International Journal of Engineering Research in Electronic and Communication Engineering (IJERECE) Vol 3, Issue 5, May 2016

Disease Detection in Paddy Using Image Processing

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***Abstract*— India is predominantly an agrarian economy with more than 75 percent of its population living in villages and depending on agriculture and allied activities for their livelihood. Land has traditionally been the basic income yielding assets of Indian farmers. Whilst most farmers are familiar with conventional farming practices, they are often ill positioned to promptly deal with diseases and plant infestations affecting their crops. Current advisory systems tend to be generic and are not tailored to specific plots or farms.**

Our project comprises an agriculture advisory model to provide an agriculture disease mitigation system. The image of diseased/infected paddy crop is captured using the camera. The images are processed in such a way as to provide a visual representation of the affected paddy leaf. A digital image is further analyzed by taking RGB feature of that image and then classified. That classified information can be used for precision farming by farmer for decision support system.

***Keywords*— Agrarian, Paddy disease, Disease detection, Prototype, Disease detection system**

I. INTRODUCTION

Agriculture is the backbone of many nations and livelihood of ever growing population. Plants have become an important source of energy and are a fundamental piece in the puzzle to solve the problem of global warming. About 70% of people in India lives in 600,000 villages and choose agriculture as their main occupation. In India, total land is 32,87,263 square km and population is 1.17 Billion. Agriculture contributes for about 17.5% of total GDP and accounts for 52% of labor force. 50% of farms are less than 2.5 acres. Arable land for agriculture is about 48.83%.

India is one of the world's largest producers of white rice and brown rice, accounting for 20% of all world rice production. Rice is one of the chief grains of India. The rice consumption has increased from 86700 to 99351 tons in 7 years (2007- 2014) and the growth rate has been decreased to 0.17% from 4.34%.This decrease may be due to diseases affecting paddy. Some of the major diseases among these affecting the paddy crop are:

- Blast
- Brown spot
- Bacterial blight
- Sheath spot
- Crown sheath rot
- Sheath blight

There are many factors that affect the yield like temperature, rainfall, humidity, water availability, soil conditions etc. and the major loss of the crop is due to the diseases. The loss percentage varies from 4% to 52%.The two major diseases are Blast and Bacterial blight on which we are concentrating.

Rice blast (Pyriculariagrisea) is a fungus that feeds on the rice plant, causing severe damage usually seedling stage. It attacks different parts of the plant: the collar, which can ultimately kill the entire leaf blade; the stem, which turns blackish and breaks easily (node blast); the neck of the panicle, where the infected part is girdled by a grayish brown lesion, or when severe, causes the panicles to fall over; or on the branches of the panicles which exhibit brown lesions when infected. Blast is considered a major disease of rice because of its wide distribution and extent of destruction under favorable conditions.

Bacterial blight is one of the most destructive rice diseases in Asia and has historically been associated with major epidemics. Whenever susceptible rice varieties are grown in environments that favor bacterial blight, very high yield losses, as much as over 70%, may be caused by bacterial blight.

There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms associated, or those appear only when it is too late to act. Some farmers don't have enough knowledge to identify exact disease on crop by analyzing symptom on crop. There are two possibility while identifying symptom on crop, one is farmer can't understand exact disease symptom or/and farmer may get confuse in analyzing the symptom on crop. In recent

years, tools, technologies and applications of information technologies have emerged as efficient and effective measures for up gradation of the whole agricultural fields, ranging from scientific studies to farmers help.

Here we have proposed a system to detect diseases in paddy using image processing techniques. We can analyse the image of diseased paddy leaves by using advanced image processing technology and extract the features of disease spot according to color from a quantitative point of view. The cause and extent of disease can be diagnosed timely and effectively, it could be prevented and controlled by giving effective solutions.

Motivation

In last few years, our society experienced a silent, but quite dramatic revolution in terms of the number of autonomous electronic devices (e.g. laptops, palm pilots, digital cameras, household robots, etc.) that we use in our everyday lives. This fact motivated to think whether there exist a possibility of disease detection system or similar devices. Results of research lead to starting with this project.

II. METHODOLOGY

This project demonstrates statistical based recognition and classification of visual symptoms of affected disease. Color images of disease symptoms affected on paddy is used in this work. Different types of symptoms affected by disease namely bacterial leaf blight and are considered for the study.

The developed algorithms are used to preprocess, segment, extract features from disease affected regions. The affected regions are segmented using thresholding segmentation technique. Color features are extracted from affected regions and then statistical methods are used as classifiers. Tests are performed to classify image samples.

