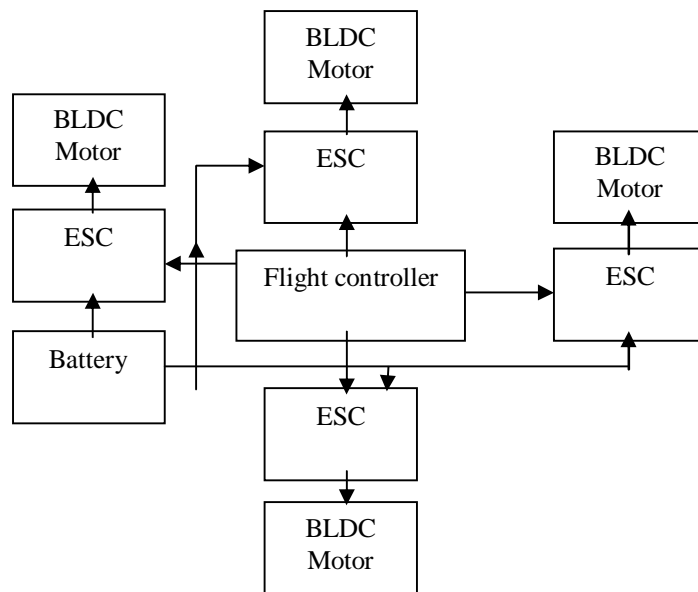


Fig 5.1: Block diagram of quad copter

4. Sprayer Module

The sprayer module has two sections, spraying part and the controller. The spraying part has two chambers, having different type of pesticide corresponding to the disease, i.e. pesticide or fertilizer. And the controller section is used to activate the sprayer. When the disease is detected, the command is received; nozzle opens and sprays the content automatically. Also the nozzle of the sprayer module will be activated by the remote control, wherever need to activate the sprayer, just comment by remote RF transmitter, and the command is received from the remote controller and it will activate manually.

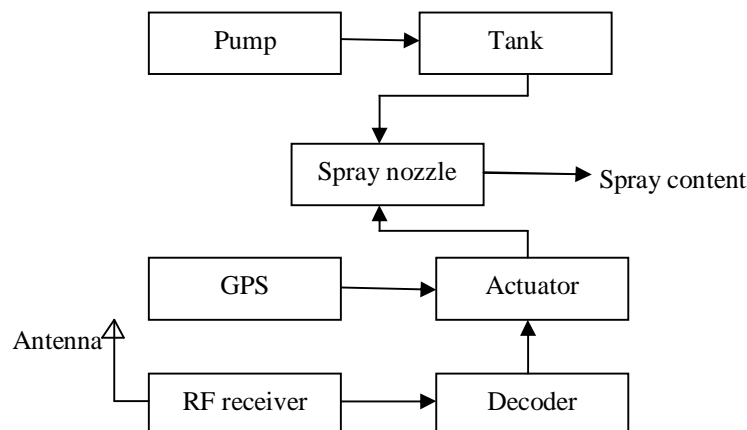


Fig 5.2: Flow diagram of sprayer module

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5. GPS

GPS is a satellite navigation system used to determine the ground position of an objects. GPS driver is used for the auto navigation of the system.

6. Actuator

Actuator activate the device, sprayer nozzle opens and sprays the pesticide based on the disease detected. A relay is a binary actuator which has two stable states. Relays are the devices which can be turned ON/OFF by the application of a low voltage across the relay terminals.

Software Description

The programming is done on raspberry pi, it is a tiny affordable computer, provide a set of GPIO (general purpose input /output) pins that allow to control electronic components for physical computing and explore internet of things. Scikit learn library is used; it is a free software machine learning library for the python programming language.

