# Classification and Detection of Plant Leaf Disease

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*Abstract*— India is any agricultural country and most of people i.e.70% depends on agriculture. So detection of leaf disease plays a vital role. Commonly found diseases are bacteria, fungi, viral, etc. observation through naked eye of experts is the traditional approach adapted in practice for detection and identification of plant disease. To overcome the disadvantage of traditional approach automatic leaf detection of plants by different image processing technique can be useful. In this paper we review the need of simple plant leaf diseases detection system that would facilitate advancement in agriculture along with some hardware solution like providing useful fertilizers. It include several steps viz .image acquisition, image pre-processing, feature extraction, neural network classification. We are using ARM controller which is interfaced with LCD display, Relay Driver circuit, Ultrasonic Level Sensor. The Communication between the master and slave unit is done by using wireless sensor.

***Key words:*** Neural Networks, Digital Image Processing, K-Means Clustering, HSI, Relay Driver

## I. INTRODUCTION

The proposed system is software and hardware solution for automatic detection and classification of plant leaf disease. The traditional method of detection of disease required continues monitoring of experts which might be expensive in case of large farms. In some developing countries farmers may have to go long distance for contacting experts, this makes the process more time consuming and mostly farmers are unaware of non-native disease. Hence, Visual identification is labor intensive, less accurate. So we are providing solution that maybe beneficial for large field monitoring, and also helps in automatic detecting the corresponding disease from symptoms appearing on plant leaves[1][2].We can analyze the image of disease by using computer image processing technology and extract the features of disease according to texture analysis. The caused and extent of disease can be diagnosed timely and effectively[5][8].

The most common plant diseases are caused by bacteria, fungi, viral, etc. as shown in fig.1.Fungi are identified primarily from their morphology, with emphasis placed on their reproductive structures. Bacteria are considered more primitive than fungi and generally have simple life cycles [3].

The system is consisting of two units i.e. master unit consisting of PC, Camera which is interfaced with other unit slave unit consisting of processor part. In slave unit ARM controller, LCD display, Level detector, Relay driver circuit for solenoid valve. Communication between master unit and slave unit is done using WSN(wireless sensor network).The system provides fertilizer solution according to detected disease like Phosphors, Nitrogen, Potassium, etc. that is passed to the field through solenoid valve with water. The level of the fertilizer solution tank is sensed by level sensor (we have used ultrasonic sensor).

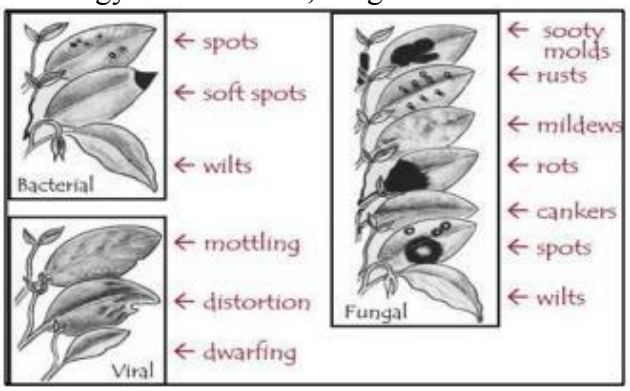


Fig. 1: Observation of disease: Naked Eye[1][3]

## II. STEPWISE PROCEDURE FOR PROPOSED DESIGN STEPS

1) RGB image Acquisition.
2) Convert the input image from RGB to HSI format.
3) Masking the green pixels.
4) Removal of masked green pixels.
5) Segment the components.
6) Obtain the useful segments.
7) Computing the features using texture analysis.
8) Detection of disease using neural networks.

Once the disease is detected then following system is used for further processing:
Fig.2 shows the master and slave unit.

