A PROJECT REPORT

on

EARLY PEST DETECTION FROM CROP USING IMAGE PROCESSING

Submitted in partial fulfillment of the requirement for
The award of the Degree of
BACHELOR OF TECHNOLOGY
in
ELECTRONICS AND COMMUNICATION ENGINEERING
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CERTIFICATE

This is to certify that the project report entitled **"EARLY PEST DETECTION FROM CROP USING IMAGE PROCESSING"** being submitted by **U.Priyanka (14JN1A04G2) , S.Vijitha (14JN1A04E5) , T.Aswini (14N1A04G1), T.Saipriya (14JN1A04F8), T.Sai Sravani (14JN1A04G0) , M.Sravana Swathi (15JN5A0403)** in partial fulfillment for the award of the Degree of **BACHELOR OF TECHNOLOGY** in **ELECTRONICS AND COMMUNICATION ENGINEERING** to the Jawaharlal Nehru Technological University Ananthapuramu, is a record of bonafied work carried out under my guidance and supervision. The results embodied in this project report have not been submitted to any other University or Institute for the award of any degree.

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I hereby declare that the project report entitled, **"EARLY PEST DETECTION FROM CROP USING IMAGE PROCESSING"** completed and written by us has not been previously formed the basis for the award of any degree certificate.

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ABSTRACT

This project presents an automatic approach for early pest detection. Agriculture not only provides food for the human existence, it is also a big source for the economy of any country. Millions of dollars are being spent to safeguard the crops annually. Insects and pests damage the crops and, thus, are very dangerous for the overall growth of the crop. One method to protect the crop is early pest detection so that the crop can be protected from pest attack. The best way to know about the health of the crop is the timely examination of the crop. If pests are detected, appropriate measures can be taken to protect the crop from a big production loss at the end.

Early detection would be helpful for minimizing the usage of the pesticides and would provide guidance for the selection of the pesticides. Traditional method of examination of the fields is naked eye examination but it is very difficult to have a detailed examination in large fields. To examine the whole field, many human experts are needed which is very expensive and time consuming. Hence, an automatic system is required which can not only examine the crops to detect pest infestation but also can classify the type of pests on crops.

Computer vision techniques provide effective ways for analyzing the images of leaves. Support Vector Machine (SVM) is used for classification of images with and without pests based on the image features. This technique is simpler as compared to the other automated technique and provides better results.

CHAPTER -1

INTRODUCTION

Plant diseases cause periodic outbreak of diseases which leads to large scale death and famine. The term disease maybe defined as the destruction of plant leaf. It can be bacterial, fungal and virus .Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures, bacteria is considered more primitive than fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simpler life cycles. With few exceptions, bacteria exist as single cells and increase in numbers by dividing into two cells during a process called binary fission Viruses are extremely tiny particles consisting of protein and genetic material with no associated protein. Since the effects of plant diseases were devastating, some of the crop cultivation has been abandoned. In this project different image processing techniques has been used for studying rice diseases. The disease found in rice crop is drechsleraoryzae and brown spot leaf. It produces oval, eye shaped spots with conspicuous dark brown dot in the centre and light brown margin. Spots are also produced on grains. Following factors are responsible for these diseases:

(a) This disease occurs in poor soil.

(b) Antifungal activity of aqueous extracts of plant which were tested in vitro against drechsleraoryzae.

(c) Mycelia growth of drechsleraoryzae at different concentrations of 5%, 10%, 15%.Different parameters that have been included to compare a healthy leaf.

1.1 BACKGROUND:

A product quality control is fundamentally required in order to gain more value added products. Many studies show that quality of agricultural products can be reduced from many causes. One of the most important factors of such quality is plant diseases. Consequently, minimizing plant diseases allows substantially improving quality of the products. Rice known as OryzaSativa (scientific name), is one of the most utilized food plants and widely grown originated in ASIA. Rice is an important crop worldwide and over half of the world population relies on it for food. Many people in the world including Malaysia eat rice as

staple food. However, there are many factors that make paddy rice production become slow and less productive. One of the main factors is paddy disease. An abnormal condition that injures the plant or leads it to function improperly is called as a disease. Diseases are readily recognized by their symptoms. There are a lot ofpaddy disease types which are Bakanae, red disease virus, brown spot disease and many more. Image processing and computer vision technology are very beneficial to the agricultural industry. They are more potential and more important to many areas in agricultural technology

Paddy Disease Detection System is one of the very beneficial systems. It can help the paddy farmer detect the disease faster. This study aims to develop a prototype system to automatically detect and classify the paddy diseases by using image processing technique as an alternative or supplemental to the traditional manual method.

1.2 PROBLEM STATEMENT:

Paddy will be harvest twice in a year. Most of paddy farmer faces many problems to harvest their paddy because they had been attack by snail, worm and fungi. Furthermore, when the paddy had been infected or attacked, the others areas had been exposed to be infected. Thus, it will decrease paddy farmer's income and lead to significance losses to farmer. Currently, the paddy farmer determines the type of disease manually. The errors might occur in order to determine the type of diseases. Paddy farmer also have to spend a lot of time to detect the type of disease. It also takes a time as the paddy farmers manually check the disease since the paddy field is in wide area.

1.3 OBJECTIVE:

There are three objectives to achieve in this project:

i. to develop the prototype of paddy disease detection system

ii. to detect the paddy disease by using image processing

iii. to apply image processing technique to analyze the pattern of paddy disease

1.4 SCOPE:

• The users of this system are paddy farmers.

• The prototype will be develop by using MATLAB 14

• 10 samples each of the normal, brown spot disease, narrow brown spot disease and blast disease will be used in this project.

CHAPTER -2

LITERATURE REVIEW

This chapter briefly reviews, explains and discusses on existing literature review related with the current project which is “Paddy Disease Detection System Using Image Processing” that will be developed later. This chapter comprises three sections. The first section describes the overviews of paddy. The subsections are the definition, type of paddy disease, paddy symptom and paddy management. The second section is the review of some existing system that used same techniques and methods. The third section discusses the review on technique and method used by the system. The subsections are image acquisition, image segmentation and artificial neural network and Image processing Techniques.

2.1 DEFINITION OF PADDY:

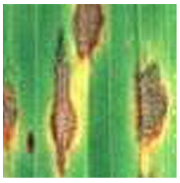
Paddy also known as rice is the starchy seeds of an annual southeast Asian cereal grass (*Oryzasativa*) that are cooked and used for food. This cereal grass that is widely cultivated in warm climates for its seeds and by-products [8]. Rice is one of the most utilized food plants and widely grown originated in ASIA. Rice is an important crop worldwide and over half of the world population relies on it for food. Many people in the world including Malaysia eat rice as staple food.

2.2 PADDY DISEASES, SYMPTOMS AND MANAGEMENT:

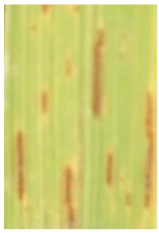
There are many factors that make paddy rice production become slow and less productive. One of the main factors is paddy disease. The table below will show you type of paddy disease, the symptom of paddy disease and the management of paddy disease. This researches focus on three types of diseases, which are paddy blast, brown spot disease and narrow brown spot disease.

The following paddy diseases are shown below:

Table 2.1: Paddy Disease, Symptom and Management

S. No	Disease	Disease Symptoms
1	**Paddy Blast**  Fig. 2.1 : Blast Disease Onleaf	**Paddy Blast Symptoms** Disease can infect paddy at all growth stages and all aerial parts of plant (Leaf, neck and node).Among the three leaves and neck infections are more severe.Small specks originate on leaves -subsequently enlarge into spindle shaped spots(0.5 to 1.5cm length, 0.3 to 0.5cm width)with ashy center.Several spots coalesce -> big irregular patches **Management** Avoid excess N - fertilizer application Apply nitrogen in three split doses. Removes weed hosts from bunds. Use of tolerant varieties (Penna, Pinakini, Tikkana, Sreeranga, Simphapuri, Palghuna, Swarnamukhi, Swathi, Prabhat, Co 47, IR - 64, , IR - 36, Jaya) Burning of straw and stubbles after harvest Dry seed treatment with *Pseudomonas fluorescens*talc formulation @10g/kg of seed. Stagnate water to a depth of 2.5cm over an area of 25m2 in the nursery. Sprinkle 2.5 kg of *P. fluorescens*(talc) and mix with stagnated water. Soak the root system of seedlings for 30 min and transplant. Spray *P. fluorescens*talc formulation @ 0.5% from 45 days after transplanting at 10 day intervals, three times.

