

FORECASTING THE CLOUD COVER FOR AGRONOMICAL FUNCTION BASED ON REAL TIME VALUATION

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering
by

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SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **ABIRAMI M** (Reg. No. 37140002) and **KRITHIKA K** (Reg. No. 37140047) who carried out the project entitled **"FORECASTING THE CLOUD COVER FOR AGRONOMICAL FUNCTION BASED ON REAL TIME VALUATION"** under our supervision from December 2020 to April 2021.

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DECLARATION

We **ABIRAMI M** (Reg. No. 37140002) and **KRITHIKA K** (Reg. No. 37140047) hereby declare that the Project Report entitled “**FORECASTING THE CLOUD COVER FOR AGRONOMICAL FUNCTION BASED ON REAL TIME VALUATION**” done by us under the guidance of **Mrs. M Pushpavalli** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

DATE: 08.04.2021

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ABSTRACT

There's an assortment of advancement which has been made with respect to computerized picture preparing and Machine Learning calculations which likewise incorporate its different applications. Presently we are living in a period where the issue with respect to agribusiness is a significant issue these days.

Less yield, greater expense of creation because of work shortage and compost cost are the significant difficulties before the farmers. To improve the quality and amount of the horticulture item there is a need to embrace the new technology. Fertilizer and pesticide the board requires early and financially savvy arrangements which will prompt higher yield. One of the major problem is to identify the plant diseases. For this we use Hue Saturation Intensity (HSI) shading model and bunching calculation and also utilize MATLAB for this task.

In current situations it's difficult to supply water to the farmlands manually and is consuming more time and manual power. For that We also included an automatic irrigation system to water the plants automatically.

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CHAPTER - 1

INTRODUCTION

1.1 AGRICULTURE IN INDIA

The farming area is the primary supporter in Indian economy and is doing admirably in white, green and blue upheaval. As indicated by APEDA by 2014 share of Indian horticulture will reach to 5% of complete creation of the world and rank tenth in the ranking. Farming expects crucial part in the course of action of food surplus to developing people, obligation to capital turn of events, gives rough material to organizations, market for current things and huge responsibility in worldwide trade.

With expanding populace, despite the fact that the commitment is constantly falling since autonomy from 55.1% in 1950 to 14% in 2012, it stayed the significant work area with a minimal contrast. So there is a need to speed up the speed for serious, beneficial, enhanced and feasible horticulture. Raising rural profitability per unit of land, diminishing country neediness through a socially comprehensive technique and guaranteeing that horticultural development reacts to food security needs are three significant difficulties for Indian farming.

1.2 SCENARIO OF HORTICULTURE

India has been skilled with a wide scope of physio-topographical conditions and environment. This climate is appropriate for agriculture crops like vegetables, organic products, blossoms, nuts and estate crops. The cultivation area showed 30% development in the most recent five years and contributes 28% of agribusiness GDP. During 2010-11 India was the second biggest maker of cultivation items, despite the fact that the efficiency is lower than different nations.

Indian commitment was 12 % and 14 % for leafy foods separately. Maharashtra, Andhra Pradesh, Tamilnadu, Karnataka, Uttar Pradesh and Gujarat are the states that contribute in organic product creation in India. Banana, Mango, Guava, Papaya, Citrus and Grapes are the significant organic products delivered in these states.

The speed of modernization in the horticulture area is low. We can brief the serious issues looked by Indian Agriculture as,

- Uneconomic size of land holding
- Neediness and obligation of ranchers
- Shortage and cost of agribusiness inputs.
- Absence of infrastructural offices
- Low efficiency
- Absence of agribusiness exploration, schooling and preparing
- Soil disintegration and corruption

So there is a need for quick development in farming areas for confidence, yet additionally to achieve impartial appropriation of pay and abundance in rustic zones just as to lessen destitution and improve personal satisfaction.

1.3 PROBLEM STATEMENT

Less yield, greater expense of creation because of work shortage and manure cost are the significant difficulties before the ranchers. To upgrade the quality and amount of the agribusiness item there is a need to embrace the new innovation. Compost and pesticide the executives requires early and savvy arrangements which will prompt better return. Picture preparing approach is a non intrusive strategy which gives predictable, sensibly precise, less tedious and financially savvy answers for ranchers to oversee manures and pesticides.

CHAPTER - 2

LITERATURE SURVEY

Anand.H.Kulkarni et al. (2015) depicts the methodology starts with a catch of leafing the pictures from the horticultural field. Gabor channel is utilized to fragment the info picture previously including extraction. At that point division of the information picture is done to extricate the surface data and shading highlights. Appropriate determination of the component esteems to prepare fake neural organization to precisely recognize the sound and ailing examples leaf effectively. ANN based classifier has exactness of 91%

Amandeep Singh, Maninder Lal Singh& et al. (2018) The most basic test looked during the work was getting the quality pictures with the most limited detail of the leaf tone. It is a regular endeavor to get the image with all of the nuances inside a procesable memory. Such pictures are molded through significant standards and in this manner are of 6-10MB of size.This was managed by using a Nikon made D5200 camera which served the endeavor very well.Second test confronted was to dispose of brightening conditions as from the beginning to the furthest limit of paddy crop season, light differs a ton in any event, when the picture obtaining time is fixed. Anyway the answer for this is variable client characterized thresholding and making important acclimations to the shades of LCC.

Malvika Ranjan, et al. (2018) Describes a determination interaction that is for the most part visual and requires exact judgment and furthermore logical techniques. Picture of ailing leaf is caught .As the consequence of division Color HSV highlights are extricated. Counterfeit neural organization (ANN) is then prepared to recognize the sound and infected examples. ANN order execution is 80% better in exactness.

P.R.Rothe(2015) et al. This paper proposed plan affirmation systems for the distinguishing proof and course of action of cotton leaf diseases of Alternaria, Myrothecium and Bacterial Blight.

The dataset pictures are taken from the field of Central Institute of Cotton Research Nagpur. Dynamic structure based division estimation is used for the separation of tainted spots. Maker has moreover prescribed some segment headings to the relative thought for the yields of wheat, orange, citrus and maize on

Sachin D. Khirade et al. (2015) This technique has discussed some division and feature extraction counts that can be used for the disclosure of plant diseases by using the image of their leaves. It is incredibly difficult to recognize plant contaminations genuinely in view of the need for nonsensical time, data on plant sicknesses and more proportion of work. Picture acquisition used the change structure for RGB leaf picture. By then the image is pre-taken to wipe out the uproar and update the image contrast. Division is cultivated for the allocating picture into various segment parts using k-implies bunching, otsu channels, etc This separated picture is also used for incorporating extraction and subsequently last request is performed using diverse game plan methodology. In this way, plant illnesses can be adequately recognized

Sannakki et al. (2013) This paper has used feed forward back spread Neural Network based systems for the assurance and course of action of diseases in grape leaf. Maker has used the photos of grape leaves with a mind boggling establishment for the assurance as information. Further anisotropic spread is used to dispose of the uproar of the image which is furthermore segmented using k-implies grouping. Finally results are seen using neural association. Results are researched fleece development and fine form pictures with propagation in MATLAB. Disorder structure is considered with the real sure and counterfeit positive limits for the endorsement of results. The maker proclaimed to have the readiness exactness of 100% at whatever point used color incorporated alone

Suhaili Beeran Kutty et al. (2013) This paper has used the neural association based system to describe the watermelon leaf diseases of Downy Mildew and Anthracnose. Maker has decided the certifiable positive rate, real negative rate and overall accuracy for the profitability of the proposed thought This course of action relies upon the concealing feature extraction from RGB concealing model which is obtained from the perceived pixels nearby premium.. The overall introduction is depicted with an ROC twist having AUC assessment of 0.5. The real request result furthermore depicts the assessment of 75.9%

Suraj et al. (2017) This framework lessens the water use since it gives water to the system according to the necessity of the harvest. This framework is a robotized water system framework so it decreases the human resources.This water system framework was discovered to be achievable and practical for upgrading water assets for horticultural creation. The water framework system can be adjusted to a variety of unequivocal yield needs and needs least help.Utilizing this framework we can screen the situation with every one of the sensors (Soil-dampness, Temperature, Water level) and furthermore the ON/OFF status of the engine and Fan.

Yunseop Kim et al. (2008) Addresses veritable time noticing and control of variable rate water framework controllers. The sensor centers measure environmental limits and send data to the base station where the base station estimates data through a straightforward unique program and all data orders transport off the water framework control station. The Irrigation control station sends machine area utilizing GPS to the base station, impart control sign back to the water system control station dependent on GPS head area for continuous observing, and distantly control of water

Zhang Feng et al.(2011) It stresses on the examination of steering conventions of sensor network hubs to accomplish the equipment and programming plan.

Utilization of cell phones and remote PDA makes it to screen soil dampness substance and control of a water system framework. Results show that water is utilized effectively by utilizing installed control innovation frameworks

CHAPTER - 3

AIM & SCOPE OF THE PROJECT

3.1 EXISTING SYSTEM

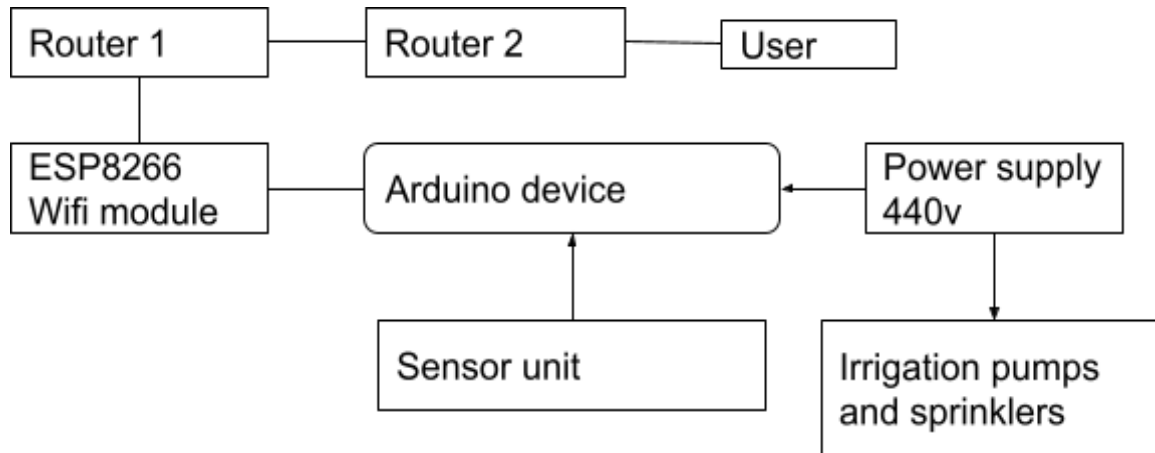


Fig 3.1 Block diagram

Figure 3.1 It represents the existing block diagram of irrigation system using Arduino

3.2 AIM

To apply and implement the new algorithm to monitor the growth of the crop and detect the diseased part in the plant by Image processing and this technique has been proved its importance in Agriculture for estimation of yield, vegetative growth, fruit sorting etc. This research is carried out to study the effectiveness of Image Processing for effective fertilizer and pesticide management of plants. We also included an automatic irrigation for smart irrigation process.

