Plant Monitoring and Leaf Disease Detection with Classification using Machine Learning-MATLAB

Ramya R[1], Kiran M[2], Marimuthu E[2], Naveen Kumar B[2], Pavithra G[2]
Assistant Professor[1], Under Graduate Students[2],
Department of ECE, K.S. Rangasamy College of Technology, Tiruchengode,
Tamil Nadu, India

Abstract **India is an agricultural dependent country wherein most of the economic income comes from agriculture. Improper maintenance and protection of crops leads to more infections and affects the overall production. This technology helps the farmer to identify what type of diseases that the plant is being affected. The image has been processed in MATLAB and the status of the leaf has been identified with the help of neural network classification. Then the environment circumstances such as temperature, humidity and moisture has been monitored. After the image has been processed in the software it sends SMS to the user by using Global System for Mobile Communication (GSM). The SMS contains leaf status, particular solution and environmental conditions. If the environmental condition is abnormal, then the pump will automatically turn on. This proposed system presents an overview of the classification and detection of plant leaf diseases using machine learning. Within the area of machine learning, neural networks are a subcategory of algorithms built around a model of artificial neurons spread across three or more layers.**

Keywords:- Image processing, disease and healthy leaf, Future extraction, Classification Machine learning, neural networks and MATLAB

I. INTRODUCTION

The cutting edge innovations have enabled human culture to deliver adequate nourishment to satisfy the need. In any case, nourishment security remains threaten by various components including environmental change, plant sicknesses and others factors. Plant leaf illnesses are not just a danger to nourishment security at the world scale, yet can likewise have unfortunate effect for smallholder ranchers whose occupations rely upon sound plants.

So as to create impeccable image classifiers for the motivations behind plant malady recognizable proof, required an increasingly, checked dataset of images of sick and sound plants. Right now, server and portable based technique for sickness distinguishing proof has been utilized for infection identification. The AI for plant illness discovery and, such AI techniques being fake neural system, and Support Vector Machine (SVM), K-implies strategy, Convolutional neural systems and so on.

This proposed framework point is to structure and build up a control framework utilizing sensors in the yield field with information the executives by means of PDA and a web application. The three parts are equipment, web and versatile application. Besides, this framework speaks to driving agribusiness through computerized development.

II. LITERATURE REVIEW

[1] Ms.Nilam R.Thorat, Prof.Swati Nikam (2017), "Early disease detection and monitoring large field of crop by using IoT" the monitoring of diseases at early stage by using the sensors like temperature, humidity and soil moisture after that it will provide recommendation about disease and its fertilizers. With using above method it will train and test dataset. In train dataset there are number of images were taken for training and only few sample images are used for testing. After testing phase it will try to match the train dataset image with the tested sample images. After that disease images foreword to the pre-processing phase. In the Pre-processing phase k-means clustering is used for cluster the image into number of parts and then that parts will classified by using Support Vector Machine (SVM) classifiers. Edge detection is done by using the genetic algorithm and then it will give effective results. Proposed systems have evaluated three objectives of this dissertation work like monitoring, detection and quality of services.

[2] Budiarianto Suryo Kusumo, Ana Heryana(2018), "Machine Learning-based for automatic detection of corn-plant Diseases using image processing", the system consists of Raspberry Pi- model B which is the main part of the system used for interfacing purpose. Initially, the input image is selected. According to selected image disease is detected with its name and remedies by using python or java and to be displayed on the App. After disease detection farmers take the necessary action i.e. Turn ON/OFF the sprinkler assembly by using app to spray pesticides or fertilizer by mixing it in water. Relay driver and single pole double throw relay is used to control the ON/OFF of external devices. Farmer can also check the soil condition and water level in the tank with the help of sensor. Four different types of sensors are used for measuring soil condition and level of water or pesticide tank. These sensors include LM 35 temperature sensor, DHT-22 Humidity Sensor, Water sensor and moisture Sensor. All these sensors are interfaced with Raspberry-Pi. The motor driver and DC motor are used for the movement of the overall system. The moving system helps to monitor soil condition at different place.

III. BLOCK DIAGRAM

The overall view of this project is shown in the Fig. 1. The input images are processed and the respective result is sent to PIC microcontroller. This takes the decision according to the input fed by the user and shows the SMS to the user via mobile.

