International Journals of Advanced Research in Computer Science and Software Engineering
ISSN: 2277-128X (Volume-9, Issue-4)

Research Article | **April 2019**

Automatic Disease Detection and Monitoring System in Plants Using K-Means Algorithm

Dr. M. Yuvaraju[1], S. Priyanka[2]
[1]*Assistant Professor,* [2]*PG Scholar*
[1, 2] *Electrical & Electronics Engineering, Anna University Regional Campus, Coimbatore, Tamil Nadu, India*
yuvsheka@gmail.com, spriyanka1496@gmail.com

Abstract: ***Agriculture is the main sources of all countries throughout the world. Many plants are easily affected to diseases due to changes in various factors such as soil moisture, varying climatic conditions, nutrients, temperature etc. Automatic plant disease detection and monitoring system using k-means algorithm helps to monitor the plant diseases through moisture values of the soil. It helps to reduce water use. The system is developed with threshold values of soil moisture sensor that is programmed into a microcontroller based gateway to control water quantity. It involves two processes such as disease detection and monitoring the soil. At first stage, wireless camera is used to capture the plant image and processed using image processing by Matlab software. Here the leaf images of paddy crops are already trained by artificial neural network by k-means algorithm. At second stage, soil moisture sensor values are compared with threshold values which are given to microcontroller. Depending upon the results of microcontroller, motor is pumped ON/OFF which is driven by driver circuit and relay. If the plant is infected to diseases, the information about the diseases is sent to the authorised person through GSM module. This system helps to increases the crop yield by identifying and classifying the diseases before it affects the entire field. Development of this system leads to high productivity.***

Keywords: k-means Algorithm, Artificial Neural Network, Classification, Image processing.

I. INTRODUCTION

In Indian Economy, Agriculture is the most important sector. Farmers cultivate variety of crops every day in which water is one of the essential parts for effective growth of the plant. Technology has a greater role in agricultural development. Agriculture requires huge amount of water and it is vanishing day by day. Irrigation like drip irrigation saves huge amount of water. Continuous Monitoring is done regularly. This is called Manual irrigation which is a traditional method in agriculture. This has been very difficult to save water and get profit from the field. Many sensor networks are used in agriculture such as precision agriculture, drip irrigationetc.

Visual way of identification of plant disease detection is difficult task as well as not more accurate and applicable only at small areas. Automatic detection technique is used with less time with accurate results. Most of the plants are affected by common bacterial, fungal and viral diseases. The colour of leaf changes in diseases like Brown spot, Shelth Blight, Rice Blast, leaf streach. Using image processing technique difference in colour of leaf and affected area of the leaf is measured.

Image segmentation process helps in separating an image into different parts. The images of all leaf is captured by camera and processed via pc which consists of Matlab. Matlab tools used for segmentation process of leaf and by use artificial neural network the captured image is compared with already trained leaf images. Thus the result of normal leaf and diseased leaf image is obtained.

Sensors are used to obtain the data from surroundings like moisture sensor, temperature, Humidity, water level etc. Communication is done with these sensors and with controller unit. Internet of things (IOT) is the system of many connected objects and can be accessible through internet. Science and technology are needed for efficient monitoring and prior disease identification. This implementation leads to water management as well as disease control using a controller unit. The message about the diseased plant is sent to authorised person using GSM module.

II. EXISTING SYSTEM

In an existing system, disease detection of plants is done only by naked eye observation only by known persons. This requires large number of people for continuous monitoring which costs high for large farms. Only one parameter like water management is possible on current irrigation system. If moisture level of the soil is found to be below the

© www.ijarcsse.com, All Rights Reserved

threshold, the control unit triggers the pump ON/OFF. This system is not aware of available water and amount of water required for particular crop. If the plant is affected with disease, early detection of disease cannot be done and it is not aware of what type of diseases and type of pesticides to be used when it is affected.