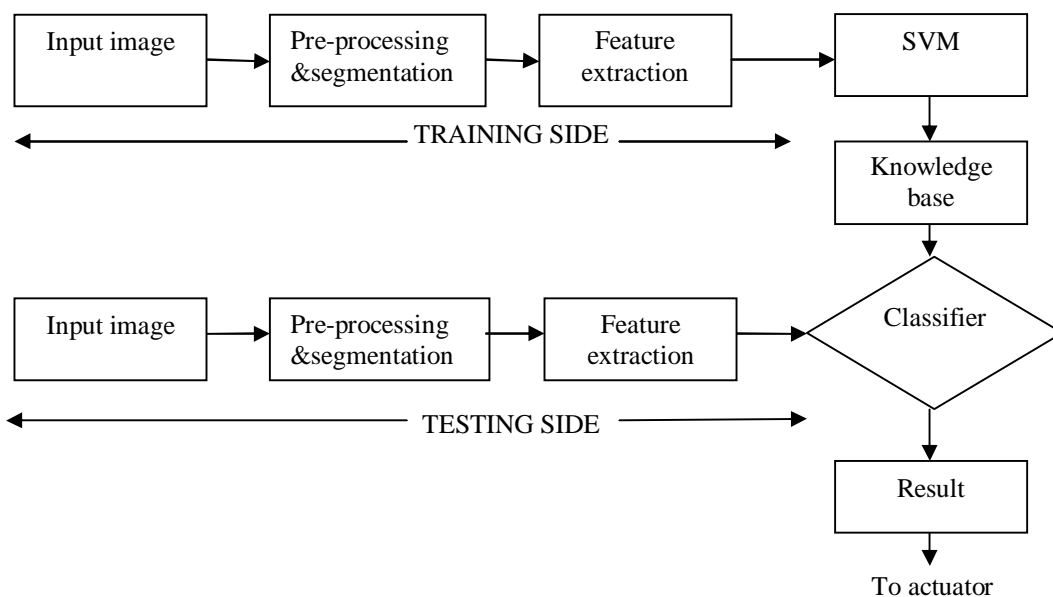


Fig 5.3 Proposed methodology using FCM clustering

FCM Clustering

Fuzzy C Mean (FCM) clustering is an efficient algorithm for detecting the disease at faster rate. It is an unsupervised clustering algorithm, used for analysis based on distance between various data points. FCM is an overlapping clustering algorithm. The main objective of fuzzy clustering algorithm is to partition the data into clusters [5] [6]. So that the similarity of data items within each cluster is maximized and the similarity of data item in different cluster is minimized. Moreover it means that the quality of partitioning that divides the dataset into clusters. It is an improve method for faster detection rate. 4.2 Image processing

In this method of plant disease detection, we use FCM (Fuzzy C Mean) clustering for segmentation of the diseased part and support vector machine (SVM) for detection and classification of diseases. The results showed that SVM could effectively detect the plant disease symptoms. Here we tested two diseases in paddy, brown spot; it is a fungal disease having circular or oval spots on leaf and narrow brown spot. Bacterial and fungal diseases are the common diseases that found in paddy. Method has two phases, training and testing phase. At training phase the diseased images are passed through several steps, pre-processing, segmentation, feature extraction and SVM training and is stored in the knowledge base. After training process, the test image is feed through the camera, after comparing with the trained images, disease identified. From the figure 5.3 shown,

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1. Pre-processing

Input image is pre-processed through the following steps.

- Image is converted from RGB to gray scale
- Images are resized
- Image filtration, is the removal of noise, done by adding blur in it. Median filters are used

2. Image segmentation

Image segmentation is done by using FCM clustering method and different clusters are formed. Here three clusters are formed, for normal non diseased part, brown spot disease, and narrow brown spot disease. Same features are included in a cluster.

3. Feature extraction

In this method, features like colour, shape and texture features are extracted using colour correlogram, Otsu, and GLCM .Correlogram is used to extract the colour feature. Otsu is used to extract the spatial relationship of pixels in an image. It enhances the image by highlighting the features. GLCM is used to extract the texture features .It considers the statistical relationship of pixels. Statistical features include contrast, energy, local homogeneity and correlation.

4. Classification of disease

Classification of disease provides faster detection of diseases. It is used in the training and testing. Here the input mage is compared with the trained data.SVM (support vector machine) is used for classification of leaf diseases.

VI. RESULTS AND DISCUSSIONS

The experimental results indicate that the proposed approach significantly enhances accuracy in normal and affected leaf .The common diseases found in the paddy are fungal and bacterial diseases. Here we tested two diseases brown spot and narrow brown spot.

a. Brown spot disease symptom

The disease appears first as minute brown dots, later becoming cylindrical or oval to circular. Spot measures 0.5 to 2.0 mm in breadth. Then several spots coalesce and leaf dries up.

b. Narrow brown spot

Typical lesions on leaf and upper leaf sheaths are light to dark brown, linear and progress parallel to the vein. It is a pattern of brown and light brown to yellow.

The color correlogram , GLCM, Otsu methods are applied on the segmented image. Based on the features the disease is detected and automated spraying is carried out corresponding to the disease.