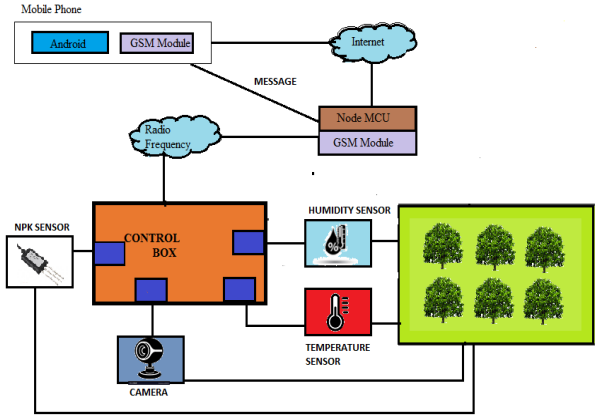


Fig. 1 Block Diagram of the Proposed Design

The different sensor blocks help in measuring the parameters of soil. The parameters such as temperature, humidity and soil moisture were displayed to the user. Finally, the information is sent to the user with the help of GSM.

IV. METHODOLOGY

A. Machine Learning: Machine learning is used to create an algorithm to model knowledge inside the data. It is also a data analytics technique that teaches computers to do what naturally humans and animals where learn from experience. In machine learning, Image processing is a method to convert an image into digital form and perform some operations on it. The four types of machine learning are Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, and Reinforcement Learning.

B. Pre-processing: Pre-processing have four different methods such as Contrast level, Intensity level, Histogram equalization.

C. Segmentation: It is the process of partitioning the pixels of an image into groups. The segmentation is to simplify or change the representation of an image into something more useful.

D. Feature Extraction: Feature extraction is a process in which the image can be analyzed by using different parameters such as size, colours, etc. The leaf disease detection system is shown in Fig. 2.

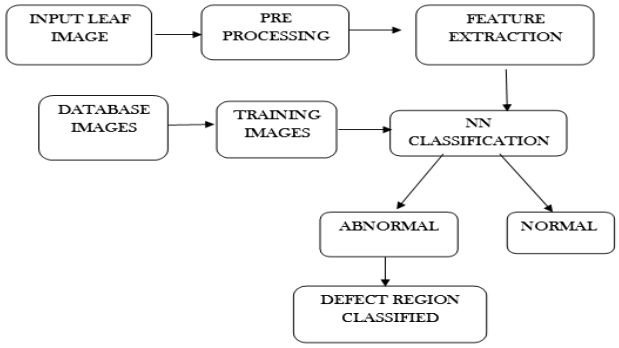


Fig. 2 Block Diagram for Disease Detection

E. Classification: The image processing classification system consists of a database that contains predefined patterns which are used to detect and classify in proper category. It is used to develop a statistical characterization of the reflectance in each information class. In this project, neural networks have been used to recognize the image. Neural networks are an interconnected collection of nodes that are called neurons or perceptron's. Every neuron takes one piece as an input data, one pixel of the image has applied for simple computation. Some of the neural networks are Artificial Neuron, Radial basis function Neural Network, Convolutional Neural Network and etc.

F. Support-Vector Machines: SVM is a supervised machine learning models which is used for classification. The idea of SVM is simple and it can solve both linear and non-linear problems.

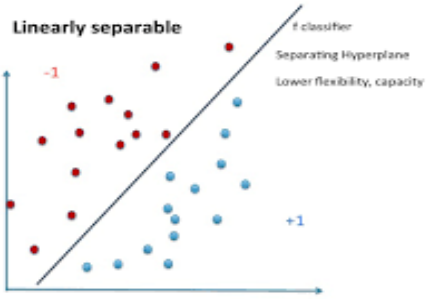


Fig. 3 SVM

DATASETS

Images were collected for five crops, corn, paddy, turmeric, tomato and sugarcane different diseases were analysed for each crop, as well as the health status of each of these crops. Table 1 showing the diseases used for each of these crops and the number of samples.

Table 1 Disease Dataset

Name of Crop	Type of Case	Number of Samples
Corn	Healthy	20
Corn	Elongated Windows	19
Corn	Bore Hole	22
Corn	Dead Heart	17
Corn	Leaf Spot	25
Paddy	Healthy	25
Paddy	Blast	20
Paddy	Sheath Blight	15
Paddy	Sheath Rot	19
Paddy	Brown Spot	14
Turmeric	Healthy	24
Turmeric	Leaf Spot	17
Turmeric	Leaf Blotch	19
Turmeric	Rhizome Rot	15
Tomato	Healthy	24
Tomato	Xanthomonas Campestris	15
Tomato	Alternia Solani	19
Sugarcane	Healthy	23
Sugarcane	Red rot	22
Sugarcane	Rust	18
Sugarcane	Yellow Leaf disease	16