3.2 SCOPE OF THE PROJECT

The specialized perspectives that are under the extent of this work are as per the following:

- The research objective is aimed to identify/develop color models for Fertilizer estimation. This research is also aimed to identify the color model for estimation of pest affected areas on various leaves .
- The sample leaves are collected from various places. These samples are taken directly from fields. The inputs like Fertilizers and pesticides applied at different fields are unknown or not considered.
- Image processing is a toolbox of MATLAB and Curve fitting tool for regression analysis along with other statistical tools LABfit are used for estimation of the fertilizers. Images are captured on field with a digital camera in natural illumination on sunny days. As it is difficult to measure the impact of illumination at the time of image capturing in normal cases, illumination effect is not considered at the time of image processing.
- This approach is very effective. Also experimental readings show that the algorithm has eighty two percent accuracy considering the average of both cases. In almost every case pomegranate disease is identified.
- Web base approach is also very fast and there is no distortion occurring in communication of images in transition of images in this approach. Pixel values remain maintained and cleared.
- MATLAB provides strong support for the implementation of the advanced algorithms. Machine learning algorithms and classifiers too are very easily implemented. MATLAB also allows users to test and train the data. Users can set various cutoffs for all the attributes and train the data on a given dataset and also using testing tools we can verify the data.
- In our problem we measure various parameters such as mean, correlation, contrast, variance, smoothness .All of these parameters can be easily calculated using existing methods in the MATLAB.

- By applying the SVM classifier in MATLAB and passing the above parameters we can easily detect the type of disease in any leaf. MATLAB allows users to plot hue, saturation and intensity values for all types of leafs i.e diseased or healthy. All requirements for the implementation of above methodologies can be done very easily in MATLAB.
- Mechanization takes out the manual activity of opening or shutting valves Probability to change recurrence of water system and fertigation measures and to advance these cycles. Reception of cutting edge crop frameworks and new innovations, particularly new yield frameworks that are intricate and hard to work physically
- Utilization of water from various sources and expanded proficiency in water and manure use. Framework can be worked around evening time, water misfortune from dissipation is subsequently limited
- Water system measure starts and stops precisely when required, hence upgrading energy necessities.

CHAPTER - 4

SIMULATION ANALYSIS

4.1 SYSTEM DEVELOPMENT

4.1.1 Tools:

MATLAB programming apparatus is utilized for the taking care of the disease recognition issue. This gives solid help for the execution of the high level calculations. Machine learning calculations and classifiers also are handily executed. MATLAB moreover permits users to test and prepare the information.

Users can set different shorts for all the ascribes and train the information on a given dataset and furthermore utilizing testing devices we can check the information.

In our difficulty we measure different boundaries like mean, RMS, contrast, correlation, smoothness .All of these boundaries can be without any problem determined utilizing existing strategies in the MATLAB. By applying the SVM classifier in MATLAB and passing the above boundaries we can without much of a stretch recognize the sort of disease in any leaf. MATLAB permits users to plot hue, immersion and force esteems for all sorts of leafs i.e diseased or healthy. All necessities for the execution of above strategies should be possible very effectively in MATLAB.

The following are the explanation that MATLAB is utilized for the reason

- Easy execution of complex calculation
- Previous history
- Accuracy and exactness
- Advanced calculation execution
- Easy GUI execution

Being an overall programming language MATLAB is best fitted for advanced picture handling. MATLAB permits user replication as it ensures that whatever means the user has carried out in the picture handling they are appropriately archived by it . In addition, MATLAB users can make interfaces effectively utilizing guide order. There is no compelling reason to compose code for the GUI as MATLAB naturally composes the coding modularities for the GUIs.

All source codes are effectively open for testing. Improvement and portion measure in picture measure is exceptionally simple in MATLAB.

4.1.2 Data attaching tools

Neural networks are best used for fitting and attaching using various applicable functions. The fact is that neural networks are designed in a way that can arrange themselves along a given set of ranges. Data attaching is also the way toward separating precision fit. Experts and scientists use the data attaching sets which consist of number terminologies and factors in order to visualize the information which is collected. One of the important features of the MATLAB is that it gives opportunity to load the data and adjust the data as per the recommendations. Fitting is achieved with the help of the fitting tool available in the MATLAB.

4.1.3 Analysis

_The above tool gives the idea of the how aimed vector are subjectively isolated in three types as such:

- Around seventy percent of the data is to get started and get ready.
- Fifteen percent of the data is used for the validation purpose means to check and validate that trained data is accurate.
- Rest of the fifteen percent of the data is used for an absolute self-sufficient preliminary of the framework theory.

4.2 BASIC ARCHITECTURE

Figure 4.1 shows the Basic architecture of image processing. Digital devices such as digital cameras or smartphones are used to take photos of the plant leaves and these images are used to separate out and measure the diseased part area. To appropriately recognize the influenced area we need a picture with no pollution so contrast improvement and other picture handling methods are applied on each information picture. By enhancing the image using the image processing techniques we get different features of the images which are not visible from the human eye. Below is the flowchart depicting the basic architectural flow. Image acquisition is the first step in the image processing. Any image is taken from the digital devices thereafter image preprocessing and segmentation are done and necessary features are extracted from the image. During classification, with

the help classification algorithm different clusters are made. We used k means color based clustering in order to detect and identify the affected area. By selecting the one of the clusters our algorithm uses a support vector machine for the prediction of disease.

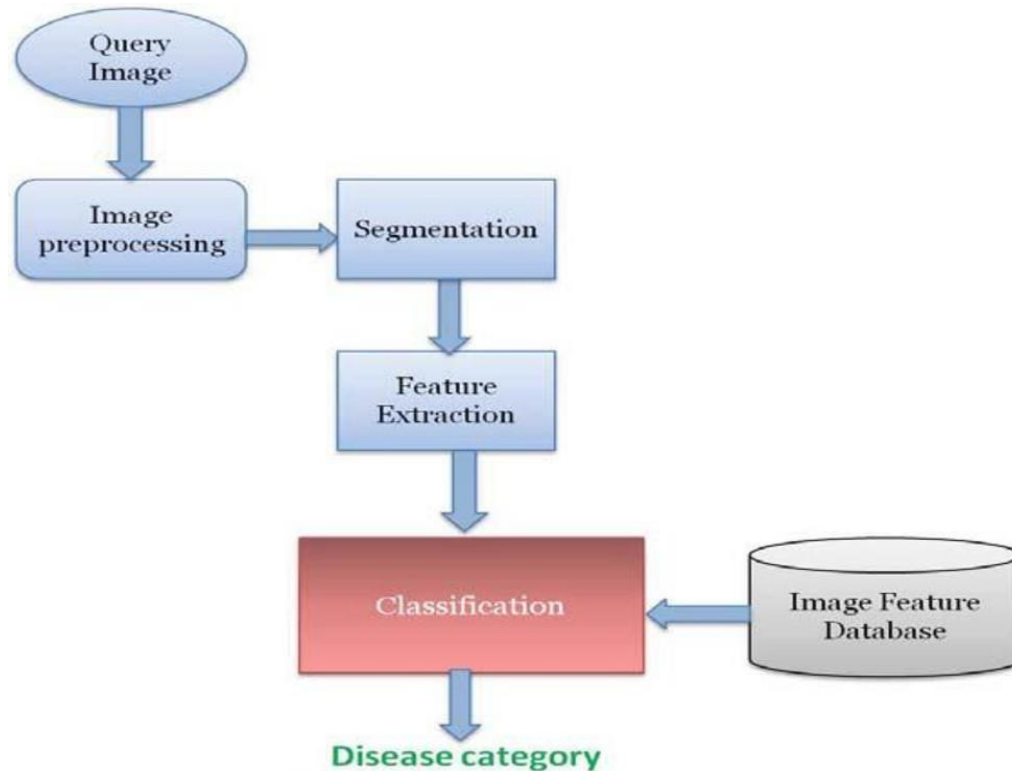


Fig 4.1 Basic architecture of image processing

Figure 4.1 Represents the basic architecture of image processing using MATLAB

4.3 INFORMATION POSIST

An information-posit is an amassing of interconnected information of interconnected data which can be placed to solely, mix and administered with everything taken into account. An instructive accumulation is dealt with a few sorts of data structure. In a data collection, for example, an instructive accumulation can have a social affair of entrepreneurship data (information, bargains, diagrams, and whatnot). The information posit is seen as an educational accumulation, as a collection of data related to an explicit sort of information, for instance, bargains data for an explicit corporate office.

Informational index utilized in the venture is put away in an exceed expectations document and further utilized for getting results in MATLAB programming.

4.4 ALGORITHM

In this chapter we describe the implementation details of the algorithm and steps in which our algorithm works for identifying the disease. K means color based clustering algorithm is used in this problem. Following the steps in which an input image is processed.

- Image acquisition
- Image preprocessing and enhancement
- Image segmentation using k means and Otsu classifier
- Feature extraction
- Classification

4.4.1 Image Acquisition

Figure 4.2 shows the Collecting sample images to form a data set. Picture procurement intends to gather various sorts of tests for the development of the info dataset. Dataset pictures further go through the different advances. In order to provide the best solution to any problem it is necessary that the dataset covers the majority of the different types of inputs. We have covered different plant leaves. Different image formats are taken in our dataset. Any other image excluding the dataset can be used in our algorithm provided its size is matching and format is known, our algorithm and its classifier gives the prediction of the disease for that random image.



Fig 4.2 Collecting sample images

Figure 4.2 Shows the process of collecting sample images for input from data set

4.4.2 Image preprocessing and enhancement

It is the second step in digital image processing. In this using MATLAB input image noise is reduced, pixel values get more classified, spot reduction and contrast enhancement is there. The purpose of the image preprocessing and enhancement step is that after preprocessing the image it's easy to separate the infected area. Indirectly the classifier we use works better with preprocessed images without any impurities. Values of the pixels also get adjusted in the preprocessed image. MATLAB provides a user number of different filters for the enhancement of the image. Figure 4.3 shows Image preprocessing & enhancement



Original image

Enhanced image

Fig 4.3 Image preprocessing & enhancement

4.4.3 Image segmentation

Image segmentation is the third step in our proposed methodology. After image acquisition and preprocessing we segment the image into three different clusters. For clustering we use k-means color based clustering algorithm and the classification is done through the Otsu classifier. After making three different clusters, the user is asked to choose one of the clusters and then disease is predicted using that particular cluster. Figure 4.4 shows K - Mean images.

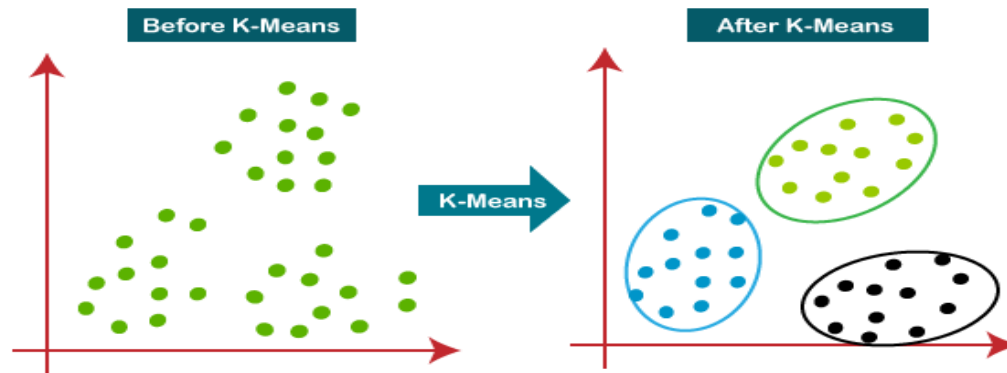


Fig 4.4 K - Mean images

Implementation of the K mean algorithm is as follows:

- Input preprocessed image
- Convert the RGB color space to lab color space
- Normal color space of the image is RGB color space which consists of the primary colors red, green and blue.
- It is easy to extract the different features from lab color space in comparison to the RGB color space.
- Lab color space is also represented by the $L^*a^*b^*$, in which L stands for lightness, b stands for the blue/yellow and a stands for the red/green value. This color space is a way to communicate with the colors and locate them. All the information of colors lies around a^* and b^* axis.
- Various clusters are made based on various colors using k mean clustering. Clusters are made using distance between the initial groups and the distance of the other from that group. The nearest one is chosen. For this we use Euclidean shortest distance formula.
- clusters of the groups depends on the base separation from the centroid