III. PROPOSED SYSTEM

In the proposed system, automated irrigation system based on microcontroller was developed. Identification of diseases is the key to prevent qualitative and quantitative losses of agricultural yields. This creates a need for image processing techniques helps in accurate and timely detection of diseases and overcome the limitations of human vision. The automated irrigation system consists of keypad to select which plant we are use in agriculture land. After the selection of crops, the microcontroller will automatically check the soil reference level depend on the particular plant growth. From day one, every regular process like watering the agricultural land, fertilizer, leaf cutting time etc. is calculated. Development of an automated system for identifying and classifying different diseases of the contaminated plants is an emerging area in precision agriculture. In image processing technique the captured image is pre-processed in which the diseased part is segmented using adaptive k- means algorithm. Feature extraction is done which includes texture and statistical features. All the extracted features are combined as per the diseases and classified using artificial neural network and appropriate fertilizers are recommended for respective diseases. This kind of information is given to GSM modem which is processed by microcontroller. Farmers make use of this information and it helps to increase the cropyield.

BLOCK DIAGRAM

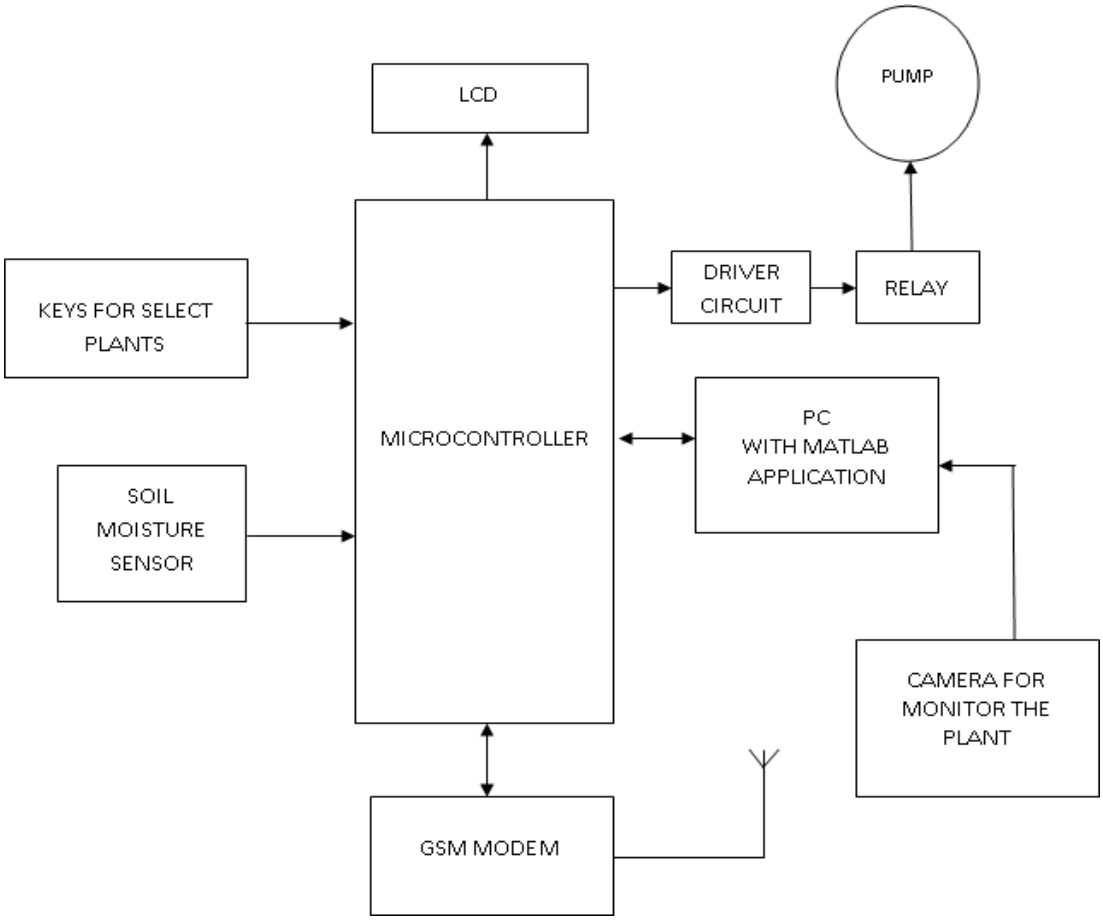

Fig-1 Block diagram

HARDWARE SELECTION MICROCONTROLLER

The microcontroller is the controlling unit of the system. The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Technology that is used in PIC16F877 is flash technology so that the data is retained when the power is switched off. It has 256 bytes of EEPROM data memory and 8 channels of 10-bit Analog-to-Digital(A/D) converter. Easy programming and erasing are the other features of PIC16F877.

© www.ijarcsse.com, All Rights Reserved

SOIL MOISTURE SENSOR