Paddy Blast

Sheath Blight

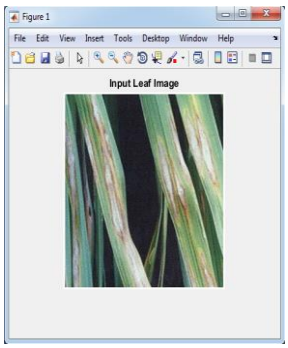
Sheath Rot

Brown Spot

Paddy Healthy

V. SIMULATION RESULT

The input image, as shown in Fig. 4, is loaded, and they are pre-processed. The contrast enhanced image of the leaf is shown in Fig. 5.



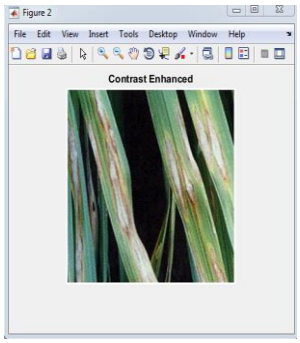


Fig. 4 Input leaf image Fig. 5 Contrast-Enhanced image

The OTSU and HIS segmentation were performed in Fig. 6 and Fig. 7 to classify the leaf segments for detecting the status of the leaf.

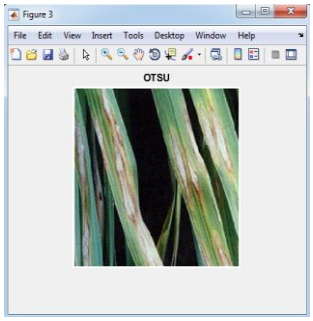


Fig. 6 OTSU Image

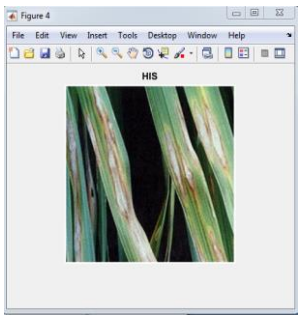


Fig. 7 HIS Image

After that, three types of cluster images have shown in Fig. 8, which is helpful for classifying the disease. In those three, users have to select one model for verifying the segmented image status that is shown in Fig. 9.

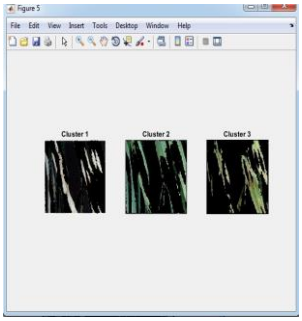


Fig. 8 Cluster images

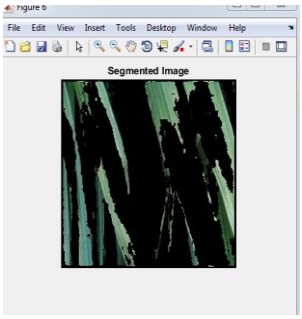


Fig. 9 Segmented image

Finally, a grayscale image has shown in Fig. 10, which is used to identify an affected image or not. After all these processes, a dialogue box is shown as an output in Fig. number 11, which will declare the status of the input image.

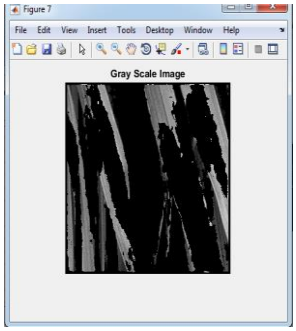


Fig. 10 Gray Scale Image

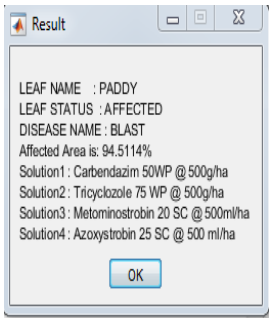


Fig. 11 Dialog box

VI. HARDWARE OUTPUT

The overall agricultural system is mentioned in the Fig. 12. Temperature sensor, moisture sensor and humidity sensor are integrated in this system. If the temperature goes abnormal state the water pump will turn on automatically. In other way if the temperature reaches the normal state then it will turn off automatically