Fig 4.5 Segmentation using K-means Clustering

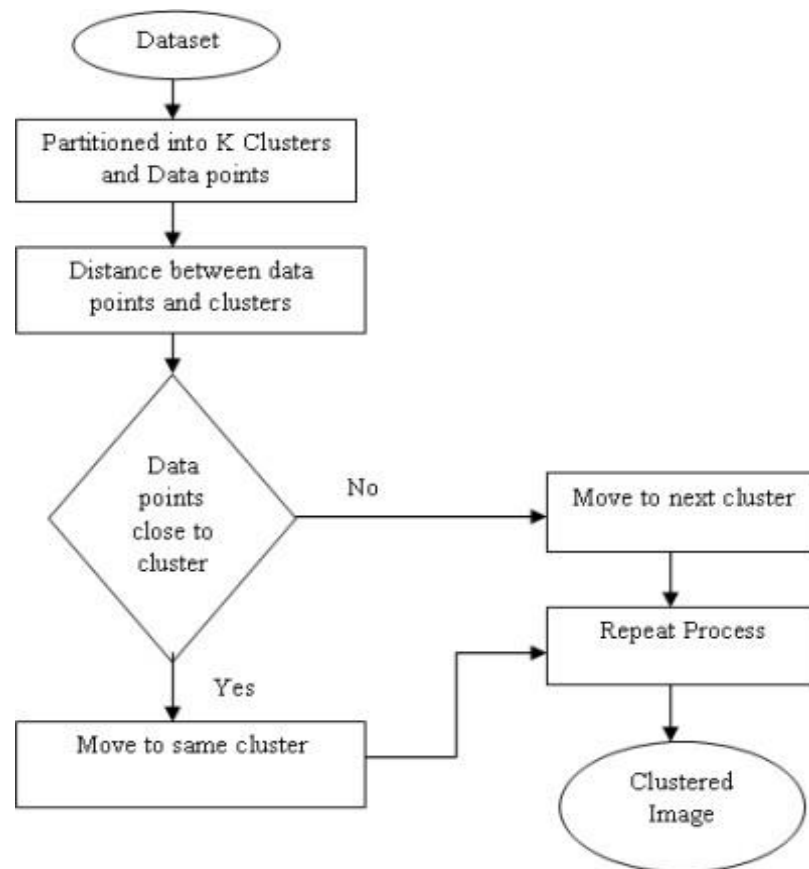


Fig 4.6 Flowchart for K-means Algorithm

Figure 4.5 and 4.6 depicts the Flowchart and segmentation using K - means clustering.

4.4.4 Feature Extraction

Various features color oriented, shape oriented are extracted using MATLAB commands. These highlights assume a critical part in deciding the influence area of the leaves. Various features like mean, variance, standard deviation and others are extracted in order to know the health of the leaf.

a. Mean

It is an action the normal estimation of the component in the picture exhibits measurement. It measures normal estimation of components in the fragmented picture. $\text{Mean} = (\text{sum of pixel value}) / (\text{absolute number of pixel})$

b. Skewness

It is an assess of the likelihood of the deviation locale. This is the equation for discovering skewness of the contaminated leaf of the fragmented part. $\text{Skewness} = (\text{third snapshot of mean}) / (\text{standard deviation}^3)$

c. Agreement

It measures the force distinction between a pixel and its neighbor pixel over the entire picture.

d. Entropy

It measures the normal estimation of all pixel esteem in that picture.

e. Homogeneity

It measures the closeness conveyance in picture askew to picture inclining.

f. Kurtosis

It is utilized to proportion the likelihood conveyance of a valid esteemed unsystematic variable. $\text{Kurtosis} = (\text{fourth focal second}) / (\text{standard deviation}^4)$

Table 4.1 Mathematical Formulas For Features Extraction

No.	Feature	Formula
1	Contrast	$\sum_i \sum_j i - j ^2 p(i, j, d, \theta)$
2	Uniformity (Energy)	$\sum_i \sum_j p(i, j, d, \theta)^2$
3	Maximum probability	$\text{Max}_{ij} p(i, j, d, \theta)$
4	Homogeneity	$\sum_i \sum_j p(i, j, d, \theta) / (1 + i - j)$
5	Inverse difference moment of order 2	$\sum_i \sum_j 1 / (1 + (i - j)^2) p(i, j, d, \theta)$
6	Difference variation	Variance of $\sum_i \sum_j i - j p(i, j, d, \theta)$
7	Diagonal variance	Variance of $p(i, j, d, \theta)$
8	Entropy	$\sum_i \sum_j p(i, j, d, \theta) \log(p(i, j, d, \theta))$
9	Correlation	$\sum_{i,j} \frac{(i - \mu_i)(j - \mu_j)p(i, j)}{\sigma_i \sigma_j}$

Table 4.1 contains the Mathematical Formulas For Features Extraction.

4.4.6 Classification

The arrangement procedure is utilized to distinguish the different sorts of leaf illness. Characterization manages a given information design with one of the particular class. In

the given framework a Linear Support Vector Machine (LSVM) is utilized for arrangement of leaf infection. Figure 4.7 It represents how the process has been implemented in MATLAB

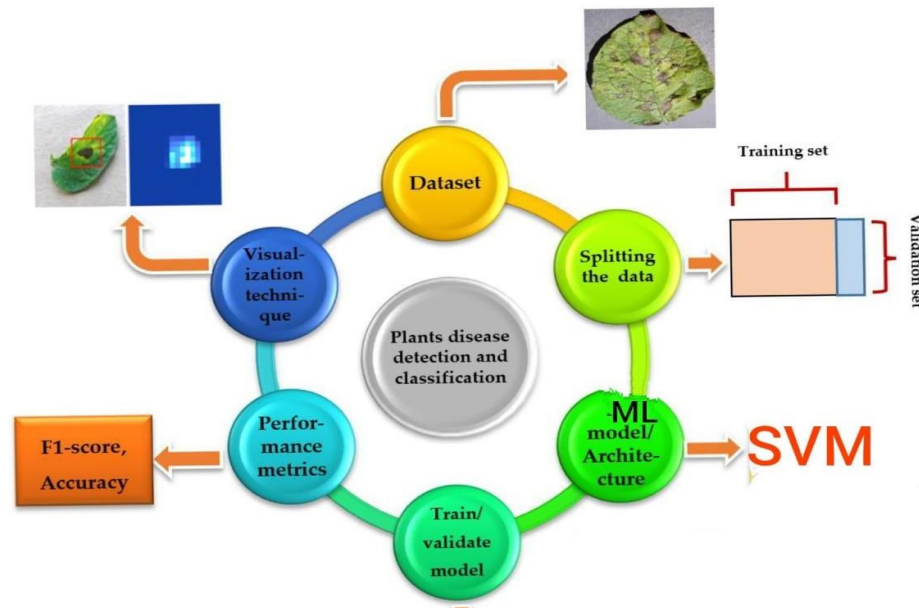


Fig 4.7 Process cycle of MATLAB

SVM is a two fold classifier which utilizes a hyper plane called the choice limit between two classes. This hyper plane attempts to separate, one class containing the objective preparing vector which is named as +1, and the other class containing the preparation vectors which is marked as -1. Utilizing these named preparing vectors, SVM enhancer tracks down a hyper plane that will then expand the edge of detachment among the two classes. Figure 4.8 It represents Linearly separable condition of cluster image by using SVM method in MATLAB.

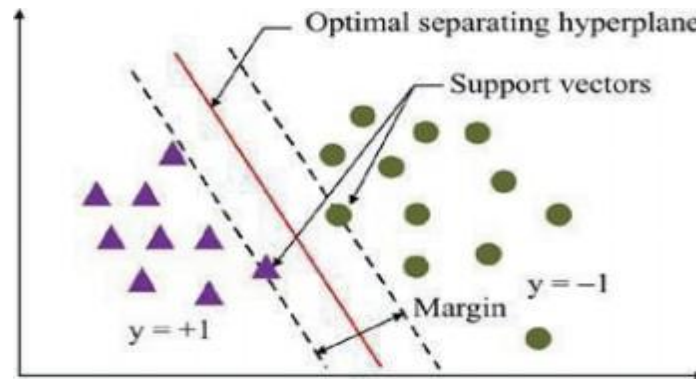


Fig 4.8 SVM in Linearly Separable Condition

Arrangement includes two phases, preparing and testing utilizing any classifier. In the preparation stage, the classifier is prepared utilizing highlights esteems and its particular objective qualities. These prepared classifiers are then used to order test pictures.

4.5 GRAPHICAL USER INTERFACE(GUI)

This is a GUI that shows some essential picture handling functionalities. Models tone separating, movement sifting, and so forth The client can stack any of the essential picture record types and afterward create an optional picture dependent on the given functionalities. The entirety of the embraced functionalities utilize Matlab buildin capacities, aside from the "Shading Filter" methodology, which isn't direct and has been carried out for this demo. Figure 4.9 Represents the output interfacing window after execution of the program in MATLAB.

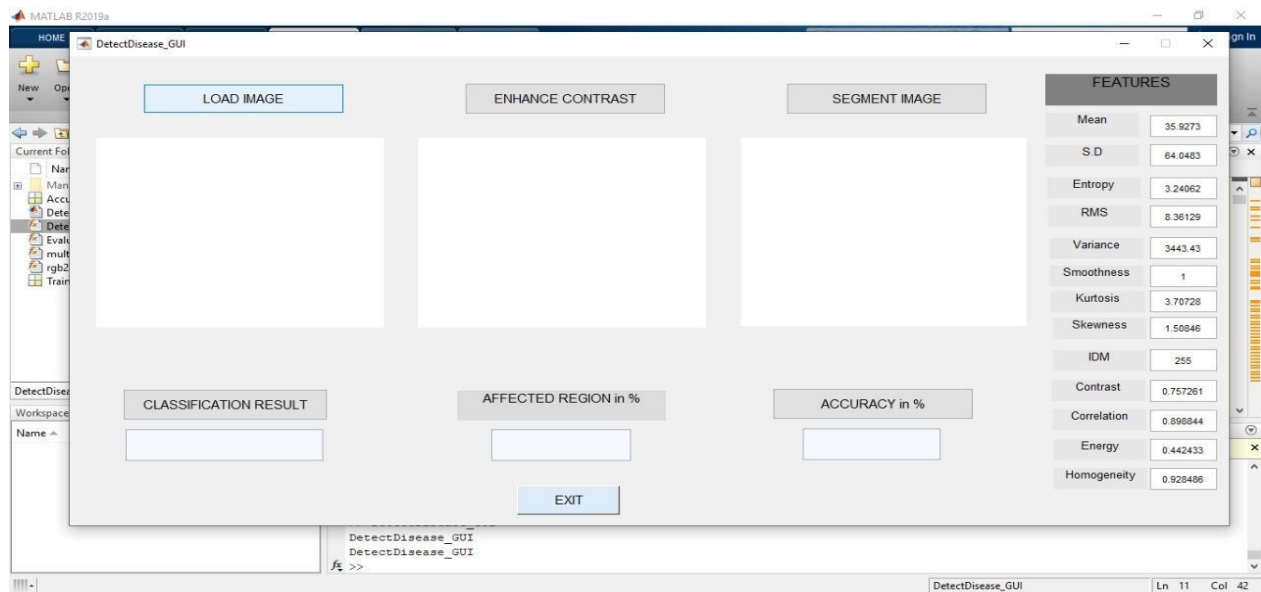


Fig 4.9 Graphic User Interface - Matlab

4.6 PUSH BUTTONS

btn = uibutton makes a press button in another figure and returns the Button object. MATLAB® calls the figure capacity to make the figure. btn = uibutton(style) makes a catch of the predefined style. btn = uibutton(parent) makes the catch in the predefined parent holder. Figure 4.10 Shows the pushbuttons to load input and clustering images to get Features