Water content of the soil is measured by soil moisture sensor. When the soil is having water storage, the module output is at high level; else the output is at low level. Water content is determined by its dielectric constant which helps to measure the capacitance between two electrodes implanted in the soil. In sandy soil, the dielectric constant is directly proportional to the moisture value. There are two probes to be dipped in soil and analog output is varied from 0.60volts-5volts with input voltage of5volts.

GSM MODULE

GSM module is second generation cellular network which is interfaced with PIC16F877 through MAX232.A SIM card is mounted with it. GSM digitizes and reduces the data and then sends it through a channel with its own time slots. It has ability to carry 64kbps to 120Mbps of data rates. It helps to alert the farmer about the information of the plant.

LCD DISPLAY

In this work, 16*2 LCD display is used to display the results of plant from day 1 to the end of process which is interfaced with port0-port7 of microcontroller. It can display 16 characters per line and has 2 suchlines.

SOFTWARE REQUIREMENTS MPLAB

MPLAB support code editing, debugging and programming of all PIC families. MPLAB IDE is used for the microchip technology incorporated PIC microcontroller and digital signal controller families. MPLAB SIMULATOR is a debugging tool to assist the users in debugging software. PRO MATE II and COMPILER HIGH TECH C are also running under supported OS.MPLAB program is loaded to PICmicrocontroller.

MATLAB

MATLAB stands for MATrixLABoratory. It is developed by Math Works. It is a fourth generation high level programming language and interactive environment for numerical computations, visualization and programming. Specific application has collection of packages called toolbox. It has many toolboxes like signal processing, symbolic computation, control theory, simulation, optimization etc. It allows implantation of algorithms, plotting of functions and data, interfacing with programs written in other languages. This application is built around MATLAB scripting language. Common usage of MATLAB involves using the Command Window or executing text files containing MATLAB code. Matlab supports Object-oriented programming and graphical user interface features. Matlab consists of variables, structures and functions. Segmentation is done by adaptive k-means algorithm.