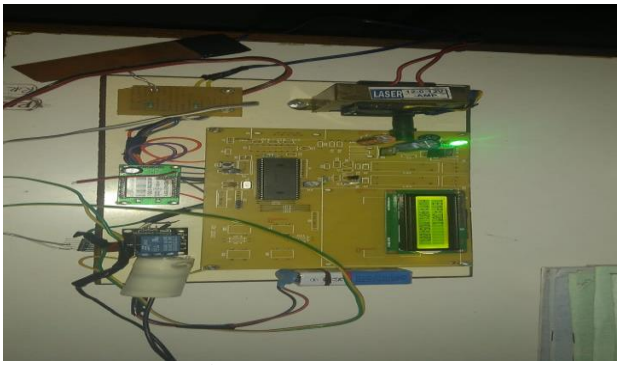


Fig. 12 Interfacing Sensor with LCD display and PIC Microcontroller

The end user will receive the message regarding the leaf disease. This message contains temperature, moisture, humidity level of the environment, leaf name, disease name and particular solution for that disease.

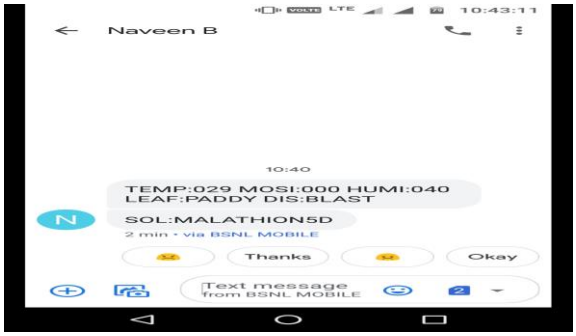


Fig. 13 Snapshot of the user received SMS

VII. CONCLUSION

An application to detect, controls, and monitor the plant disease helps the farmer to reduce their work as well as time. This application helps the farmer to reduce their effort, and also helps in increasing the farm of production. The proposed method helps to find the plant disease and in monitoring the several environmental conditions. The image has been processed in MATLAB and the status of the leaf has been identified with the help of neural network classification. Then the environment circumstances such as temperature, humidity and moisture has been monitored. After the image has been processed in the software it sends SMS to the user by using Global System for Mobile Communication (GSM). The SMS contains leaf status, particular solution and environmental conditions. If the environmental condition is abnormal, then the pump will automatically turn on. If it is normal, it will remain turned off.

VIII. REFERENCES

[1] Channamallikarjuna Mattihalli, Edemialem Gedefaye, Fasil Endalamaw, “Plant leaf diseases detection and auto-medicine” Internet of Things 1–2 (2018) 67–73 Internet of Things.

[2] Esmael Hamuda , Brian Mc Ginley, Martin Glavin, Edward Jones, " Improved image processing-based crop detection using Kalman filtering and the Hungarian algorithm", Computers and Electronics in Agriculture 148 (2018) pg.no.37–44.

[3] M. K. Gayatri, J. Jayasakthi and Dr. G. S. Anandha Mala,“Providing Smart Agriculture Solutions to Farmers for better yielding using IOT,” IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development, 2015.

[4] Budiarianto Suryo Kusumo, Ana Haryana, "Machine Learning-based for Automatic detection of Corn-Plant Diseases Using Image Processing", 2018 International conference on computer, Control, Informatics and its Applications.

[5] Channamallikarjuna Mattihalli, Edemialem Gedefaye"Real-time Automation of Agriculture Land, by Automatically Detecting Plant Leaf Diseases and Auto Medicine", 2018 32nd International Conference on Advanced Information Networking and Applications Workshops.

[6] Gaja Priya, Abishek Pandu, “Automatic plant monitoring and controlling system over gsm using sensors” IEEE International Conference on Technological Innovations in ICT for agriculture and rural development (TIAR 2018).

[7] Arya M S, Anjali K, Divya Unni, "Detection of unhealthy plant leaves using image processing and genetic algorithm with Arduino" IEEE International Conference on Technological 2018.

[8] Dashsonali K, Chiranjeevi U and R. Jena Trinadh akula, "Comparative Study of Image Texture Classification Technique", International Conference on Electrical Electronics Signals Communication and Optimization IEEE, 2015.

[9] Saurabh Malgaonakr, Sanchi Soral, Shailja Sumeet and Tanay Parekhji, “IEEE Study on Big Data Analytics Research and Development” Mulund, Mumbai, India, vol.65, pp.187 to 196.

[10] Baljitkaur and Dilipkumar, “Development of Automated Nutrients Composition Control Fertigation System, “International Journal of Computer Science, Engineering and Application, vol.3, June 2013.