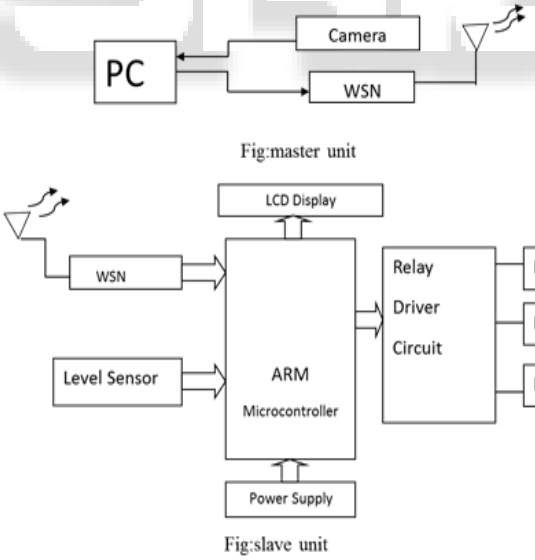


Fig. 2: System Block Diagram

In this paper we have used Camera, WSN (module of Bluetooth), LCD Display, Relay driver circuit, Solenoid valve and PC. The detailed description is as shown below:

### *A. Camera*

We are using camera (ROBO K20) which is high quality 5G wide angle lens for sharp and clear picture. This camera is used for capturing the RGB image (i.e. color image) of plant leaf.

 

Fig. 3: Camera(ROBO K20)

This camera is of 300K pixels (Interpolated 20M pixels still image resolution and 2M video resolution) with JPEG compression technique.

*B. WSN (Bluetooth Module)*

The basic function of Bluetooth module here is as Wireless Sensor Network, which is used for communication between the master unit and slave unit.

We will use HC-05 for bluetooth module.HC-05 module is an easy to use Bluetooth SPP(Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature).

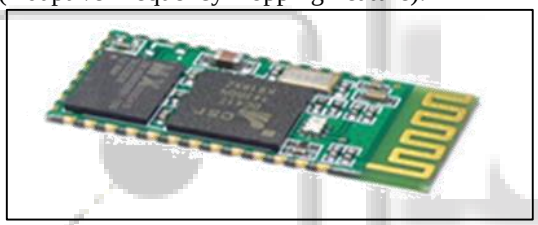

Fig. 4: Bluetooth Module

Features of Bluetooth module are typical -80dBm sensitivity, up to +4dBm RF transmit power, Low power 1.8V operation (3.3 to 5V I/O).

*C. Microcontroller ARM7-LPC 2138*

The LPC2131/32/34/36/38 microcontroller are based on a 16/32 bit ARM&TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller with 32kB, 64kB,128 kB,256kB, and 512kB of embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at max clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty.

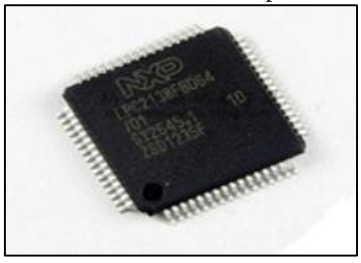

Fig. 5: LPC2138 Microcontroller

Due to their tiny size and low power consumption, these microcontroller are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. With a wide range of serial communications interface and on-chip SRAM options of 8kB, 16kB, 32kB. They are very well suited for communication gateway sand protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit 8-channel ADC, 10-bit DAC, PWM channels and 47 GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical system.

*D. Relay Driver*

Relay Driver is having features as Eight Darlington's with common emitters, output current to 500ma, output voltage to 5v.

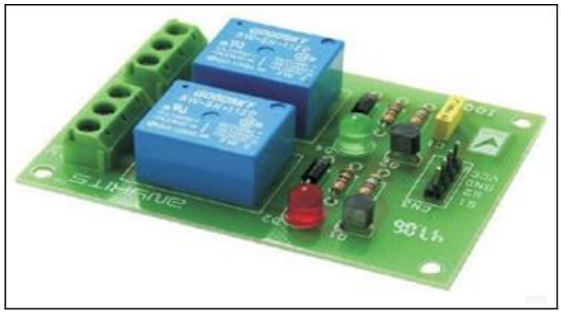

Fig. 6: Relay Driver Circuit

Output voltage of relay driver is up to 50v, integral suppression diodes versions for all popular logic families, output can be paralleled inputs pinned opposite, output to simplify board layout.

*E. Ultrasonic Sensor*

Level measurement can be performed via ultrasonic or sonic technology too. Ultrasonic level measurement devices basically employ sound waves for detection of liquid level. They usually work over the frequency range between 20kHz to 200kHz.


Fig. 7: Ultrasonic Sensor

*F. LCD Display*

LCD screen is an electronic exhibit module and find a extensive range of applications. A 16x2 LCD display is basic module and is very usually used in different devices and circuits. A 16x2 LCD it can display 16 characters per line and there are 2 lines. Each character is display in 5x7 pixel matrix in this LCD. This LCD has two registers one is command second is data. The command instructions stored command register. A command is an instruction given to LCD to do a predefined task like initializing, clearing its screen, setting the cursor position, scheming display etc. The data register stores the data and displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD conclusion.