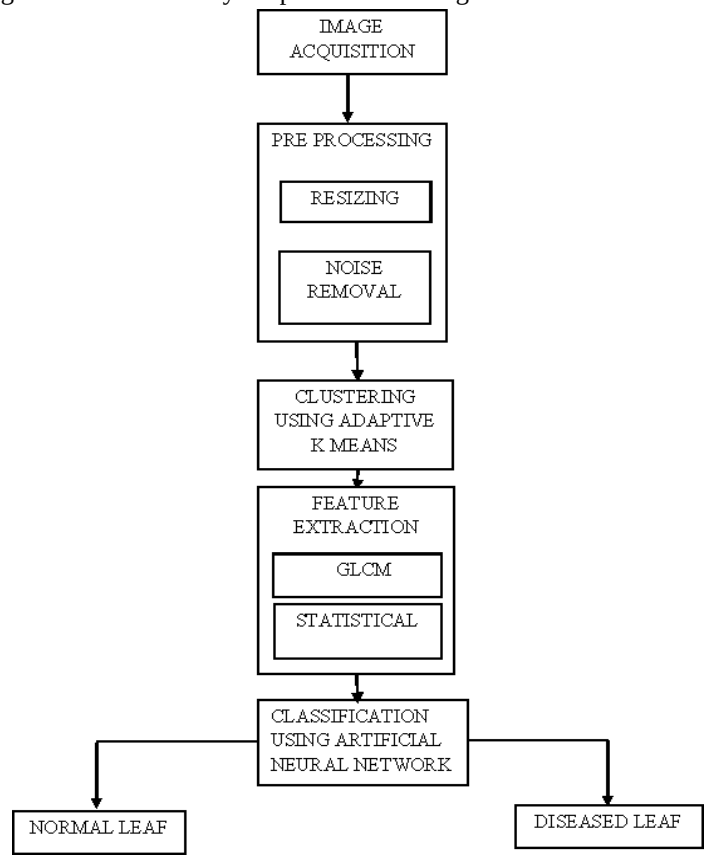

Fig-2 Flow diagram

© www.ijarcsse.com, *All Rights Reserved*

Flow diagram describes the flow of techniques in image processing. The captured undergoes the process of pre-processing were resizing and noise removal is done. Adaptive k- means algorithm is used for clustering and feature extraction is carried out. After extraction, all features are combined as per the diseases and diseases have been classified using artificial neural network.

IMAGE PROCESSING AND ITS TOOLBOX

In order to get some useful information from the image, an image processing is used. Here input to the system is an image. This system treats images as two dimensional signals. In MATLAB, Image processing toolbox isused.

SHELTH BLIGHT DISEASE

Image processing toolbox consists of standard algorithms and applications for image processing, visualisation, analysis and development. Image enhancement, image segmentation, image restrictions, geometric transformations, noise reduction etc. are performed. This toolbox helps to analyse and automate image processing techniques.

K- MEANS CLUSTERING ALGORITHM

K-means clustering is a type of unsupervised learning which is used in case of unlabelled data. This algorithm is guaranteed to a best result. The main goal of this algorithm is to find groups in the data, with the number of groups represented by the variable K. Each data points are assigned to one of K groups. All data points are clustered based on feature similarity. It uses the iterative refinement to produce a final result. This algorithm inputs are the number of clusters k and the dataset. It involves two steps.

- Data assignment step involves a collection of centroids in a set were each data points is assigned to a cluster based on standard Euclideandistance.
- Centroid update step is done by taking a mean of all data points assigned to that centroidcluster.

This algorithm iterates between steps one and two until a stopping criteria is met with no data points. To find the number of clusters in the data, the user needs to run the k-means clustering algorithm for the range of k values and compare the results.Thereforeit finds the clusters and data set labels for particular pre-chosenk.

ARTIFICIAL NEURAL NETWORK

Artificial neural networks are electronic networks of neurons based on the neural networks of the brain. They records one at a time and learn by comparing their classification of the record with the known actual classification of the record. The errors from the initial classification of the first record is fed back into the network and used to modify the networks. In order to classify the different types of rice leaf diseases, artificial neural network is used forclassification.

To achieve this by computer, it involves three steps namely training, classification and pattern recognition. A neural network has several inputs, hidden and output nodes. A single sweep forward through the network results in assignment value to the input node and record is assigned to each node with highestvalue.

A neuron in an artificial neural network consists of

- A set of input values and its associatedweights.
- A function that sums the weights and maps the results to anoutput.

It is used for classifying the normal crop and weed parts in the farms using extracted features.