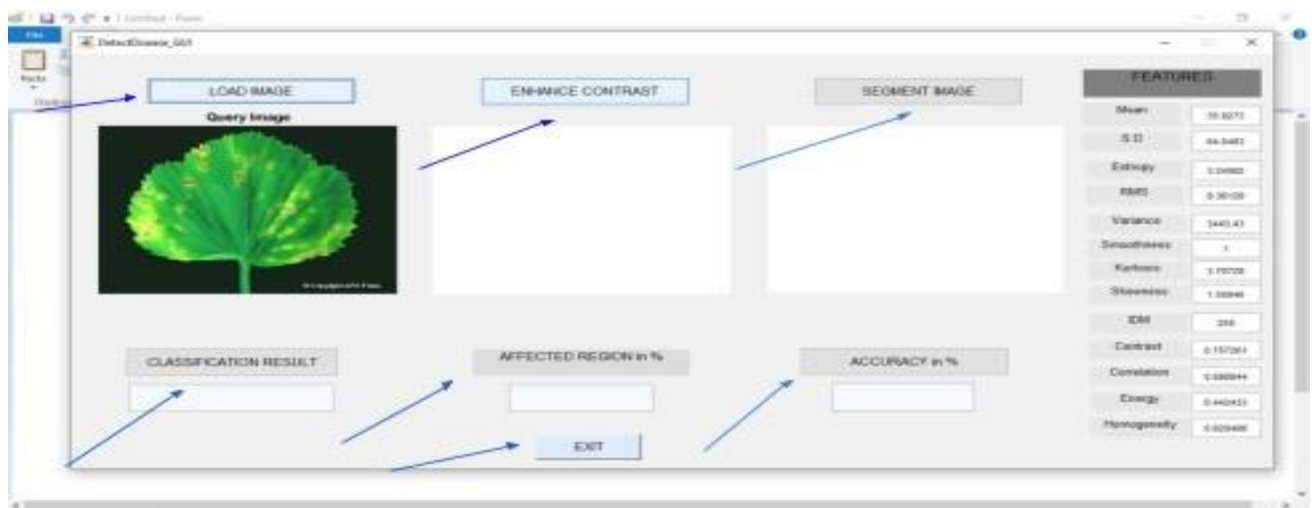


Fig 4.10 Push buttons

4.7 PLANTS AND ITS DISEASES

4.7.1 *Alternaria alternata*

It causes dark spots in numerous leafy foods around the globe. It is an idle organism that creates during the chilly stockpiling of natural products, getting obvious during the showcasing time frame subsequently causing enormous postharvest misfortunes. To control *Alternaria alternata* illnesses, it is imperative to improve the current procedures to distinguish this species.

A. alternata infections in products of the soil by utilizing regular techniques just as various novel methodologies including organic control, heat treatment, common mixtures (chitosan, isothiocyanates, fundamental oils, elicitors of normal safeguard system), among others, are incorporated. As of recently, there is still no solid convention to recognize and control postharvest infections brought about by *A. alternata*.

4.7.2 *Anthracnose*

Anthracnose, brought about by the growth of *Colletotrichum gloeosporioides*, is the most boundless and genuine postharvest illness of numerous tropical organic products including mango, papaya, pitaya, and avocado.

The most harming period of the sickness starts as a clam disease, when the natural product is in the pre climacteric period of improvement. Development of the microbe is continued solely after reap when the natural product begins to age and postharvest anthracnose creates prompting critical rot misfortunes during capacity and advertising. The infection is customarily constrained by engineered synthetic fungicides and high temp water treatment, on account of papaya and mango. Be that as it may, when gathered organic products are treated with fungicides, there is a more prominent probability of direct human openness to them and of advancement of opposition in microbes.

4.7.3 Bacterial blight

Bacterial curse (*Pseudomonas savastanoi*) of soybeans is commonly an early season sickness, which over winters in the field on plant buildup.

Introductory disease of soybeans happens when wind or sprinkling water drops from plant buildup on the dirt surface to the leaves convey bacterial cells. The microorganisms enter the plants through stomata and wounds on leaves. With the end goal for contamination to happen, the leaf surface should be wet. Seedlings might be tainted through contaminated seed. Microorganisms that enter the host produce a poison, which forestalls chlorophyll creation. Microbes can likewise be spread to uninfected leaves when they rub against contaminated ones during development, downpour, and wind.

Earthy colored spots on the edges of the cotyledons describe plants contaminated from the get-go in the developing season. Youthful plants might be hindered and if the disease arrives at the developing point, they may pass on. Indications in later development stages incorporate precise injuries, which start as little yellow to brown spots on the leaves. The focus of the spots will turn a dim ruddy earthy colored and dry out. A yellowish-green "radiance" will show up around the edge of water splashed tissue that encompasses the injuries. In the long run the sores will drop out of the leaf and the foliage will seem battered. By and large youthful leaves are generally vulnerable to scourge disease. Injuries can likewise happen in the cases making the seeds become wilted and stained. Nonetheless, seeds normally don't show indications.

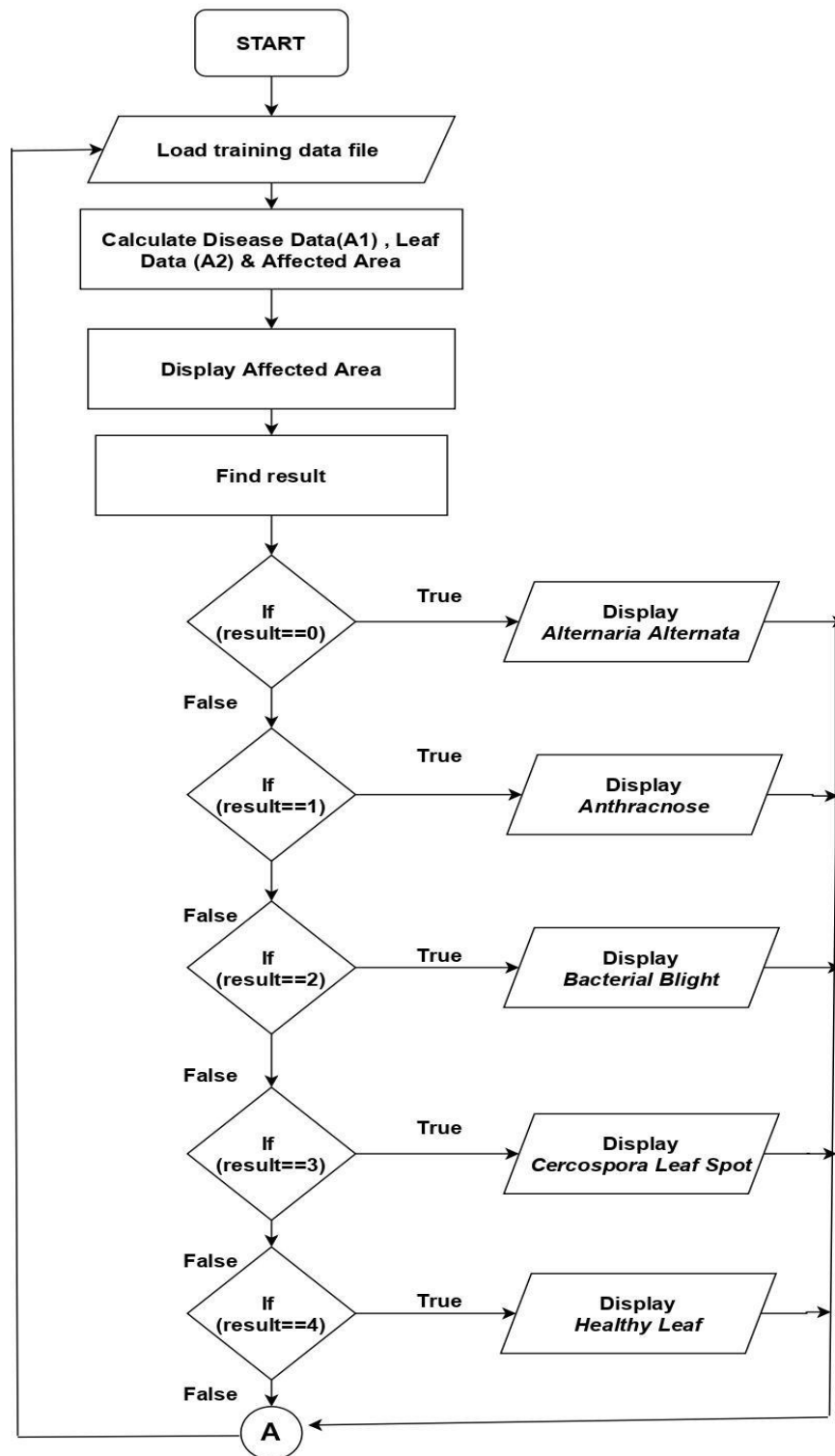
4.7.4 Cercospora leaf spot

Conidial morphology changes incredibly with ecological conditions. Hereditary variety among secludes normally exists in field populaces, despite the fact that there is no known sexual state. Host plants incorporate many weed species like lambsquarters, pigweed, mallow, and bindweed. Financial hosts incorporate tablebeet, sugar beet, Swiss chard, spinach, and most wild Beta species. Infection and injury arrangement at first happen on more established leaves prior to advancing to more up to date ones. Sores at development are 1/8 inch in width and show up light dim hued to dull tan with an earthy colored to purple boundary.

Seriously influenced leaves shrink and kick the bucket from blending sores. An analytic component is the presence of little dark spots (pseudo stomata) that structure in leaf substomatal pits inside the grayish-tan sores.

The pseudo stomata produce conidiophores borne in groups that fill in as conidia-bearing designs. Pseudo Stomata are obvious with a hand focal point, and after the openness of leaves to high moistness, whole sores seem fluffy because of the presence of various conidia.