		Seed treatment at 2.0 g/kg seed with Captan or Carbendazim or Thiram or Tricyclazole. Spraying of Tricyclazole at 1g/lit of water or Edifenphos at 1 ml/lit of water or Carbendazim at 1.0 gm/lit. 3 to 4 sprays each at nursery, tillering stage and panicle emergence stage may be required for complete control. **Nursery stage** Light infection - Spray Carbendazim or Edifenphos @ 0.1 %. **Pre-Tillering to Mid-Tillering** Light at 2 to 5 % disease severities - Apply Edifenphos or Carbendazim @ 0.1 %. Delay top dressing of N fertilizers when infection is seen. Panicle initiation to booting At 2 to 5% leaf area damage spray Edifenphos or Carbendazim or Tricyclazole @ 0.1 %. F**lowering and after** At 5 % leaf area damage or 1 to 2 % neck infection spray Edifenphos or Carbendazim or Tricyclazole @ 1 g /lit of water.
2	**Paddy Brown Spot Disease**  Fig. 2.2 :Paddy Brown Spot Disease	**Paddy Brown Spot Disease** Initial lesions are water-soaked to greenish gray and later become grayish white with brown margin Lesions on leaf sheaths near waterlinePresence of sclerotia Lesions may coalesce death of the whole leaf Partially filled or empty grains **Management** Apply FYM 12.5 t/ha or green manure 6.25

		t/ha to promote antagonistic microflora. Soil application of *P. fluorescens@* 2.5 kg/ha mixed with 50 kg FYM after 30 days of transplanting.Foliar spraying of *P. fluorescens*@0.2% at boot leaf stage and 10 days later. Avoid flow of irrigation water from infected to healthy field.Carbendazim (1 g/lit), Propiconazole (1ml/lit) may be applied. Spraying of infected plants with fungicides, such as Benomyl and Iprodione, and antibiotics, such as Validamycin and Polyoxin,is effective against the disease Reduce Nitrogen dosage and skip top dressing
3	**Narrow Brown Spot Disease**  Fig. 2.3 : Narrow Brown Spot Disease	**Symptoms** Short, narrow, elliptical to linear brown lesions usually on leaf blades but may also occur on leaf sheaths, pedicels, and glumes or rice hulls Lesions about 2-10 mm long and 1 mm wide Lesions narrower, shorter, and darker brown on resistant varieties Lesions wider and lighter brown with gray necrotic centers on susceptible varieties Leaf necrosis may also occur on susceptible Varieties Lesions occur in large numbers during the later growth stages **Why Occurs?** The disease is observed on rice crops grown on soil deficient in potassium. Temperature ranging from 25-28° C isfavorable for the optimum growth of the disease. Susceptibility of the variety to thefungus

		and the growth stage of the rice crop are other factors that affect the development of the disease. Although rice plants are susceptible tothe fungus at all stages of growth, they aremore susceptible from panicle emergence to maturity, thus, becoming more severe as rice approaches maturity. **Management** Cultural practices, such as the use of potassium and phosphorus fertilizers, and planting ofearly maturing cultivars early in the growing season, are recommended to manage the narrow brown leaf spot.The use of resistant varieties isthe mosteffective approach to manage the disease.However,theresistant varieties and lines areonly grown in United States and India.Spraying of fungicidessuchbenomyl, propicanazole,carbendazim, propiconazole ,andiprodione, when the disease is observed in the field is effective.

Rice blast *(Pyriculariagrisea)* is a fungus that feeds on the rice plant, causing severe damage usually during the 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 highly destructive in lowland rice in temperate and subtropical Asia, as well as in upland rice in tropical Asia, Latin America and Africa. Blast is found in approximately 85 countries throughout the world. Its first known occurrence was as early as 1637 in China where the disease was known as rice fever disease.

Blast is considered a major disease of rice because of its wide distribution and extent of destruction under favorable conditions. Although blast is capable of causing very severe losses of up to 100%, little information exists on the extent and intensity of actual losses in farmers' fields. Losses of 5-10%, 8%,and 14% were recorded in India (1960-1961), Korea (mid-1970s), and in China (1980-1981), respectively. In the Philippines, yield losses ranging from 50-85% were reported. (IRRI)

The characteristic symptoms of the disease are usually observed during the late growth stages and are characterized by the presence of short, linear, brown lesions mainly on the leaves (although it may also occur on leaf sheaths, pedicels, and glumes).

Foliar fungicides such as mancozeb, benomyl, propiconazole, and iprodione effectively suppress this disease and may be economical if other diseases are also controlled along with narrow brown spot.

Typical spots on the leaves are oval, about the size and shape of sesame seeds. The spots are relatively uniform and fairly evenly distributed over the leaf surface. Young spots are small, circular (0.05 to 0.10mm in diameter) and usually dark brown. Most spots have a light-yellow halo around their margins.

Since the disease is known to be associated with soil deficient in nutrients, proper fertilization, good water management and soil amendment are suggested as management option.

2.3 EXISTING METHOD:

In recent days, there has been an attempt to assit the frmer by telephony service but, this service is not 24X7 hours service. Sometimes, the farmers are not able to connect with experts due to communication failures.Another important problem is that in a critical situation, if the farmers are not able to explain or if the disease is a new one, then farmers would not be able to identify the diseases of the crops.captured images from crop surfaces can provide a better solution where the remote agri-scientist can see instantly the image for disease diagnosis.similarly,captured skin,face,or other images through the developed application may be sent to expert doctors to extend tele health advice to remote areas.

1. Manual treatment.

2. Telephonic Suggestion

2.3.1 INVESTIGATING ON IMAGE PROCESSING TECHNIQUES FOR DIAGNOSING PADDY DISEASES:

A study conducted by NunikNovianaKurniawati, SitiNorul Huda Sheikh Abdullah, Salwani Abdullah, Saad Abdullah from UniversitiKebangsaan Malaysia aims to develop a prototype system to automatically and correctly detect and classify the paddy diseases with Blast Disease (BD), Brown Spot Disease (BSD), and Narrow Brown Spot Disease (NBSD) using image processing technique as an alternative or supplemental to the traditional manual method.[1]

2.3.1.1 METHOD:

The methodology for diagnosing paddy diseases can be simplified as Fig. 2.2. This process involves several tasks, such as image acquisition and collection, image segmentation and pre-processing, shape feature extraction and color feature extraction, and paddy diseases classification based on lesion type, boundary color, spot color, and broken paddy leaf color. Cunha used recognition technique to analyze the pathological stress conditions and characterization of the fruits or plant leafs. Runtz and Dave [19,20] applied image processing technique for classification and identifying of the plant species.