MATLAB RESULTS OF PROCESSED IMAGE USING IMAGE PROCESSING OUTPUTS OF DISEASED LEAF AND ITS DISEASE

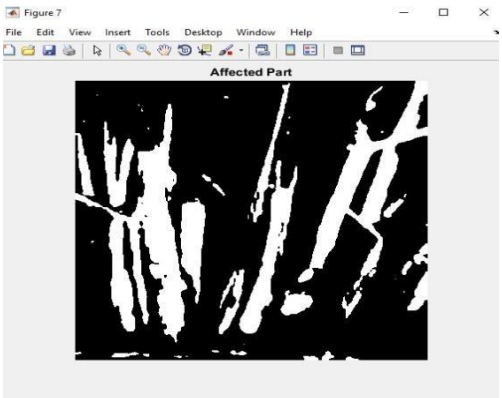

Fig-3Affectedpart

Fig-4 Type ofdisease

© www.ijarcsse.com, *All Rights Reserved*

Brown Spot Disease

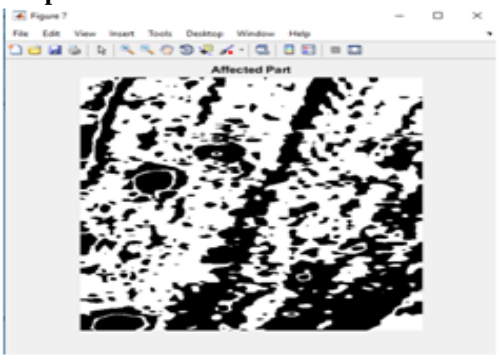

Fig-5Affectedpart

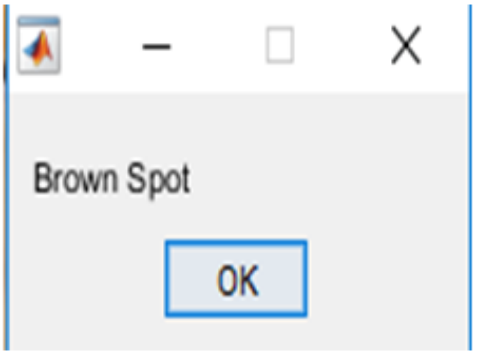

Fig-6 Type ofdisease

Bacterial leaf Blight disease

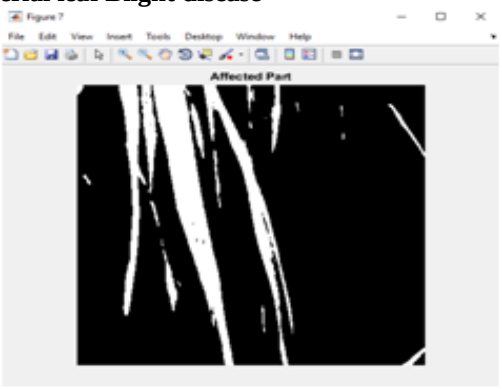

Fig-7Affectedpart

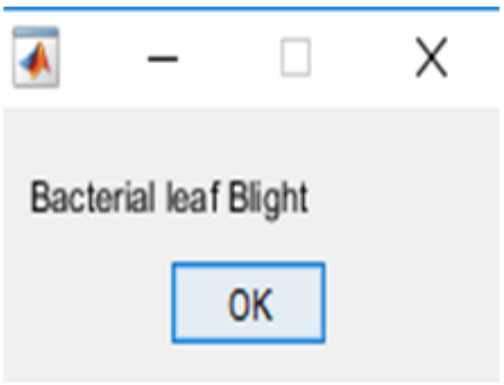

Fig-8 Type ofdisease

Rice Blast Disease

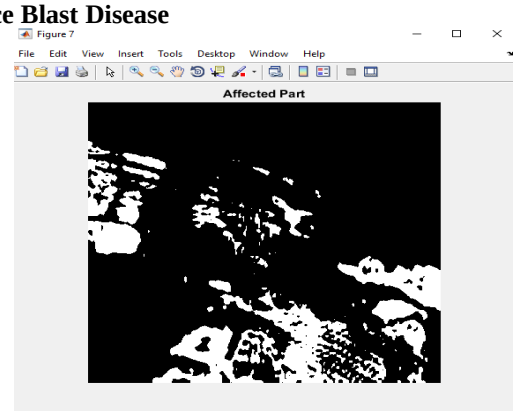

Fig-9Affectedpart

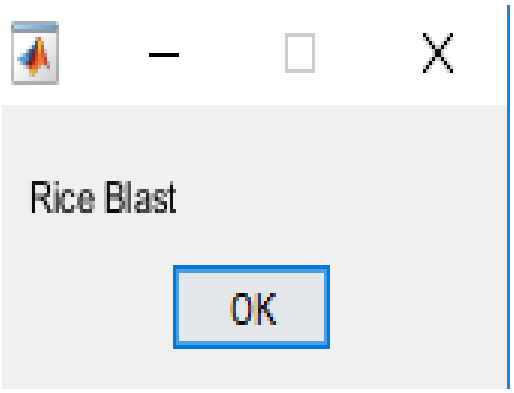

Fig-10 Type ofDisease

Bacterial leaf streach

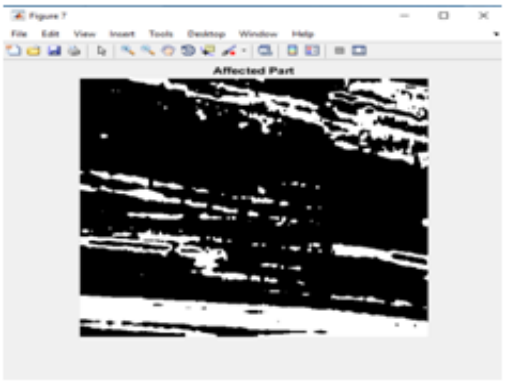