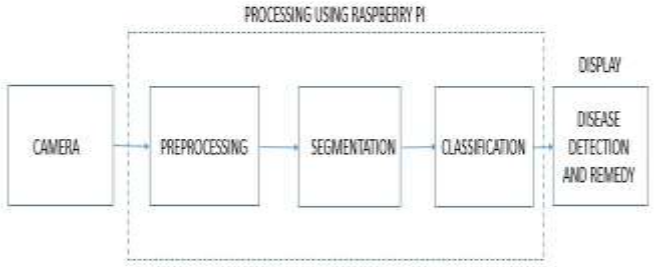

FIGURE: Block diagram of prototype of detection system

The following steps are involved in the methodology:

Step 1: In the first step image of paddy leaf is captured using raspberry pi camera module.
Step2: The second step of detection of plant diseases starts with processing of image using raspberry pi processor. The processing involves preprocessing, segmentation, extraction of features from the image. The affected regions are segmented using thresholding segmentation technique. Color features are extracted from affected regions.
Step 3: Then statistical methods are used as classifiers. Tests are performed to classify image whether it is diseased or not.
Step 4: If disease is detected the name of the disease and appropriate remedy is displayed.

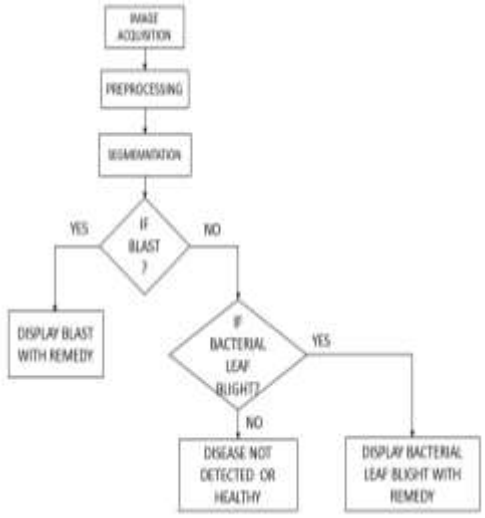

Figure: Flow of program

The fundamental operations involved in processing are:

III. IMAGE ACQUISITION-

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement.

One hundred and fifty two samples of paddy leaves were collected from farms of shiramagondanalli, a village in advancer district, Karnataka. Out of these samples seventy three were infected with blast, sixty with bacterial sheath

blight and remaining nineteen were unaffected or healthy samples.

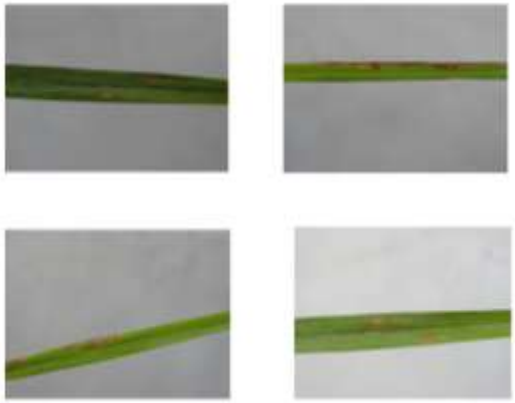

Figure: Samples of Blast infected leaves

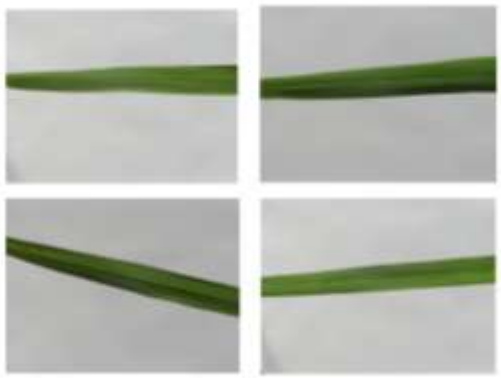

Figure: Samples of healthy leaves

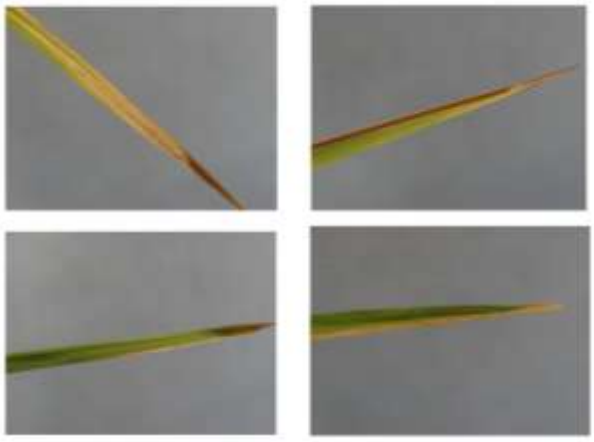

Figure: Samples of bacterial leaf blight leaves

IV. PREPROCESSING-

Image pre-processing can significantly increase the reliability of an optical inspection. Several filter operations which intensify or reduce certain image details enable an easier or faster evaluation. Filtering is a neighborhood operation, in which the value of any given pixel in the output image is determined by applying some algorithm to the values of the pixels in the neighborhood of the corresponding input pixel. A pixel's neighborhood is some set of pixels, defined by their locations relative to that pixel.