4.8 FLOWCHART FOR MATLAB CODE



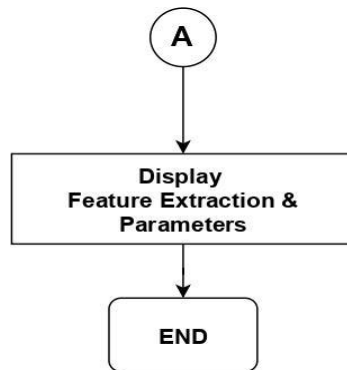


Fig 4.11 Flowchart for matlab code

Figure 4.11 depicts the flowchart for matlab code identify the disease on leaf

4.8 OUTPUT

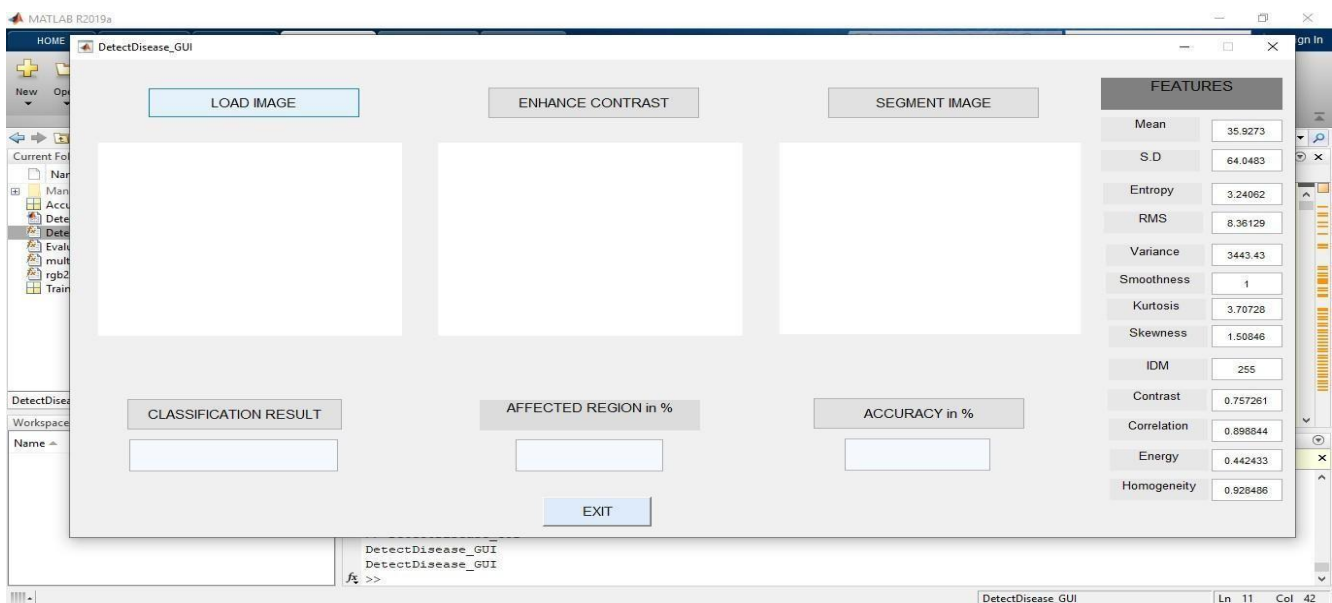


Fig 4.12 Loading input image using pushbutton

Figure 4.12 It represents the loading input image using pushbutton in matlab tool.

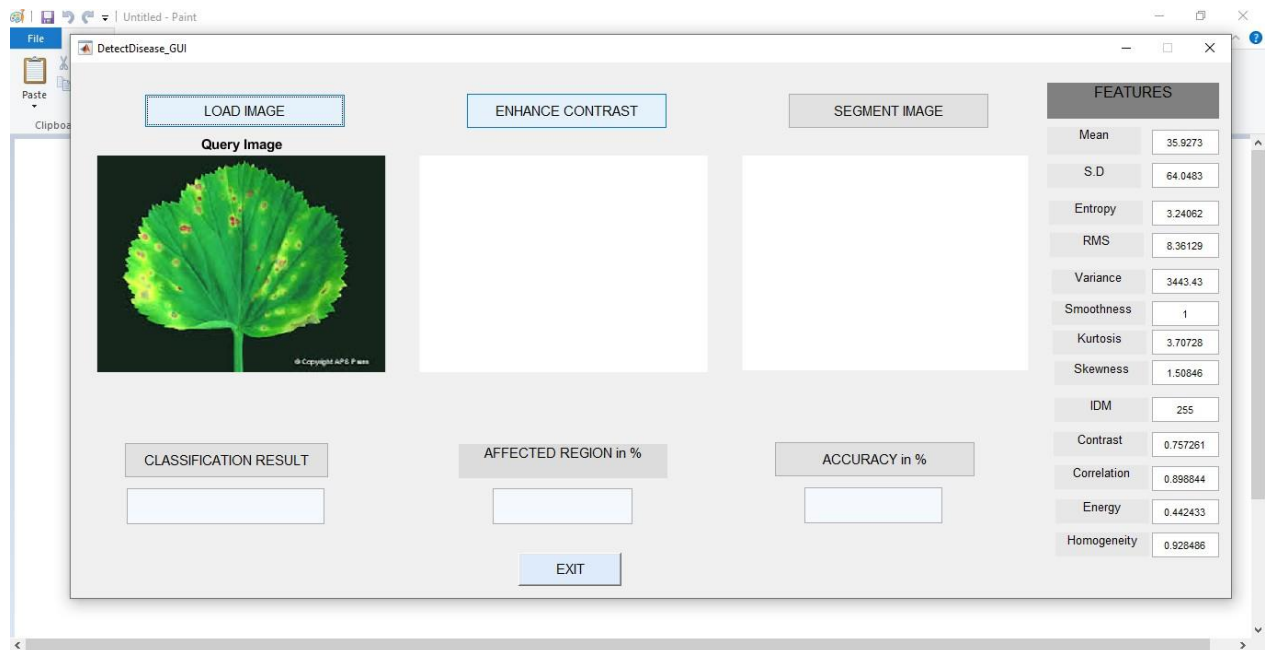


Fig 4.13 Selecting contrasted image

Figure 4.13 It represents the selecting contrasted image in matlab tool.

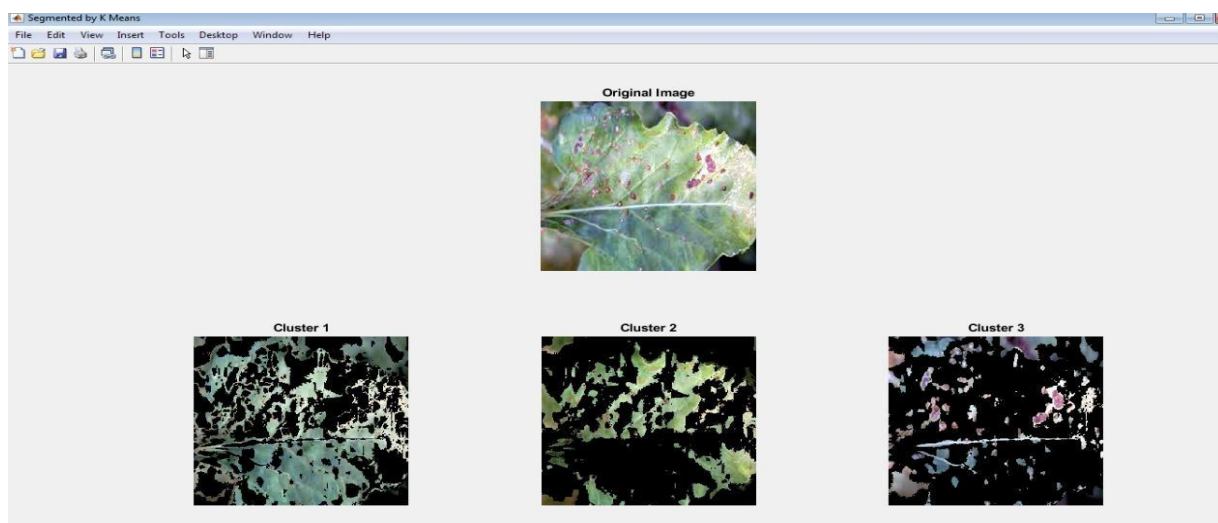


Figure 4.14 Output for clustering image

Figure 4.14 It represents the Output for clustering image in matlab tool.

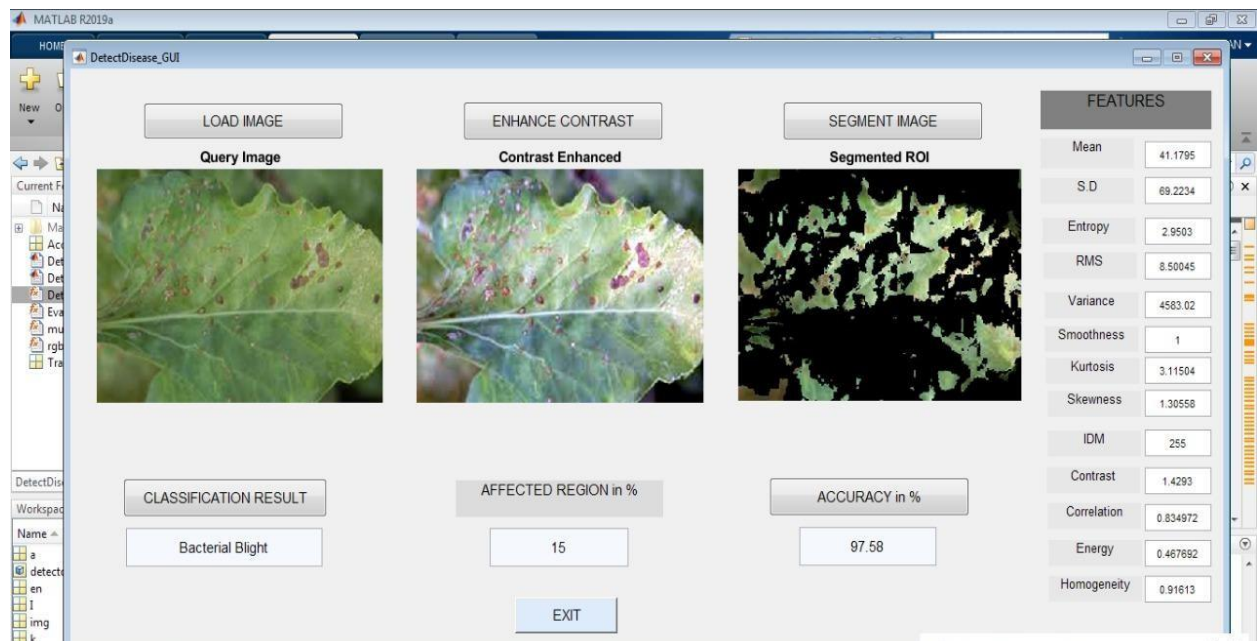


Fig 4.15 Overall Output for Affected region & Accuracy - Bacterial Bight

Figure 4.15 shows Bacterial curse. It occurs in soybeans commonly an early season sickness, which over winters in the field on plant buildup. Introductory disease of soybeans happens when wind or sprinkling water drops from plant buildup on the dirt surface to the leaves convey bacterial cells. The microorganisms enter the plants through stomata and wounds on leaves. With the end goal for contamination to happen, the leaf surface should be wet. Seedlings might be obtained through contaminated seed.

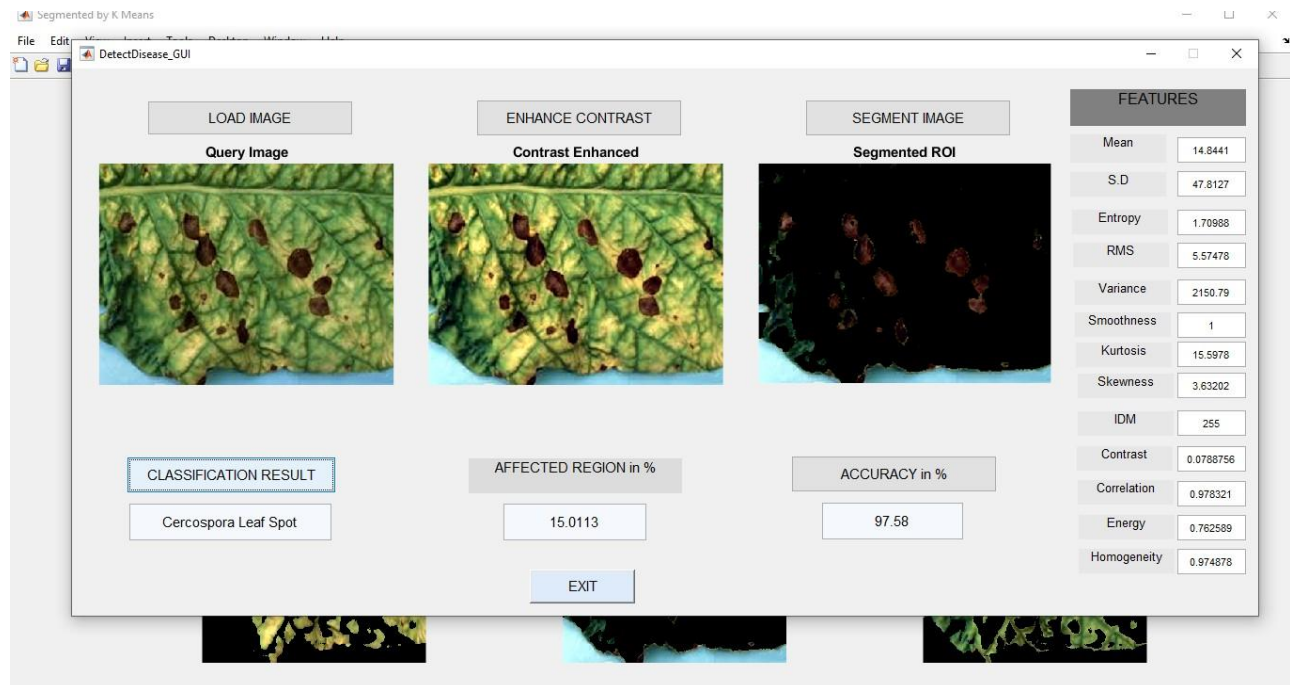


Figure 4.16 Overall Output for Affected region & Accuracy - Cercospora leaf spot

Figure 4.16 shows Cercospora leaf spot. Conidial morphology changes incredibly with ecological conditions. Hereditary variety among secludes normally exists in field populaces, despite the fact that there is no known sexual state. Host plants incorporate many weed species like lamb squarters, pigweed, mallow, and bindweed. Financial hosts incorporate table beet, sugar beet, Swiss chard, spinach, and most wild Beta species.