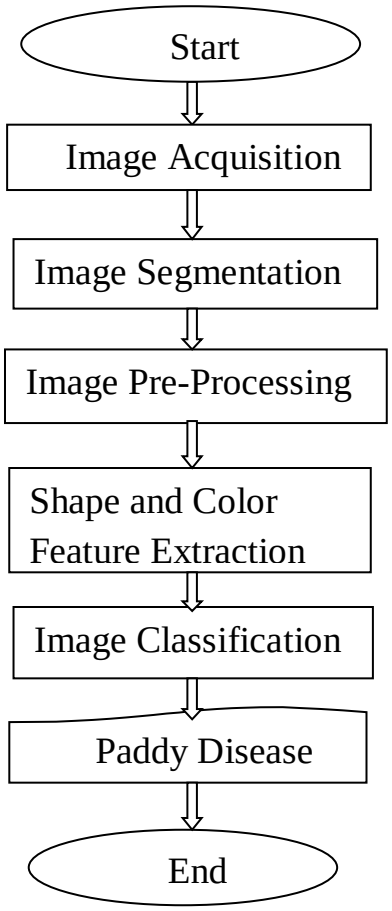
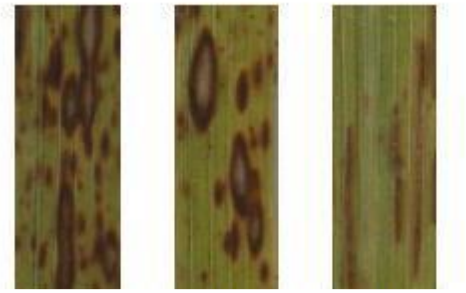


Fig. 2.2 : The Methodology

2.3.1.2 IMAGE AQUISITION:

The RGB colour images of paddy leaf are captured using a Canon PowerShot G2 digital camera, with pixel resolution 768x1024. The digitized images are about 225 KB size each. Those images are cropped into a smaller image with dimension of 109 x 310 pixels. There have collected about 94 data samples. It consists of three types of paddy diseases as shown in Fig. 2.3. Images are stored in BMP format. The prototype uses Matlab image processing library

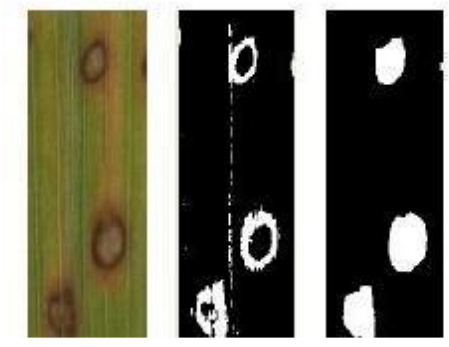


(a) **(b)** **(c)**

Fig. 2.3 : (a) Blast Disease ; (b) Brown Spot Disease; (c) Narrow Brown Spot Disease

2.3.1.3 IMAGE SEGMENTATION AND PRE-PROCESSING:

The main objective of this process is to obtain the binary image with less noise or noise free. In order to achieve high accuracy, an appropriate silhouette should be obtained. The RGB image (Fig. 2.4(a)) is converted into a binary image using threshold method, as shown in Fig. 2.4(b). They used local entropy threshold methods of Eliza and Chang and Otsu method. A morphological algorithm is used to remove noises by using region filling technique.



(a) (b) (c)

Fig. 2.4 : (a) RGB image ; (b) Binary image with noise; (c) Binary image with noise free

2.3.1.4 FEATURE EXTRACTION USING TEXTURE ANALYSIS:

The image analysis focused on the shape feature extraction and color based segmentation. Feature extraction is the most important part of this project. Some properties of the images are considered here. The different types of properties includes region properties, gray covariance matrix properties etc. The properties standard deviation, entropy, contrast etc are extracted from the image and are used to train the dataset for the SVM classification. Support Vector Machines (SVM's) are a relatively new learning method used for binary classification. The basic idea is to find a hyper plane which separates the d-dimensional data perfectly into its two classes. Mean returns the mean value of the elements along different parameters of an array Standard Deviation computes the standard deviation of the values in matrix. Contrast Returns a measure of intensity contrast between pixels. Energy Returns the sum of squired elements in the glcm Filled Area Scalar specifying the number of pixels in filled area

2.3.1.5 IMAGE CLASSIFICATION:

The production rules have been developed through serial interviews with agricultural expert based on above characteristics, such as lesion type, boundary color, spot color, and broken paddy leaf color, paddy diseases is recognized using production rule method with forward-chaining method.

2.3.1.6 DISADVANTAGES OF EXISTING SYSTEMS:

- Identifying plants using such keys is a very time consuming task and has been carried out only by trained botanists.
- However, in addition to this time intensive task,there are several other drawbacks in identifying plants using these features such as the unavailability of required morphological information and use botanical terms that only experts can understand.

2.3.2 A FRAMEWORK FOR DETECTION AND CLASSIFICATION OF PLANT LEAF AND STEM DISEASE:

A study conducted by Dheeb Al Bashish, Malik Braik, and SuliemanBani-Ahmad ona framework for Detection and Classification of Plant Leaf and Stem Diseases. Studies show that relying on pure naked-eye [15] observation of experts to detect such diseases can be prohibitively expensive, especially in developing countries. Providing fast, automatic, cheap and accurate image processing-based solutions for that task can be of great realistic significance.

2.3.2.1 METHOD:

The proposed framework is image processing-based and is composed of the following main steps;

a) The images at hand are segmented using the K-Means technique

b) The segmented images are passed through a pre-trained neural network.

2.3.2.2 CLUSTERING METHOD:

K-means clustering is used to partition the leaf image into four clusters in which one or more clusters contain the disease in case when the leaf is infected by more than one disease.The k-means clustering algorithms tries to classify *objects* (pixels in our case) 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. On this experiment, the K-means clustering is set to use squared Euclidean distances.

2.3.2.3 FEATURE EXTRACTION:

The method followed for extracting the feature set is called the Color Co-occurrence Method or CCM method in short. It is a method, in which both the color and texture of an image are taken into account, to arrive at unique features, which represent that image.

- ✓ Co-occurrence Methodology for Texture Analysis
- ✓ Normalizing the CCM matrices
- ✓ Texture features identification

As a test bed, D. Al Bashish (2001) use a set of leaf images taken from Al-Ghor area in Jordan. There are five diseases which effect on the plants;

a) Cottony mold

b) Early scorch

c) Ashen mold

d) Late scorch

e) Tiny whiteness.

The experimental results indicate that the proposed approach can significantly support accurate and automatic detection of leaf diseases. The developed Neural Network classifier that is based on statistical classification perform well and could successfully detect and classify the tested diseases with a precision of around 93%.

CHAPTER -3

PROPOSED SYSTEM

There is a growing demand of image processing in diverse application areas, such as multimedia computing, secured image data communication, biomedical imaging, biometrics, remote sensing, texture understanding, pattern recognition, content-based image retrieval, compression and so on. To improve the quality of paddy, there must be a system that can accurately detect the disease so that the paddy farmer can cure it as soon as possible. The methodology consists of the pre processing and segmentation of paddy disease and classification of the disease. The techniques that will be applied for the classification of paddy disease in this system are feed-forward neural network technique.

3.1 INTRODUCTION:

The purpose of this chapter is to discuss the approach and framework for the project. Method, technique or approach that will be or has been used while designing and implementing the project included in the content. This chapter also explains about the justification of method or approach used and hardware and software necessity. This project will be conducted based on the Iterative and Incremental Method.

3.2 THE JUSTIFICATION OF ITERATIVE AND INCREMENTAL DEVELOPMENT METHODOLOGY:

Typically agile software development combines iterative and incremental techniques to deliver functionality early and often. Iterative means perform repeatedly. Iterative also can be refers as repeated application of a procedure, applying it each time to the result of the previous application. Besides, iterative development refactors code repeatedly, making progress through successive refinement. Increment means an increase or addition.

Incremental development builds and delivers software to a production environment as a series of small and regular releases with expanding functionality. Agile software development employs both iterative and incremental development techniques but also applies feedback across releases or increments or iteration. Moreover, incremental development becomes evolutionary, where the previous iteration guides the next iteration. Iterative and Incremental development developed in response to the weakness of the waterfall model. It starts with an initial planning and ends with deployment with the cyclic interaction in between.

3.3 ITERATIVE AND INCREMENTAL DEVELOPMENT METHOD:

Paddy Disease Detection System contains some stage or phase of development method such as planning stage, requirement, analysis and design, implementation, testing, evaluation and maintenance.

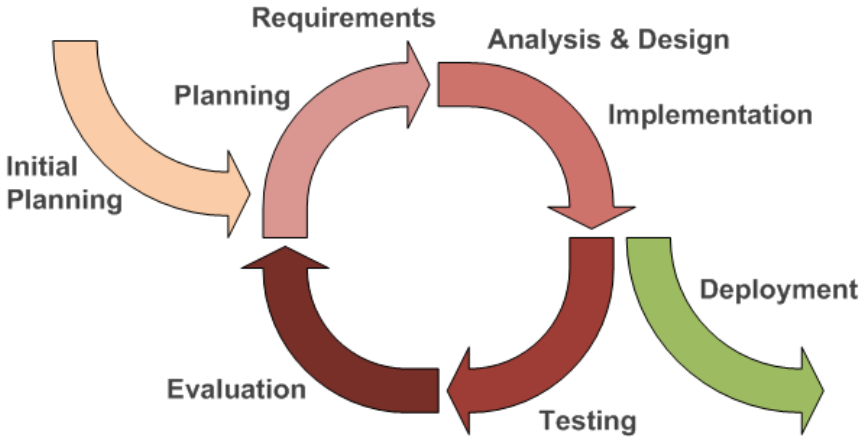


Fig 3.1 : Iterative and incremental development method

3.3.1 PLANNING STAGE:

The first stage to start the development of Paddy Disease Detection System using Image Processing is planning. Planning is the process of gathering all the information including problem statements, objectives and the scope of the system from the journal and article reading from the internet.