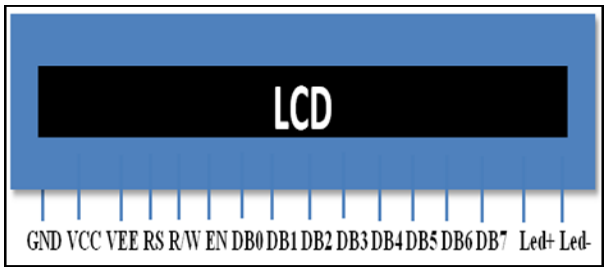

Fig. 8: LCD Pin Diagram

## III. METHODOLOGY

The following steps are involved for detection of plant leaf disease:

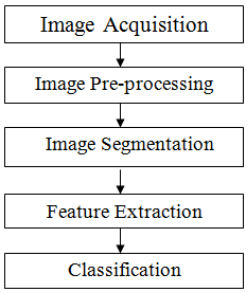

Fig. 9: Plant Leaf Disease Identification Process

### A. Image Acquisition

The plant leaf images are acquired through digital camera. This image is given as input to the identification system. This is the image in which the leaf disease has to be identified by the system.

### B. Image Pre-Processing

Image pre-processing includes image cropping, image converting (RGB to HSI), image enhancement. The noise is removed from the captured image for better processing. Then the green pixels are masked coz green component of the pixel intensity is less than the pre-computed threshold value.

### C. Image Segmentation

The infected region is segmented into equal matrix. Useful segments are extracted. All segments do not contain significant amount of information hence the matrix having more than fifty percent information are taken in consideration for further analysis.

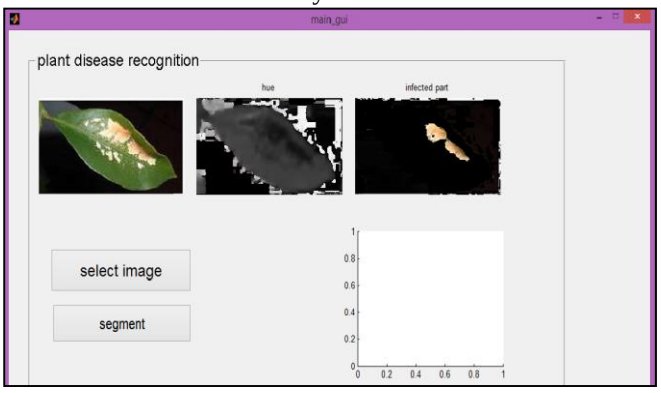

Fig. 10: Image Segmentation

### D. Feature Extraction

Changing the information into set of features is called as feature extraction.

### E. Classification

According to classification result the leaf disease is identified and appropriate action can be taken by the farmers in the initial stage of disease for its control.

After completing all above steps the disease of plant leaf will be recognized and accordingly the fertilizers solution will be provided from the solenoid valve as shown below:

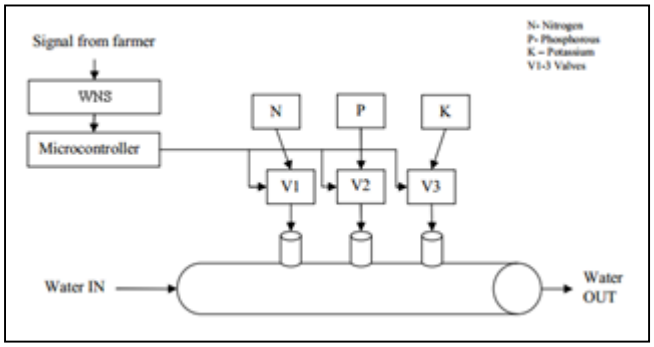

Fig. 11: Fertilizer System

## IV. CONCLUSION

Detection of disease is identifies the affected part of plant leaf spot by using image processing technique using matlab. Main characteristics of classification and detection of plant leaf disease are speed and accuracy. There are number of technique use for disease detection but Neural Network is much faster and accurate than any other identification technique. Our project is thus going to be useful for farmers, Agricultural field by providing an useful plant leaf detection system and eventually identify their disease as well as provide the fertilizer.

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