CHAPTER - 5

RESULTS AND DISCUSSION , PERFORMANCE ANALYSIS

5.1.PROPOSED BLOCK DIAGRAM

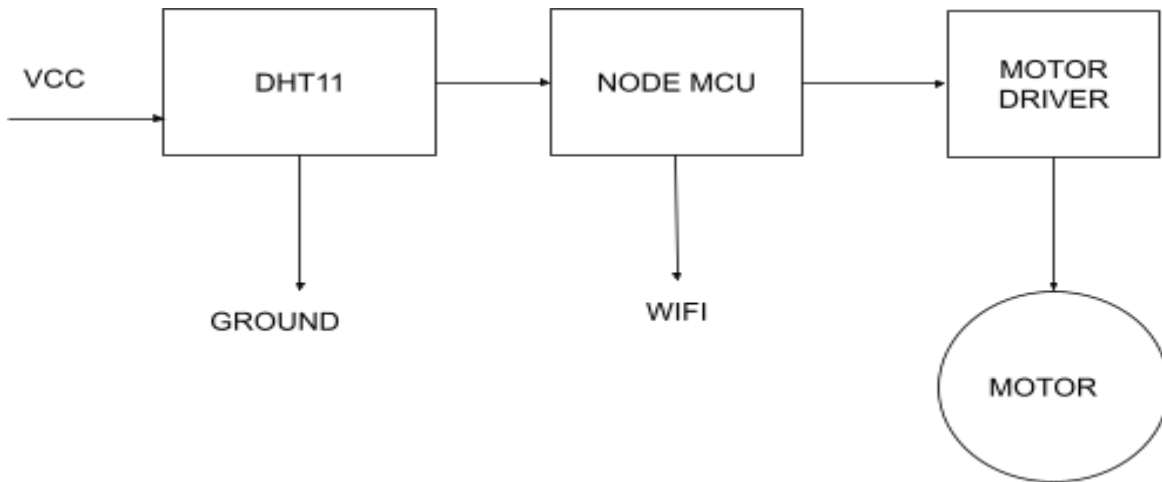


Fig 5.1 Block diagram of proposed system

Figure 5.1 It represents the proposed block diagram using NODE MCU

5.2 COMPONENTS USED:

5.2.1 DHT11

Temperature and stickiness sensor: Humidity Sensor is quite possibly the main gadget that has been broadly in purchaser, mechanical, biomedical, and ecological and so forth applications for estimating and observing Humidity esteems. For observing the temperature and stickiness we utilize the DHT11 sensor. The DHT11 distinguishes the water fume by estimating the electrical obstruction between two anodes. The stickiness detecting part is a dampness holding substrate with anodes applied to the surface. At the point when water fume is consumed by the substrate, particles are delivered by the substrate which builds the conductivity between the terminals. The adjustment in obstruction between the two terminals is corresponding to the relative moistness.

Higher relative moistness diminishes the obstruction between the terminals, while lower relative mugginess expands the opposition between the cathodes. The rule in the stickiness sensor is They comprise of a moistness detecting segment, a NTC temperature sensor (or thermistor) and an IC on the rear of the sensor.

Stickiness shows the probability of predictions, dew, or mist. Higher mugginess decreases the viability of perspiring in cooling the body by diminishing the pace of dissipation of dampness from the skin. This impact is determined in a warmth list table or humidex the measure of water fume that is expected to accomplish immersion increments as the temperature increases. As the temperature of a package of water becomes lower it will at last arrive at the mark of immersion without adding or losing water mass.

5.2.2 NodeMCU

The expression "NodeMCU" naturally alludes to the firmware instead of the dev units. The firmware utilizes the Lua scripting language. It depends on the eLua project and based on the Espressif Non-OS SDK for ESP8266. It utilizes many open source projects, for example, Lua-cjson and spiffs.LUA based natural firmware for Expressif ESP8622 Wi-Fi SoC, similarly as an open source gear board that despite the \$3 ESP8266 Wi-Fi modules consolidates a CP2102 TTL to USB chip for programming and exploring, is breadboard-obliging, and can essentially be constrained through its small USB port.

5.2.3 Wi-Fi Module

ESP-12E module like ESP-12 module however with 6 extra GPIOs.

5.2.4 USB

Miniature USB port for force, programming and troubleshooting

5.2.5 Headers

2x 2.54mm 15-pin header with admittance to GPIOs, SPI, UART, ADC, and force

pinsMisc – Reset and Flash catches

5.2.6 Force

5V through miniature USB port

5.2.7 Measurements

49 x 24.5 x 13mm

5.2.8 Arduino-like equipment IO

Progressed API for equipment IO, which can drastically diminish the excess work for designing and controlling equipment. Code like Arduino, however intuitively in Lua content.

5.2.9 Nodejs style network API

Occasion driven API for network applications, which encourages engineers composing code running on a 5mm*5mm measured MCU in Nodejs style. Incredibly accelerate your IOT application creating measure.

5.3 MOST MINIMAL EXPENSE WI-FI

Under \$2 WI-FI MCU ESP8266 coordinated and simple to prototyping improvement pack. We give the best stage to IOT application advancement at the least expense.

5.4 IMPROVEMENT KIT

1. The Development Kit dependent on ESP8266, coordinated GPIO, PWM, IIC, 1-Wire and ADC across the board. Force your advancement in the quickest manner by joining with NodeMcu Firmware.
2. The ESP8266 chip requires 3.3V force supply voltage. It ought not be controlled with 5 volts like other arduino sheets.
3. NodeMCU ESP-12E dev board can be associated with 5V using miniature USB connector or Vin nail accessible to board.
4. The I/O pins of ESP8266 impart or input/output max 3.3V as it were. for example the pins are NOT 5V lenient sources of info.

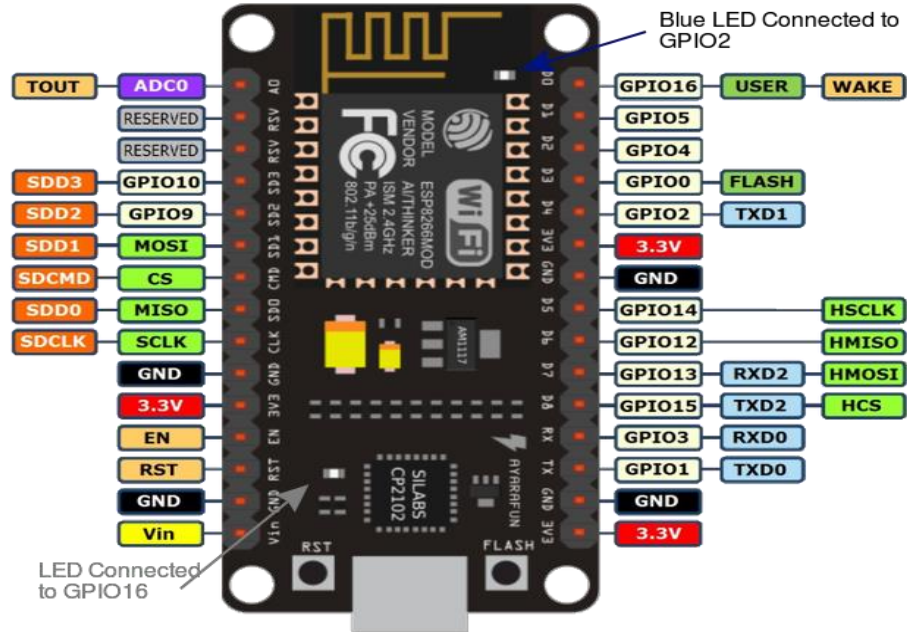


Fig 5.2 Node MCU

Figure 5.2 Shows the pin representation of Node MCU

5.5 PROPOSED SYSTEM BLOCK DIAGRAM(INTERFACING DHT11)

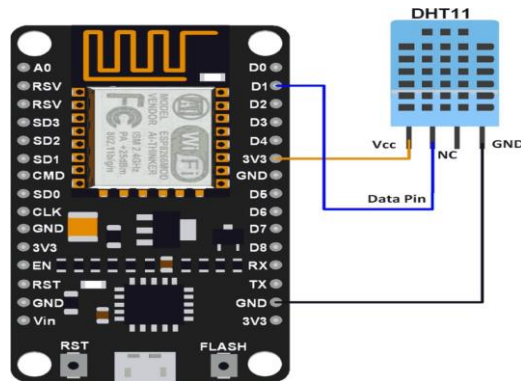


Fig 5.3 Interfacing DHT11

Figure 5.3 Shows the interfacing DHT11.

5.6 L293D

L293D is an ordinary Motor driver or Motor Driver IC which licenses DC motors to drive on either bearing. L293D is a 16-pin IC which can deal with a lot of two DC motors simultaneously toward any way. It suggests that you can deal with two DC motors with a single L293D IC. Twofold H-interface Motor Driver joined circuit (IC).

5.7 IDEA

It chips away at the idea of H-connect. As you most likely are aware, voltage needs to alter its course for having the option to turn the engine clockwise or anticlockwise, Hence H-connect IC are ideal for driving a DC engine.

1. Due to its size it is a lot utilized in mechanical applications for controlling DC engines. Given underneath is the pin chart of a L293D engine regulator.
2. There are two Enable pins on l293d. Pin 1 and pin 9, for having the option to drive the engine, the pin 1 and 9 should be high. For driving the engine with a left H-connect you need to empower pin 1 to high. In the event that anybody of either pin1 or pin9 goes low, the engine in the comparing area will suspend working. It resembles a switch.

5.8 L293 PIN GRAPH

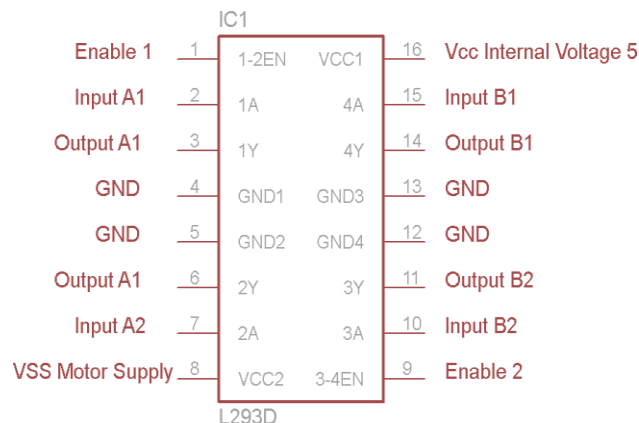


Fig 5.4 L293 pin diagram

Figure 5.4 Shows the pin details of L293

5.9 WORKING OF L293D

There are 4 info pins for L293d, nail 2,7 to one side and pin 15 ,10 on the privilege as demonstrated on the pin graph.