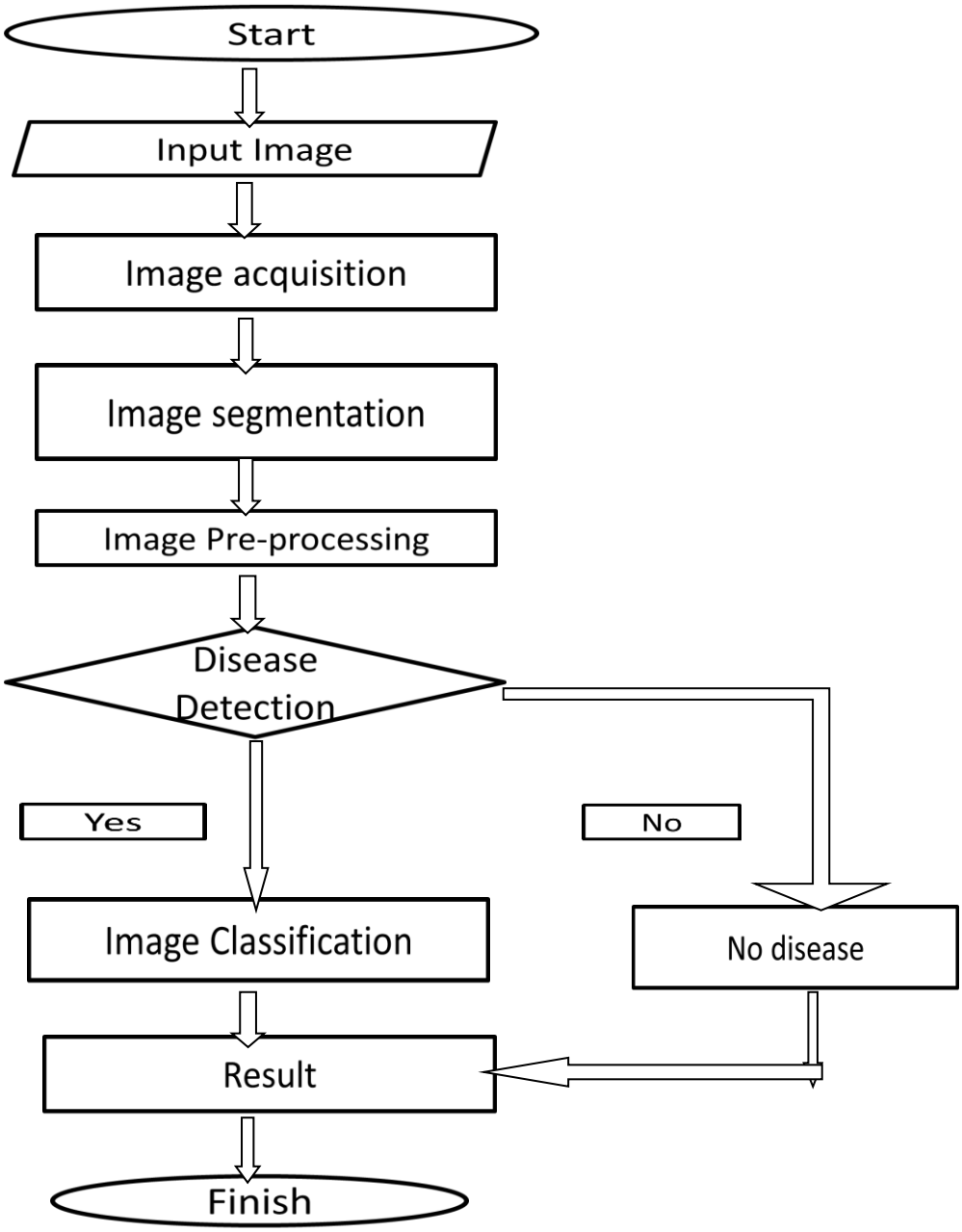


Fig. 3.2 : Flow Chart Of Paddy Disease Detection System

3.3.2 SOFTWARE AND HARDWARE REQUIREMENT/SPECIFICATION:

There are several things that should be considered to make sure the development stage of the system can run successfully. There are software and hardware specification. Software is a conceptual entity which is a set of computer programs, procedures, and associated documentation concerned with the operation of a data processing system. Hardware is component devices which are typically installed into or peripheral to a computer case to create a personal computer upon which system software is installed including a firmware interface.

	Software	**Purpose**
Operating System	Microsoft Windows Vista Ultimate Service Pack 1	As the operating system
Software	Microsoft Office Word 2010	For documentation
	Microsoft Office Project 2010	Gantt chart
	Microsoft Office Visio 2010	Flowchart
	Microsoft Power Point 2010	For slide presentation
	Adobe Acrobat Reader X	For reading from the internet resources
	MATLAB 7.10	Development tools

3.3.3 ANALYSIS AND DESIGN STAGE:

Analysis is the process determining the needs or conditions to meet for a new or altered the system. Design is the process of problem solving and planning for a software solution. It includes low-level component and algorithm implementation issues as well as architectural view.

There is a growing demand of image processing in diverse application areas, such as multimedia

computing, secured image data communication, biomedical imaging, biometrics, remote sensing,

texture understanding, pattern recognition, content-based image retrieval, compression and so on.

3.3.3.1 IMAGE ACQUISITION:

In this process, it is a preparation process to obtain paddy leaf images. The RGB color images of paddy leaf are captured using Olympus *fe*-4050 digital camera with pixel resolution 2048x1024. Those image are cropped into smaller image. Images are stored in BMP format. The prototype uses Matlab image processing library.

Fig. 3.3 (a): Blast Disease

Fig. 3.3(b): Narrow Brown Spot Disease

3.3.3.2 IMAGE SEGMENTATION AND PRE-PROCESSING:

i. Converting RGB to gray scale image:

The segmentation and pre-processing task are the initial stage before the image is used for the next process. The main objective of this process is to obtain the binary image with Otsu method. The Otsu method is based on selecting the lowest point between two classes of the histogram by considering the between-class variance.

Fig. 3.4 : RGB Image

Fig. 3.5 : Binary Image With Noise

TABLE 3.1: PROPERTIES OF AN IMAGE

Mean	Returns the mean value of the elements along different parameters of an array
Standard Deviation	Computes the standard deviation of the values in matrix
Contrast	Returns a measure of intensity contrast between pixels
Energy	Returns the sum of squired elements in the glcm
Filled Area	Scalar specifying the number of pixels in filled area

Fig. 3.6 : Binary Image With Noise Free

3.3.3.3 FILTERING:

Averaging filter is implemented in this process. The average filter computes the mean (average) of the gray-scale values within a rectangular filter window surrounding each pixel. This has the effect of smoothing the image (eliminating noise). The filtered pixel will be calculated by:

$$r = (a1 + a2 + \ldots + a9) / 9 \qquad (1)$$

3.3.3.5 IMAGE CLASSIFICATION:

Based on above training and testing of neural network, the image will be classify weather it is paddy blast, brown spot disease and narrow brown spot disease with the feed forward neural network.

ENTROPY:

E = entropy(I) returns E, a scalar value representing the entropy of gray scale image I. Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image. Entropy is defined as –sum(p.*log2(p))

Where p contains the histogram counts returned from imhist.By default, entropy uses two bins for logical arrays and 256 bins for unit8,unit16, or double arrays.

I can be a multidimensional image. If I has more than two dimensions, the entropy function treats it as a multidimensional gray scale image and not as an RGB image.

STD2: It computes the standard deviation of the value of element.