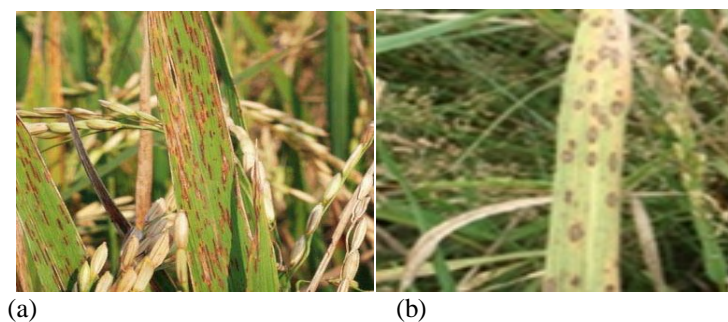


Fig 6.1 Tested disease symptoms (a) narrow brown spot disease (b) Brown spot disease

It is an efficient technique for the detection of plant diseases. Based on SVM classifiers, the diseases are classified into clusters based on texture shape and color.

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VII. CONCLUSION

To enhance the quality and quantity of agricultural products the pests and disease invasion should be reduced. The proposed technique is a solution to this problem. It detect he disease based on the features such as texture, color and shape after segmenting the images using FCM clustering technique and classifies the disease using support vector machine (SVM) algorithm. After detecting the disease, targeted spraying of pesticide corresponding to the disease ensure the limited usage of pesticide and reduction of ill effects.

REFERENCES

- [1] Bruno S. Faiçal, Heitor Freitas, Pedro H. Gomes, Leandro Y. Mano, Gustavo Pessin, André C.P.L.F. de Carvalho, Bhaskar Krishnamachari, Jô Ueyama “An adaptive approach for UAV-based pesticide spraying in dynamic environments”, Computers and Electronics in Agriculture 138 210–223 ,2017.
- [2] <https://www.mathworks.com/help/images/texture-analysis-using-the-gray-level-co-occurrence-matrix-gldm.html>
- [3] Sabah Bashir, Navdeep Sharma. “Remote Area Plant Detection Using Image Processing” IOSR Journal of Electronics and Communication Engineering ,ISSN: 2278-2834 vol 2, issue 6, PP 31-34, 2012.
- [4] Johnny L. Miranda, Bobby D. Gerardo, Bartolome T. Tanguilig “Pest Identification using Image Processing Techniques in Detecting Image Pattern through Neural Network” International Journal of Advances in Image Processing Techniques– IJPT Volume 1 : Issue 4 [ISSN 2372 – 3998] , 2014
- [5] Soumi Ghosh and Sanjay Kumar Dubey, amity university, “Comparative Analysis of K-Means and Fuzzy C-Means Algorithms” (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 4, No.4, 2013.
- [6] Subhagata chattopadhyay, dilip kumar pratihar, sanjib chandra de sarkar ,“A comparative study of fuzzy c-means algorithm and entropy-based fuzzy clustering algorithms”, computing and informatics, vol. 30, 701–720,2011
- [7] kumar, Nnitish kumar ,Dr sreenivas.T.H . “Autonomous Navigation of Flying Quadcopter” IJRITCC, vol. 3, issue. 6,2015.
- [8] Harsh Vardhan P.D.P.R, Dheepak.S, Aditya P.T, Sanjivini Arul.”Development of Automated Aerial Pesticide Sprayer” IJRET, vol.03, issue .04, pISSN: 2321-7308,vol.03,issue.04 , 2014
- [9] Renuka Rajendra Kajale, “Detection & Reorganization of Plant Leaf Diseases using Image Processing and Android O.S.”, International Journal of Engineering Research and General Science, Vol. 03, No. 02, 2015
- [10] Basvaraj.S.Anami1, J.D.Pujari2, Rajesh.Yakkundimath, “Identification and Classification of Normal and Affected Agriculture/horticulture Produce Based on Combined Colour and Texture Feature Extraction”,2011
- [11] Mr. Sachin B. Jagtap and Mr. Shailesh M. Hambarde, “Agricultural Plant Leaf Disease Detection and Diagnosis Using Image Processing Based on Morphological Feature Extraction”, IOSR Journal of VLSI and Signal Processing, Vol. 04, No. 05, 2014.
- [12] Prof. Sanjay B. Dhaygude and Mr.Nitin P.Kumbhar, ““Agricultural Plant Leaf Disease Detection using Image Processing”, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 02, No. 1, 2013.
- [13] Prakash M. Mainkar1, Shreekant Ghorpade2, Mayur Adawadkar, “Plant Leaf Disease Detection and Classification Using Image Processing Techniques”, International Journal of Innovative and Emerging Research in Engineering, Vol. 02, No. 04, 2015.