For this prototype, various filtering techniques were used like median filter, gaussian filter, laplacian filter and wiener filter. Among these filters gaussian filter gave the desired output.

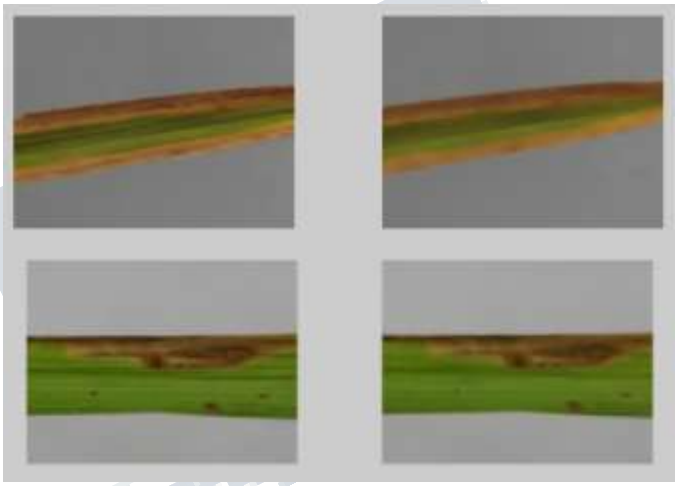

Figure: Result after pre-processing

V. SEGMENTATION-

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects orotherrelevant information in digital images. The main motto of segmentation is to reduce the information for easy analysis.

Segmentation is also useful in Image Analysis and Image Compression. There are many different ways to perform image segmentation, including: Region Based, Edge Based, Threshold, Feature Based Clustering and Model Based. Among the various color formats available like RGB, LAB, HSV and Cyber, choosing LAB color space the diseased part is extracted. The affected regions are segmented using thresholding segmentation technique. Color features are extracted from affected regions.

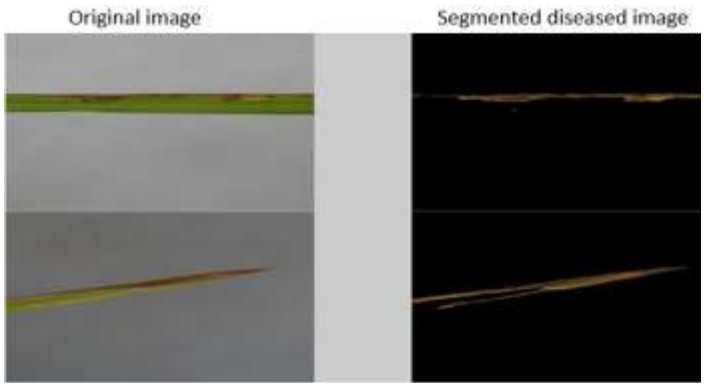

Figure: Results after segmentation

VI. CLASSIFICATION-

Classification is a general process related to categorization, the process in which objects are recognized, differentiated, and understood. Classification includes a broad range of decision-theoretic approaches to the identification of images.

We have used statistical methods for classification based on standard deviation, structural similarity index and area of segmented image.

Standard deviation is a measure that is used to quantify the amount of variation or dispersion of a set of data values.

Structural similarity index is a method for predicting the perceived quality of digital television and cinematic pictures, as well as other kinds of digital images and videos.

Area estimates the area of the objects in binary image.

VII. RESULTS AND DISCUSSION

The results obtained after classification are as follows:

One hundred and fifty two samples of each data class are considered to test the system. For different classification techniques it has been found that the overall success rate is 94.07%, 94.7% and 92.1% respectively for standard deviation, ssim and area of segmented image summarized in following tables.

	BLAST	BLB	HEALTHY
BLAST	73	6	0
BLB	0	54	0
HEALTHY	0	0	19
EFFICIENCY	100	90	100

Figure: Results of standard deviation

	BLAST	BLB	HEALTHY
BLAST	73	13	0
BLB	0	57	0
HEALTHY	0	0	19
EFFICIENCY	100	81.42	100

Figure: Results of ssim

	BLAST	BLB	HEALTHY
LAST	71	11	0
LB	0	48	0
EALTHY	2	1	19
FFICIENCY	97.26	80	100

Figure: Results of area of segmented image

Advantages

The advantages of the prototype model are as below:

1.From this model it is possible to detect accurately the diseases affecting paddy.

2. Famers can reduce their loss caused by diseases without panic.

3. The loss is reduced as the farmer need not have to wait for an expert to identify.

Disadvantages

The disadvantages of the prototype model are as below:

1. Need of high resolution camera for efficiency.

2. Initial investment cost is more.

VIII. CONCLUSION AND FUTURE WORK

The proposed methodology uses leaf features for disease detection, where feature extraction is done by segmenting diseased area using color space conversion. Segmented image contains the actual disease part. This part is used for statistical analysis for the classification of 2 different paddy leaf diseases which shows accurate classification. The extension of this work will focus on developing algorithms and NN's in order to increase the recognition rate of classification process.

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