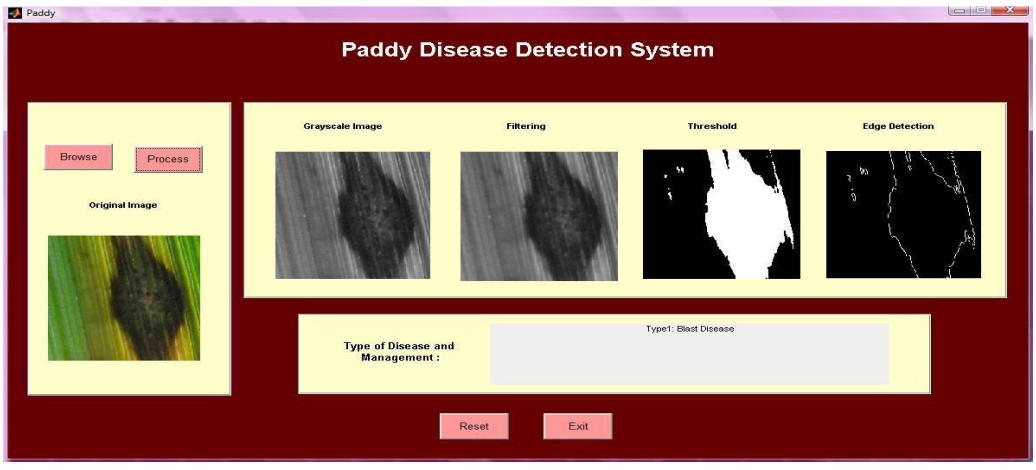


Fig. 3.7 : Prototype of paddy disease detection system

3.3.3.6 TESTING STAGE:

Software testing is an investigation conducted to provide information about the quality of the product or service under test[24]. Testing stage is the process of executing a program or application with the intent of finding software bugs (errors or other defects). A primary purpose of testing is to detect software failures so that defects may be discovered and corrected. The scope of software testing often includes examination of code as well as execution of that code in various environments and conditions as well as examining the aspects of code There are some criteria of validating and verifying that a software program/application/product of paddy system:

1. Meets the requirements that guided its design and development;
2. Works as expected; and
3. Can be implemented with the same characteristics.

CHAPTER - 4

SOFTWARE DISCRIPTION

4.1 MATLAB:

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modelling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including graphical user interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar noninteractive language such as C or FORTRAN.

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects. Today, MATLAB uses software developed by the LAPACK and ARPACK projects, which together represent the state-of-the-art in software for matrix computation.

MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in which

toolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

4.1.1 THE MATLAB SYSTEM:

The MATLAB system consists of five main parts:

4.1.1.1 DEVELOPMENT ENVIRONMENT:

This is the set of tools and facilities that help you use MATLAB functions and files. Many of these tools are graphical user interfaces. It includes the MATLAB desktop and Command Window, a command history, and browsers for viewing help, the workspace, files, and the search path.

4.1.1.2 THE MATLAB MATHEMATICAL FUNCTION LIBRARY:

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigen values, Bessel functions, and fast Fourier transforms.

4.1.1.3 THE MATLAB LANGUAGE:

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

4.1.1.4 GRAPHICS:

This is the MATLAB graphics system. It includes high-level commands for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level commands that allow you to fully customize the appearance of graphics as well as to build complete graphical user interfaces on your MATLAB applications.

4.1.1.5 THE MATLAB APPLICATION PROGRAM INTERFACE (API):

This is a library that allows you to write C and FORTRAN programs that interact with MATLAB. It includes facilities for calling routines from MATLAB (dynamic linking), calling MATLAB as a computational engine, and for reading and writing MAT-files.

4.1.2 DEVELOPMENT ENVIRONMENT:

4.1.2.1 INTRODUCTION:

This chapter provides a brief introduction to starting and quitting MATLAB, and the tools and functions that help you to work with MATLAB variables and files. For more information about the topics covered here, see the corresponding topics under Development Environment in the MATLAB documentation, which is available online as well as in print.

4.1.2.2 STARTING AND QUITTING MATLAB:

4.1.2.2.1 STARTING MATLAB:

On a Microsoft Windows platform, to start MATLAB, double-click the MATLAB shortcut icon on your Windows desktop. On a UNIX platform, to start MATLAB, type Matlab at the operating system prompt.

After starting MATLAB, the MATLAB desktop opens - see MATLAB Desktop.You can change the directory in which MATLAB starts, define start-up options including running a script upon start-up, and reduce start-up time in some situations.

4.1.2.2.2 QUITTING MATLAB:

To end your MATLAB session, select Exit MATLAB from the File menu in the desktop, or type quit in the Command Window. To execute specified functions each time MATLAB quits, such as saving the workspace, you can create and run a finish m script.

4.1.3 MATLAB DESKTOP:

When you start MATLAB, the MATLAB desktop appears, containing tools (graphical user interfaces) for managing files, variables, and applications associated with MATLAB.

The first time MATLAB starts, the desktop appears as shown in the following illustration, although your Launch Pad may contain different entries.

You can change the way your desktop looks by opening, closing, moving, and resizing the tools in it. You can also move tools outside of the desktop or return them back inside the desktop (docking). All the desktop tools provide common features such as context menus and keyboard shortcuts.

You can specify certain characteristics for the desktop tools by selecting Preferences from the File menu. For example, you can specify the font characteristics for Command Window text. For more information, click the Help button in the Preferences dialog box.

4.1.3.1 DESKTOP TOOLS:

This section provides an introduction to MATLAB's desktop tools. You can also use MATLAB functions to perform most of the features found in the desktop tools. The tools are:

4.1.3.2 COMMAND WINDOW:

Use the Command Window to enter variables and run functions and M-files.

4.1.3.3 COMMAND HISTORY:

Lines you enter in the Command Window are logged in the Command History window. In the Command History, you can view previously used functions, and copy and execute selected lines. To save the input and output from a MATLAB session to a file, use the diary function.

4.1.3.4 RUNNING EXTERNAL PROGRAMS:

You can run external programs from the MATLAB Command Window. The exclamation point character! Is a shell escape and indicates that the rest of the input line is a command to the operating system? This is useful for invoking utilities or running other programs without quitting MATLAB. On Linux, for example, emacsmagik.m invokes an editor called emacs for a file named magik.m. When you quit the external program, the operating system returns control to MATLAB.

4.1.3.5 LAUNCH PAD:

MATLAB's Launch Pad provides easy access to tools, demos, and documentation.

4.1.3.6 HELP BROWSER:

Use the Help browser to search and view documentation for all your Math Works products. The Help browser is a Web browser integrated into the MATLAB desktop that displays HTML documents.

To open the Help browser, click the help button in the toolbar, or type help browser in the Command Window. The Help browser consists of two panes, the Help Navigator, which you use to find information, and the display pane, where you view the information.Use to Help Navigator to find information. It includes:

Product filter:

Set the filter to show documentation only for the products you specify.

Contents tab:

View the titles and tables of contents of documentation for your products.

Index tab:

Find specific index entries (selected keywords) in the Math Works documentation for your products.

Search tab:

Look for a specific phrase in the documentation. To get help for a specific function, set the Search type to Function Name.

Favorite's tab:

View a list of documents you previously designated as favorites.

4.1.3.7 DISPLAY PANE:

After finding documentation using the Help Navigator, view it in the display pane. While viewing the documentation, you can:

Browse to other pages:

Use the arrows at the tops and bottoms of the pages, or use the back and forward buttons in the toolbar.

Bookmark pages:

Click the Add to Favorites button in the toolbar.

Print pages:

Click the print button in the toolbar.

Find a term in the page:

Type a term in the Find in page field in the toolbar and click Go.

Other features available in the display pane are: copying information, evaluating a selection, and viewing Web pages.

4.1.3.8 CURRENT DIRECTORY BROWSER:

MATLAB file operations use the current directory and the search path as reference points. Any file you want to run must either be in the current directory or on the search path.

4.1.3.9 SEARCH PATH:

To determine how to execute functions you call, MATLAB uses a search path to find M-files and other MATLAB-related files, which are organized in directories on your file system. Any file you want to run in MATLAB must reside in the current directory or in a directory that is on the search path. By default, the files supplied with MATLAB and Math Works toolboxes are included in the search path.