Left information pins will manage the turn of the engine associated across the left side and right contribution for the engine on the correct hand side. The engines are pivoted based on the sources of info given across the information pins as LOGIC 0 or LOGIC 1. In basic we need to give Logic 0 or 1 across the info pins for turning the engine.

5.10 L293D LOGIC TABLE.

Let's think about a Motor associated on left side yield pins (pin 3,6). For turning the engine clockwise way the info pins must be given Logic 1 and Logic 0.

- Pin 2 = Logic 1 and Pin 7 = Logic 0 | Rightward direction
- Pin 2 = Logic 0 and Pin 7 = Logic 1 | Counter clockwise
- Pin 2 = Logic 0 and Pin 7 = Logic 0 | No revolution
- Pin 2 = Logic 1 and Pin 7 = Logic 1 | No revolution

In a very much like manner the engine can likewise work across input nail 15,10 for engine to the correct hand side

5.11 CIRCUIT DIAGRAM FOR L293D MOTOR DRIVER IC CONTROLLER CIRCUIT

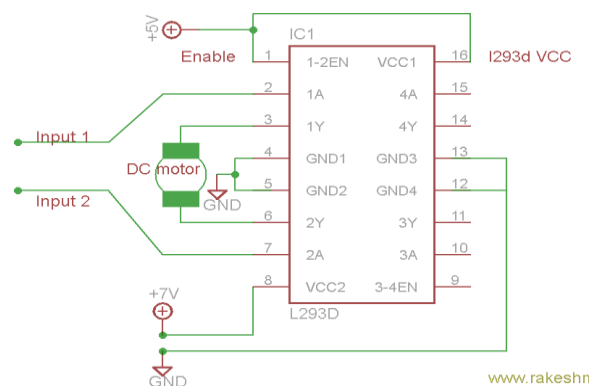


Fig 5.5 L293 Motor driver IC controller circuit

Figure 5.5 Shows the motor driver connected with IC controller circuit

5.12 BLYNK

It was proposed for the Internet of Things. It can deal with hardware remotely, it can show sensor data, it can store data, imagine it, and do various other cool things. It works something comparable the alternate way and everything happens in a Blink of an eye.

There are three significant segments in the stage:

Blynk App – permits you to make astonishing interfaces for your activities utilizing different gadgets we give.

Blynk Server – answerable for every one of the correspondences between the cell phone and equipment. You can utilize our Blynk Cloud or run your private Blynk worker locally. It's open-source, could without much of a stretch handle a large number of gadgets and can even be dispatched on a Raspberry Pi.

Blynk Libraries – for all the mainstream equipment stages – empower correspondence with the worker and interaction all the approaching and outcoming orders. Figure 5.6 shows the bylnk application yield.

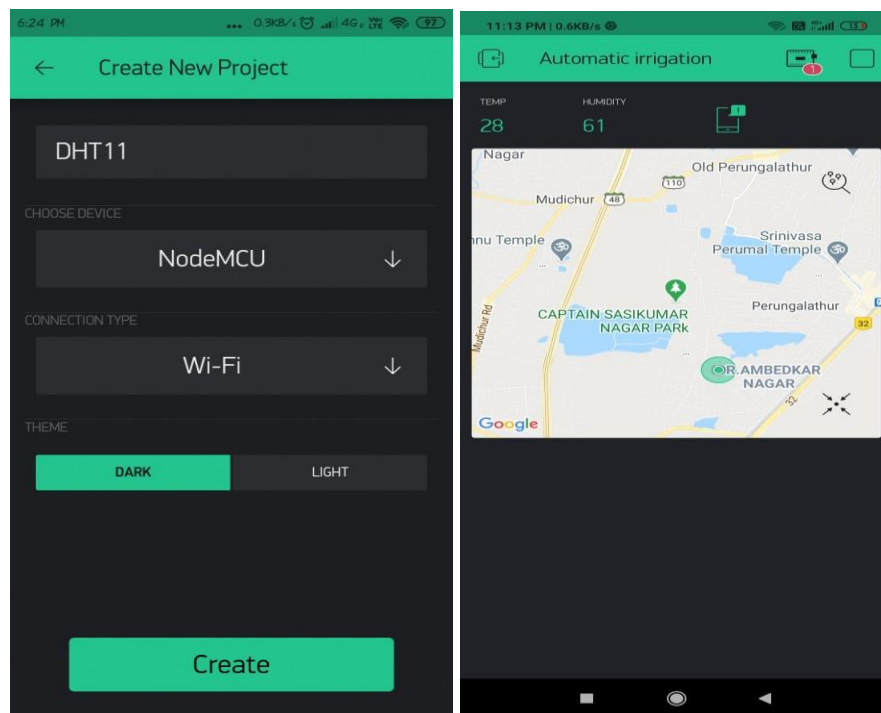


Fig 5.6 Blynk application output display

Figure 5.6 It shows the Humidity and Temperature output in Blynk screen.

5.13 PROCESS FLOWCHART

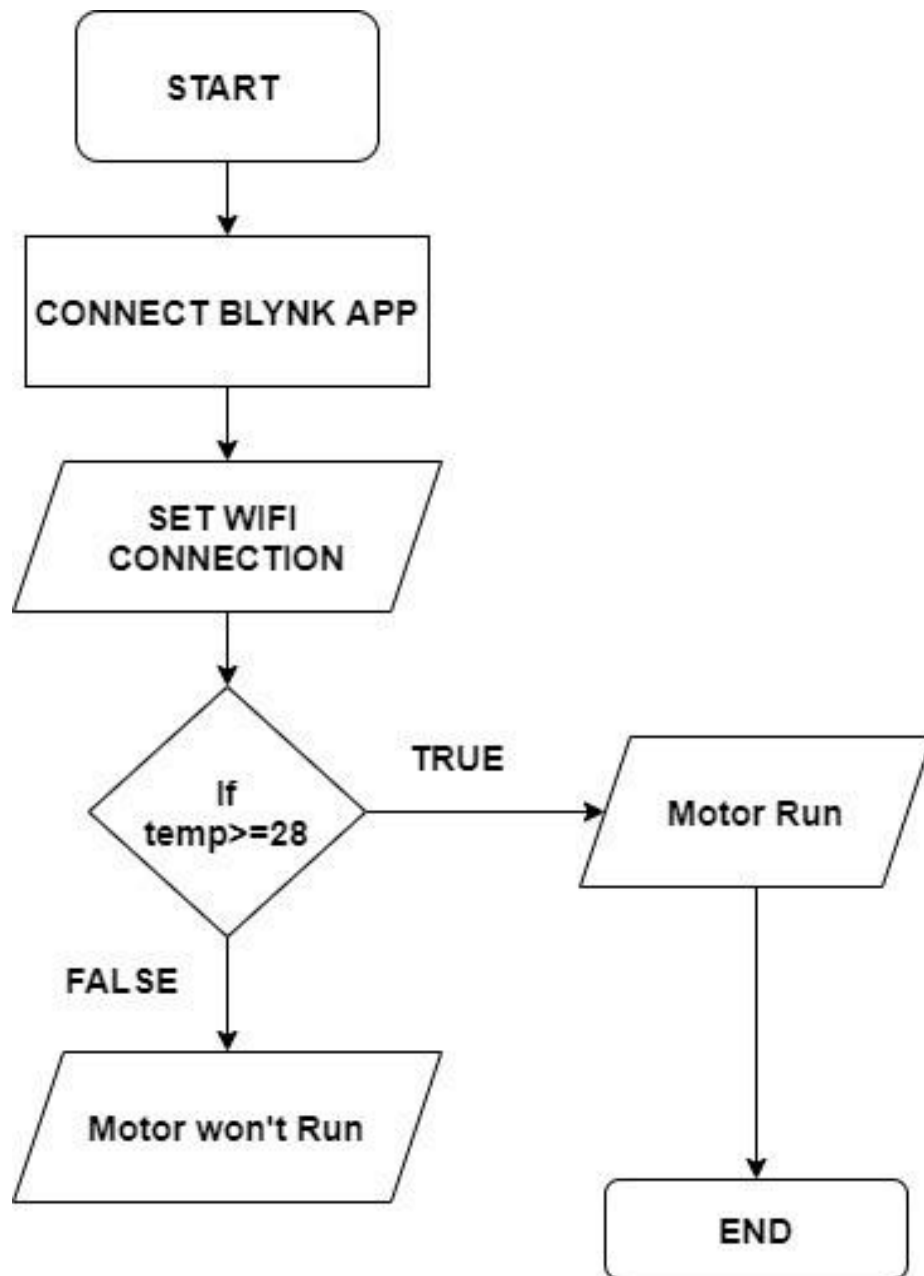


Fig 5.7 Process flowchart

Figure 5.7 shows the Process flow in Matlab Code. Using the above process, coding is written in matlab.

5.14 HARDWARE MODEL

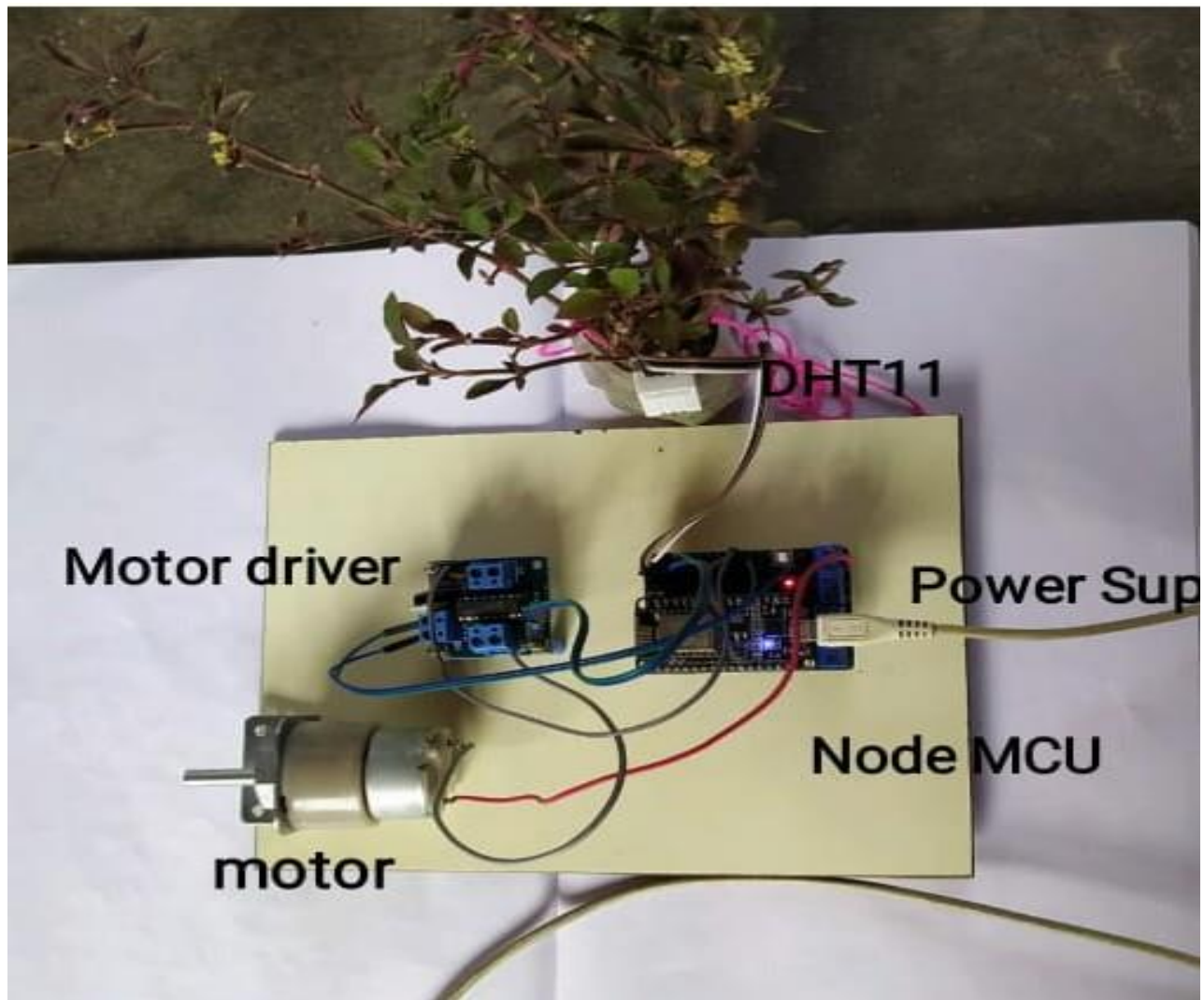


Fig 5.8 Hardware part of automatic irrigation proposed system

Figure 5.8 shows the Hardware image of automatic irrigation proposed system. The articulation "NodeMCU" normally insinuates the firmware rather than the dev units.