4.1.3.10 WORKSPACE BROWSER:

The MATLAB workspace consists of the set of variables (named arrays) built up during a MATLAB session and stored in memory. You add variables to the workspace by using functions, running M-files, and loading saved workspaces.

To view the workspace and information about each variable, use the Workspace browser, or use the functions who and who.

To delete variables from the workspace, select the variable and select Delete from the Edit menu. Alternatively, use the clear function.

4.1.3.11 ARRAY EDITOR:

Double-click on a variable in the Workspace browser to see it in the Array Editor. Use the Array Editor to view and edit a visual representation of one- or two-dimensional numeric arrays, strings, and cell arrays of strings that are in the workspace.

4.1.3.12 EDITOR/DEBUGGER:

Use the Editor/Debugger to create and debug M-files, which are programs you write to run MATLAB functions. The Editor/Debugger provides a graphical user interface for basic textediting, as well as for M-file debugging.

You can use any text editor to create M-files, such as Emacs, and can use preferences (accessible from the desktop File menu) to specify that editor as the default. If you use another editor, you can still use the MATLAB Editor/Debugger for debugging, or you can use debugging functions, such as dbstop, which sets a break point.

4.1 MANIPULATING MATRICES:

4.2.1 ENTERING MATRICES:

The best way for you to get started with MATLAB is to learn how to handle matrices. Start MATLAB and follow along with each example.

You can enter matrices into MATLAB in several different ways:

- Enter an explicit list of elements.
- Load matrices from external data files.
- Generate matrices using built-in functions.
- Create matrices with your own functions in M-files.

Start by entering Durer's matrix as a list of its elements. You have only to follow a few basic conventions:

- Separate the elements of a row with blanks or commas.
- Use a semicolon, ; , to indicate the end of each row.
- Surround the entire list of elements with square brackets, [ ].

To enter Durer's matrix, simply type in the Command Window

A = [16 3 2 13; 5 10 11 8; 9 6 7 12; 4 15 14 1]

MATLAB displays the matrix you just entered.

A =

```
   16     3     2    13
    5    10    11     8
    9     6     7    12
    4    15    14     1
```

This exactly matches the numbers in the engraving. Once you have entered the matrix, it is automatically remembered in the MATLAB workspace. You can refer to it simply as A.

4.2.2 EXPRESSIONS:

Like most other programming languages, MATLAB provides mathematical expressions, but unlike most programming languages, these expressions involve entire matrices. The building blocks of expressions are:

4.2.2.1 VARIABLES:

MATLAB does not require any type declarations or dimension statements. When MATLAB encounters a new variable name, it automatically creates the variable and allocates the appropriate amount of storage. If the variable already exists, MATLAB changes its contents and, if necessary, allocates new storage. For example,

```
num_students = 25
```

Creates a 1-by-1 matrix named num_students and stores the value 25 in its single element.

Variable names consist of a letter, followed by any number of letters, digits, or underscores. MATLAB uses only the first 31 characters of a variable name. MATLAB is case sensitive; it distinguishes between uppercase and lowercase letters. A and a are not the same variable. To view the matrix assigned to any variable, simply enter the variable name.

4.2.2.2 FUNCTIONS:

MATLAB provides a large number of standard elementary mathematical functions, including abs, sqrt, exp, and sin. Taking the square root or logarithm of a negative number is not an error; the appropriate complex result is produced automatically. MATLAB also provides many more advanced mathematical functions, including Bessel and gamma functions. Most of these functions accept complex arguments. For a list of the elementary mathematical functions, type

For a list of more advanced mathematical and matrix functions,

Type

Help spec fun

Help el mat

Some of the functions, like sqrt and sin, are built-in. They are part of the MATLAB core so they are very efficient, but the computational details are not readily accessible. Other functions, like gamma and sinh, are implemented in M-files. You can see the code and even modify it if you want. Several special functions provide values of useful constants.

4.3 COMMANDS IN MATLAB FUNCTION:

CLC: clc clears all input and output from the Command Window display, giving you a "clean screen." After using clc, you cannot use the scroll bar to see the history of functions, but you still can use the up arrow key, ↑, to recall statements from the command history

CLEAR ALL: clear all clears all objects in the MATLAB® workspace and closes the MuPAD® engine associated with the MATLAB workspace resetting all its assumptions.

CLOSE ALL:

Clear All removes all variables, global, functions and MEX links.

Clear All at the command prompt also clears the base import list.

IMREAD:

Imread reads image from graphic file.

Eg: A=imread(FILENAME.FMT);

Read a gray scale or a color image from the file specified by the string FILENAME. If the file is not in the current directory, or in a directory on the MATLAB path,specify the full path name. The text string FMT specifies the fomat of the file by its standard file extension. For example, specify 'gif' for graphics interchange format files. To see a list of supported formats, with their file extensions, use the IMFORMATS functions. If imread cannot find a file named FILENAME, it looks for a file named FILENAME.FMT.

IMSHOW : Imshow display image in Handle Graphics figure.

Eg: imshow(FILENAME);

Display the image stored in the graphics file FILENAME. The file must contain an image that can be read by IMREAD or DICOMREAD. Imshow calls IMREAD or DICOMREAD to read the image from the file, but doesnot store the image data in the MATLAB workspace. If the file contains multiple images, the first one will be displayed. The file must be in the current directory or on the MATLAB path.

FIGURE : Figure create figure window. Figure, by itself, creates a new figure window and returns its handly.

Eg: Figure (H)

Figure makes H current figure forces it to become visible, and rises it above all other figuers on the screen. If figure H does not exist, and H is an integer, a new figure is created with handle H.

TITLE : Graph title

Eg: title ('text');

It adds text at the top of the current axis.

SIZE : Size of array.

Eg: D=size(X);

For M-by-N matrix X,returns two-element row vector.

Eg: D=[M,N]

Contains the number of rows and columns in the matrix. For N-D arrays, size(X) returns a 1-by-N vector of dimension lengths. Trailing singleton dimensions are ignored.

Eg: [M,N]=size(X)

For matrix X, returns the number of rows and columns inX as separate output variables.

CHAPTER -5

ADVANTAGES & APPLICATIONS

ADVANTAGES:

i) This system used the neural network to classify the paddy disease. Neural network is one of the accurate techniques that can be applied in the system for detecting disease

ii) This system can detect and classify the paddy disease automatically

iii) This is an alternative or supplement to replace the traditional manual method

iv) Human sight error can be eliminate when determine the paddy disease

5.1 ACHIEVED OBJECTIVES:

The objectives of this project are:

i. to develop the prototype of paddy disease detection system

ii. to detect the paddy disease by using image processing

iii. to apply image processing technique to analyze the pattern of paddy disease

All the objectives stated above are achieved. The GUI has been developed for detect the paddy disease. This system also use some image processing in order to enhance the image and this system also applied the neural network technique to analyze the pattern of paddy disease which then classify it into 3 diseases.

5.2 CONSTRAINTS:

There are some constraints happen that effect the system when it is running. First, the image produces from the threshold process gain a lot of noise which affect the neural network training and testing. The quality of the image samples was blurring and sometimes it is not able to be process.

APPLICATIONS:

1. INTELLIGENT TRANSPORTATION SYSTEMS - This technique can be used in automatic number plate recognition and Traffic sign recognition.

2. REMOTE SENSING-For this application, sensors capture the pictures of the earth's surface remote sensing satellites or multi-spectral scanner which is mounted on an aircraft. These pictures are processed by transmitting into the Earth station. Techniques used to

interpret the objects and regions are used in flood control, city planning, resource mobilization, agricultural production monitoring, etc.

3. MOVING OBJECT TRACKING - This application enables to measure motion parameters and acquire visual record of the moving object. The different types of approach to track an object

Motion based tracking

Recognition based tracking

4.DEFENCE SURVEILLANCE - Aerial surveillance methods are used to continuously keep an eye on the land and oceans. This application is also used to locate the types and formations of naval vessels of the ocean surface. The important duty is to divide the various objects present in the water body part of the image. The different parameters such as length, breadth, area, perimeter, compactness are set upto classify each of divided objects.It is important to recognize the distribution of these objects different directions that are east, west, north, south, northeast, northwest, southeast, and southwest to explain all possible formations of the vessels. We can interpret the entire oceanic scenario from the spatial distribution of these objects.

5.BIOMEDICAL IMAGING TECHNIQUES - For medical diagnosis, different types of imaging tools such as X-ray,ultrasound ,computer aided tomography(CT) etc are used.The diagrams of X- ray,MRI,and computer aided tomography(CT) are given below.Some of the applications of Biomedical imaging applications are as follows.

Heart disease identification-The important diagnostic features such as size of the heart and its shape are required to know in order to classify the heart diseases .To improve the diagnosis of heart diseases, image analysis techniques are employed to radiographic images.

Lung diseases identification-In X-rays, the regions that appear dark contain air while region that appears lighter are solid tissues. Bones are more radio opaque than tissues. The ribs, the heart, thoracic spine, and the diaphragm that separates the chest cavity from the abdominal cavity are clearly seen on the X-ray film.

Digital mammograms-this is used to detect the breast tumor mammograms can analyzed using image processing techniques such as segmentation, shape analysis, contrast enhancement, feature extraction, etc.

6. AUTOMATIC VISUAL INSPECTION SYSTEM - This application improve the quality and productivity of the product in the industries.

Automatic inspection of incandescent lamp filaments –This involves examination of the bulb manufacturing process. Due to uniformly in the pitch of the wiring in the lamp, the filament of the bulb gets fused with in a short duration. In this application, a binary image slice of the are filament is created from which the silhouette of the filament is fabricated. Silhouettes are analyzed to recognize the non uniformly in the pitch of the wiring lamp. This system is being used by the General Electric Corporation.

Automatic surface inspection systems-In metal industries it is essential to detect the flaws on the surfaces. For instance, it is essential to detect any kind of aberration on the rolled metal surface in the hot or cold rolling mills in a steel plant. Image processing techniques such as texture identification, edge detection, fractal analysis etc are used for the detection.

Faulty component identification- This application identifies the faulty components in electronics or electromechanical systems. Higher amount of thermal energy is generated by these faulty components. The Infra-red images are produced from the distribution of thermal energies in the assembly. The faulty components can be identified by analyzing the Infra-red images.