CHAPTER - 6

6.1.CONCLUSION

The data mining techniques are playing a significant role in the agriculture industry and other industries. Data mining algorithms are easy to implement, we can solve complex problems using these techniques. Using image techniques and data mining algorithms we successfully identified the affected area in the plant leaf. The algorithm used here is very much efficient and best case time space complexities are achieved. For ninety percent of images average clustering and processing time is less than twenty seconds. Average accuracy of ninety plus percentage is achieved in every query image of the dataset. As of now, ranchers control the water system method manually and flood their zone at a methodical period. These instruments exhaust high measure of water and the result is water misfortune. While dry zones have less precipitation and the water framework is challenging. Therefore, ESP8266 Wi-Fi based correspondence structure has been taken because of the effortlessness of utilization and cost. The contraption is robotized that will correctly screen and control the water need and steadfastness. The correspondence through the locales favors the customer to connect with sensors from wherever in the world in nanoseconds which is beneficial for the customer.

6.2.FUTURE SCOPE

Web based image processing techniques can be implemented. In this user is provided with two modes with and without the internet. In case of web based processing remote area users can upload images in the system and the whole image system techniques and classification algorithm will be implemented in the cloud itself. Real time monitoring of the data is there using the cloud platform. We can include much more localised irrigation systems with cloud based monitoring in future.

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APPENDIX SOURCE CODE

PROGRAM FOR MATLAB SOFTWARE

```
function varargout = DetectDisease_GUI(varargin)

gui_Singleton = 1;
gui_State = struct('gui_Name',    mfilename, ...
    'gui_Singleton', gui_Singleton, ...
    'gui_OpeningFcn', @DetectDisease_GUI_OpeningFcn, ...
    'gui_OutputFcn', @DetectDisease_GUI_OutputFcn, ...
    'gui_LayoutFcn', [] , ...
    'gui_Callback', []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

handles.output = hObject;
ss = ones(300,400);
axes(handles.axes1);
imshow(ss);
axes(handles.axes2);
imshow(ss);
axes(handles.axes3);
imshow(ss);
guidata(hObject, handles);

clc
[filename, pathname] = uigetfile({'*. *'; '*.bmp'; '*.jpg'; '*.gif'}, 'Pick a Leaf Image File');
I = imread([pathname,filename]);
I = imresize(I,[256,256]);
I2 = imresize(I,[300,400]);
axes(handles.axes1);
imshow(I2);title('Query Image');
ss = ones(300,400);
axes(handles.axes2);
imshow(ss);
axes(handles.axes3);
imshow(ss);
handles.ImgData1 = I;
guidata(hObject,handles);

function pushbutton3_Callback(hObject, eventdata, handles)
I3 = handles.ImgData1;
I4 = imadjust(I3,stretchlim(I3));
```

```

I5 = imresize(I4,[300,400]);
axes(handles.axes2);
imshow(I5);title(' Contrast Enhanced ');
handles.ImgData2 = I4;
guidata(hObject,handles);

ab = double(lab_he(:,2:3));
nrows = size(ab,1);
ncols = size(ab,2);
ab = reshape(ab,nrows*ncols,2);
nColors = 3;
[cluster_idx cluster_center] = kmeans(ab,nColors,'distance','sqEuclidean', ..'Replicates',3);
pixel_labels = reshape(cluster_idx,nrows,ncols);

segmented_images = cell(1,3);
rgb_label = repmat(pixel_labels,[1,1,3]);
for k = 1:nColors
    colors = I;
    colors(rgb_label ~= k) = 0;
    segmented_images{k} = colors;
end
figure,subplot(2,3,2);imshow(I);title('Original Image');
subplot(2,3,4);imshow(segmented_images{1});title('Cluster 1');
subplot(2,3,5);imshow(segmented_images{2});title('Cluster 2');
subplot(2,3,6);imshow(segmented_images{3});title('Cluster 3');
set(gcf, 'Position', get(0,'Screensize'));
set(gcf, 'name', 'Segmented by K Means', 'numbertitle','off')
pause(2)
x = inputdlg('Enter the cluster no. containing the ROI only:');
i = str2double(x);

cc = bwconncomp(seg_img,6);
diseasedata = regionprops(cc,'basic');
A1 = diseasedata.Area;
sprintf('Area of the disease affected region is : %g%',A1);

I_black = im2bw(I,graythresh(I));
kk = bwconncomp(I,6);
leafdata = regionprops(kk,'basic');
A2 = leafdata.Area;
sprintf(' Total leaf area is : %g%',A2);

%Affected_Area = 1-(A1/A2);
Affected_Area = (A1/A2);
if Affected_Area < 0.1

```

```

    Affected_Area = Affected_Area+0.15;
end
sprintf('Affected Area is: %g%%',(Affected_Area*100))
Affect = Affected_Area*100;

glcms = graycomatrix(img);

stats = graycoprops(glcms,'Contrast Correlation Energy Homogeneity');
Contrast = stats.Contrast;
Correlation = stats.Correlation;
Energy = stats.Energy;
Homogeneity = stats.Homogeneity;
Mean = mean2(seg_img);
Standard_Deviation = std2(seg_img);
Entropy = entropy(seg_img);
RMS = mean2(rms(seg_img));

Variance = mean2(var(double(seg_img)));
a = sum(double(seg_img(:)));
Smoothness = 1-(1/(1+a));
Kurtosis = kurtosis(double(seg_img(:)));
Skewness = skewness(double(seg_img(:)));

m = size(seg_img,1);
n = size(seg_img,2);
in_diff = 0;
for i = 1:m
    for j = 1:n
        temp = seg_img(i,j)./(1+(i-j).^2);
        in_diff = in_diff+temp;
    end
end
IDM = double(in_diff);

feat_disease = [Contrast,Correlation,Energy,Homogeneity, Mean, Standard_Deviation, Entropy, RMS,
Variance, Smoothness, Kurtosis, Skewness, IDM];
I7 = imresize(seg_img,[300,400]);
axes(handles.axes3);
imshow(I7);title('Segmented ROI');

set(handles.edit5,'string',Mean);
set(handles.edit6,'string',Standard_Deviation);
set(handles.edit7,'string',Entropy);
set(handles.edit8,'string',RMS);

```

```

set(handles.edit9,'string',Variance);
set(handles.edit10,'string',Smoothness);
set(handles.edit11,'string',Kurtosis);
set(handles.edit12,'string',Skewness);
set(handles.edit13,'string',IDM);
set(handles.edit14,'string',Contrast);
set(handles.edit15,'string',Correlation);
set(handles.edit16,'string',Energy);
set(handles.edit17,'string',Homogeneity);
handles.ImgData3 = feat_disease;
handles.ImgData4 = Affect;

function pushbutton5_Callback(hObject, eventdata, handles)

load('Accuracy_Data.mat')
Accuracy_Percent= zeros(200,1);
itr = 500;
hWaitBar = waitbar(0,'Evaluating Maximum Accuracy with 500 iterations');
for i = 1:itr
    data = Train_Feat;

    groups = ismember(Train_Label,0);
    [train,test] = crossvalind('HoldOut',groups);
    cp = classperf(groups);

    Accuracy_Percent(i) = 0.9758.*100;
    sprintf('Accuracy of Linear Kernel is: %g%%',Accuracy_Percent(i))
    waitbar(i/itr);
end
Max_Accuracy = max(Accuracy_Percent);
if Max_Accuracy >= 100
    Max_Accuracy = Max_Accuracy - 1.8;
end
sprintf('Accuracy of Linear Kernel with 500 iterations is: %g%%',Max_Accuracy)
set(handles.edit4,'string',Max_Accuracy);
delete(hWaitBar);
guidata(hObject,handles);

test = handles.ImgData3;
Affect = handles.ImgData4;

load('Training_Data.mat')
result = multisvm(Train_Feat,Train_Label,test);
if result == 0
    R1 = 'Alternaria Alternata';

```

```

    set(handles.edit2,'string',R1);
    set(handles.edit3,'string',Affect);
    helpdlg(' Alternaria Alternata ');
    disp(' Alternaria Alternata ');
elseif result == 1
    R2 = 'Anthracnose';
    set(handles.edit2,'string',R2);
    set(handles.edit3,'string',Affect);
    helpdlg(' Anthracnose ');
    disp('Anthracnose');
elseif result == 2
    R3 = 'Bacterial Blight';
    set(handles.edit2,'string',R3);
    set(handles.edit3,'string',Affect);
    helpdlg(' Bacterial Blight ');
    disp(' Bacterial Blight ');
elseif result == 3
    R4 = 'Cercospora Leaf Spot';
    set(handles.edit2,'string',R4);
    set(handles.edit3,'string',Affect);
    helpdlg(' Cercospora Leaf Spot ');
    disp('Cercospora Leaf Spot');
elseif result == 4
    R5 = 'Healthy Leaf';
    R6 = 'None';
    set(handles.edit2,'string',R5);
    set(handles.edit3,'string',R6);
    helpdlg(' Healthy Leaf ');
    disp('Healthy Leaf ');
end

```

PROGRAM FOR HARDWARE

```

#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <LiquidCrystal.h>
#include <DHT.h>
#include <BlynkSimpleEsp8266.h>
char auth[] = "Nwv0kHFir9I37pOPjXZ5pZYAE8a2LV0c";
char ssid[] = "ACTIVE GALAXY";
char pass[] = "9655123644";
#define DHTPIN 16
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);

```

```

void setup()
{
  dht.begin();

  pinMode(0,OUTPUT);
  pinMode(5,INPUT);pinMode(4,INPUT);
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  Blynk.syncAll();
  Blynk.notify("Yaaay... Device detected!");
}

void dataa()
{

  float h = dht.readHumidity();
  float t = dht.readTemperature();

  if(t>34)
  {
    digitalWrite(0,1);
  }
  else
  {
    digitalWrite(0,0);
  }

  Blynk.virtualWrite(V2, h);
  Blynk.virtualWrite(V3, t);

  delay(1000);
}

void loop()
{
  Blynk.run();
  dataa();
}

```