CHAPTER -6

RESULTS

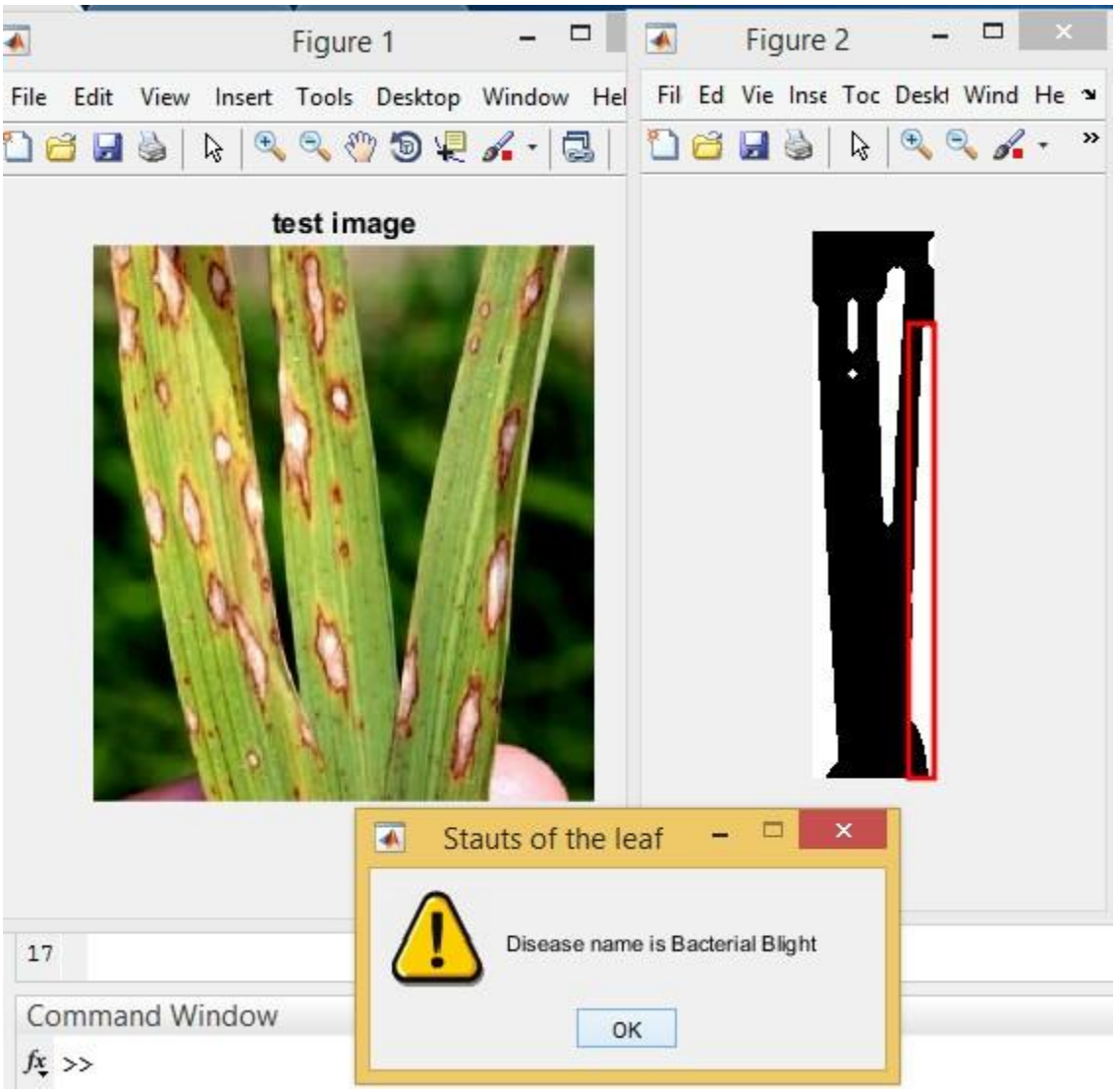


Fig 5.1: The Result For Bacterial Blight

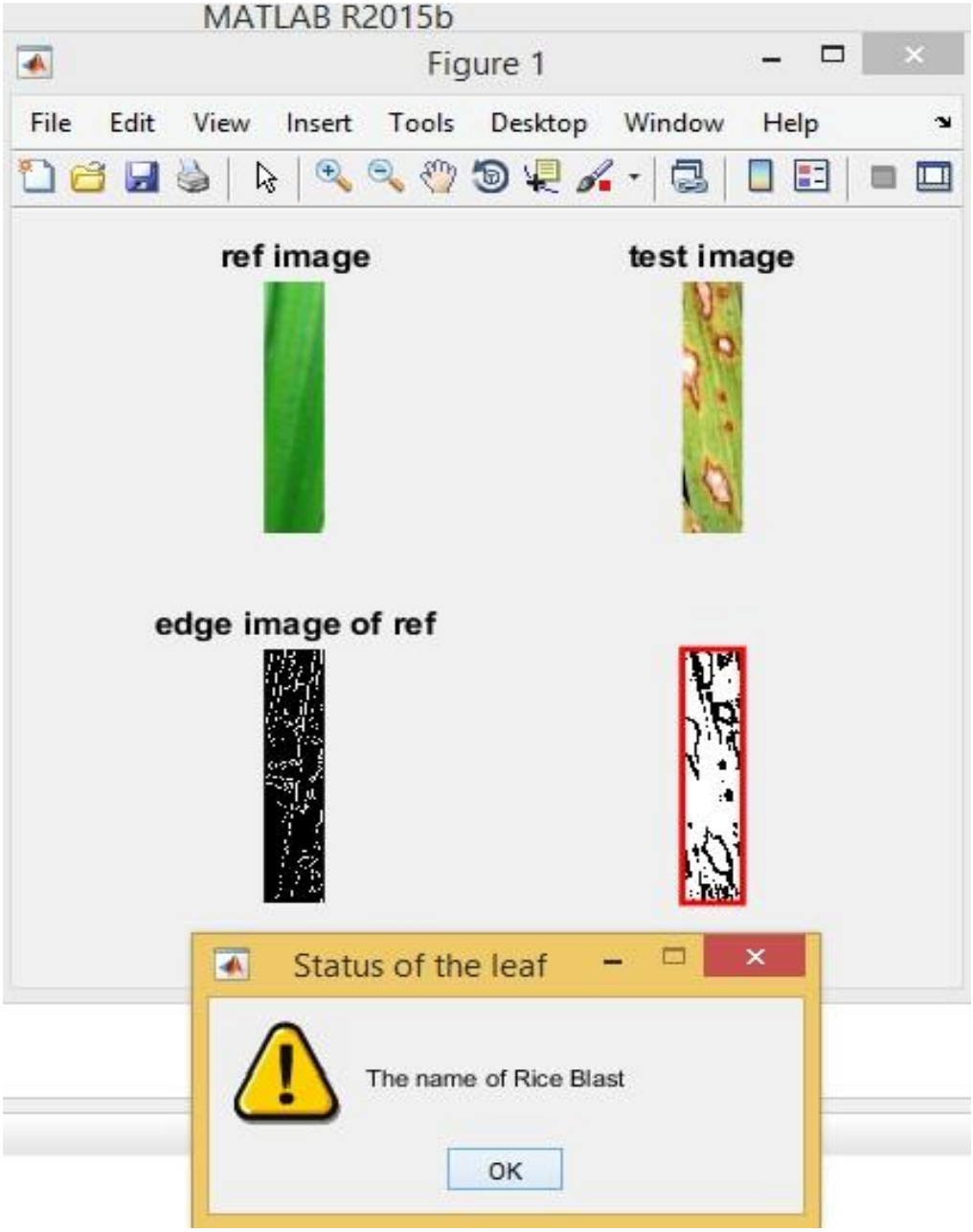


Fig 5.2: Result For Rice Blast

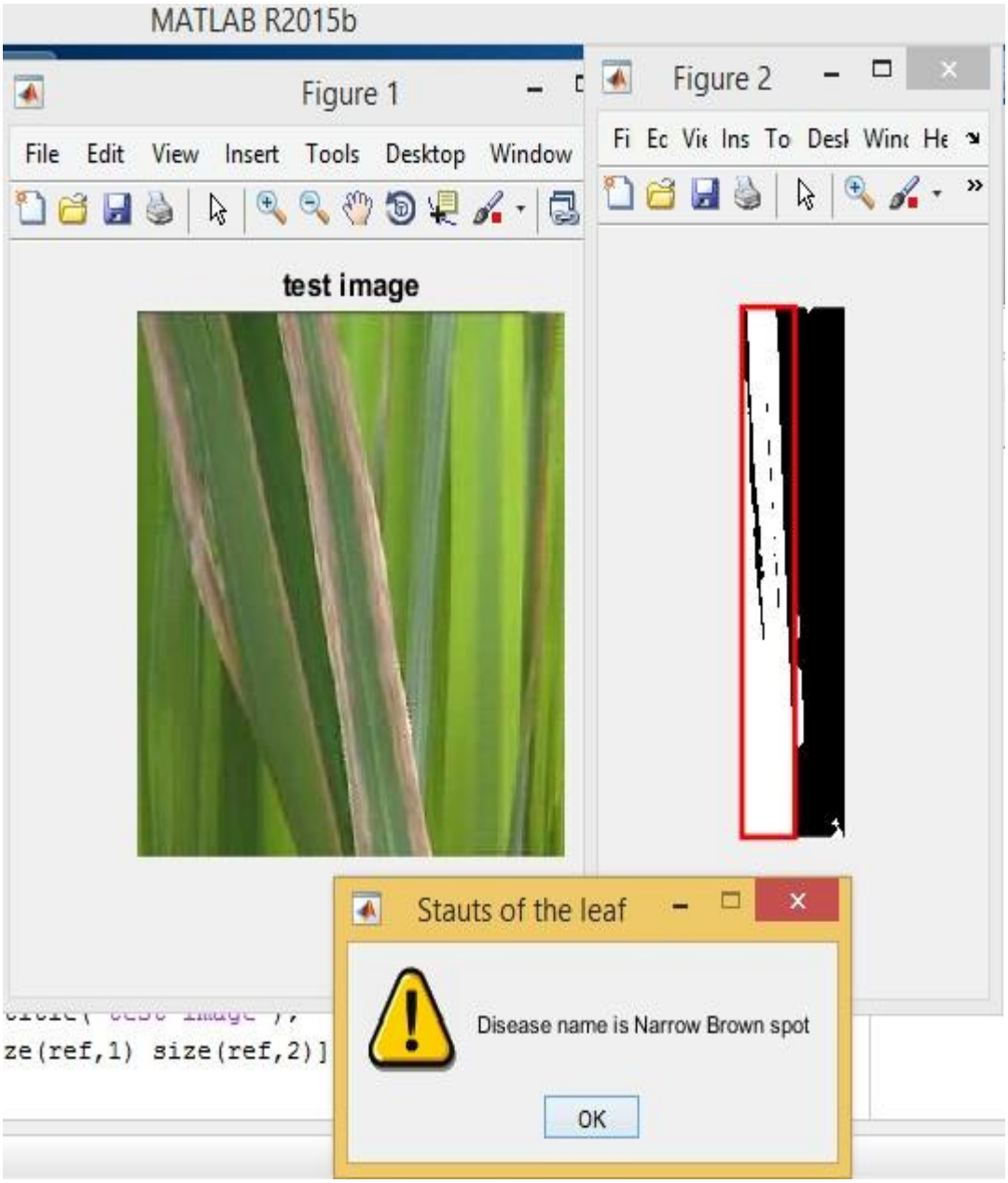


Fig 5.3: Result For Narrow Brown Spot

Table given below shows comparison of techniques of described above.

ENTROPY:

Entropy returns scalar value representing the entropy of gray scale image.It is a statistical measure of randomness that can be used to characterize the texture of input image.The larger entropy value means fine texture.

Table 5.1: Entropy Values For Reference And Test image In Bacterial Blight

TYPE OF THE IMAGE	ENTROPY VALUES
REFERENCE IMAGE	7.1214
TEST IMAGE	7.6534

Table 5.2 : Entropy Values For Reference And Test image In Rice Blast

TYPE OF THE IMAGE	ENTROPY VALUES
REFERENCE IMAGE	7.1214
TEST IMAGE	7.5438

Table 5.3: Entropy Values For Reference And Test image In Narrow Brown Spot

RICE IMAGE	STD2 VALUE
HEALTHY	31.6819
DEFECTED	30.0706

CONCLUSION AND FURTHER RESEARCH

A system for diagnosis the paddy disease has been developed using the Matlab application. The image processing techniques is applied to improve and enhance the image to a better quality. Besides, the neural network is used to classify the paddy diseases which are paddy blast, brown spot disease, narrow brown spot disease and normal paddy leaf. The methodology involves image acquisition, pre-processing and segmentation, analysis and classification of the paddy disease. All the paddy sample will be passing through the RGB calculation before it proceed to the binary conversion. If the sample is in the range of normalpaddy RGB, then it is automatically classify as type 4 which is Normal. Then, all the segmented paddy disease sample will be convert into the binary data in excel file before proceed through the neural network for training and testing. Consequently, by employing the neural network technique, the paddy diseases are recognized about 92.5 percent accuracy rates. This prototype has a very great potential to be further improved in the future.

The system should be published and used in the agricultural sector especially in paddy industry to help the farmer detect the disease early. Farmer can protect their crop from being spread to the other crop area. Therefore, some assumptions have to be considered along with the development of this system. The camera must have a good pixel so that the picture was clear and easy to the system extract the feature.

In the view of the disadvantages stated, further research should be carried out to enhance the current research. There are some suggestion and recommendation for further research to publish the system in the agriculture industry. This system must be improved on the threshold method so that there is less noise or free noise. There still a lot of technique beside the Otsu method that can be implement in this system.

Furthermore, this system should be implementing in the mobile application development. So that the paddy farmers just carry their phone to know the types of paddy disease.

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