Fig-11Affectedpart

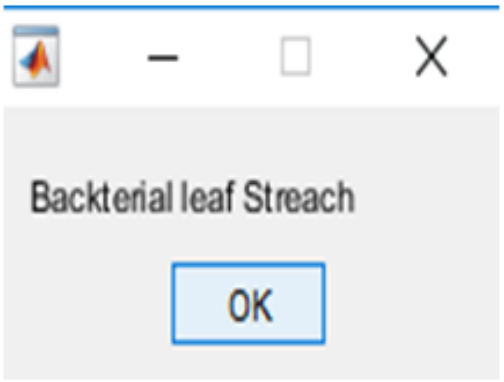

Fig-12 Type ofDisease

Affected part of leaf which is highlighted from original image by using feature extraction and type of disease is detected by matching with already trained leaf which is trained by using artificial neural network.

© www.ijarcsse.com, All Rights Reserved

OUTPUTS OF NORMAL LEAF AND ITS TYPE

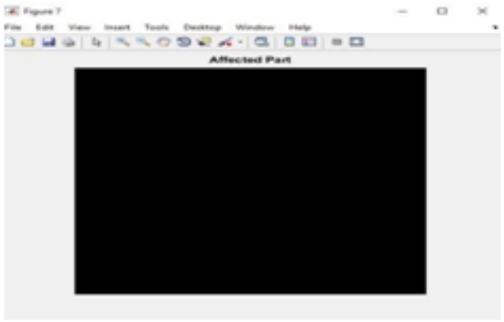

Fig-13Affectedpart

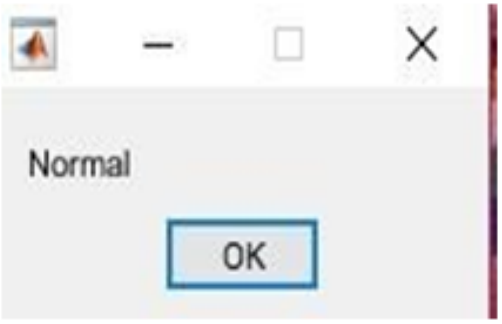

Fig-14 Type ofdisease

Here the affected part is not highlighted since it is not affected by disease. When it is matched with already trained leaf which is trained by artificial neural network it results as normal leaf.

SCHEMATIC DIAGRAM

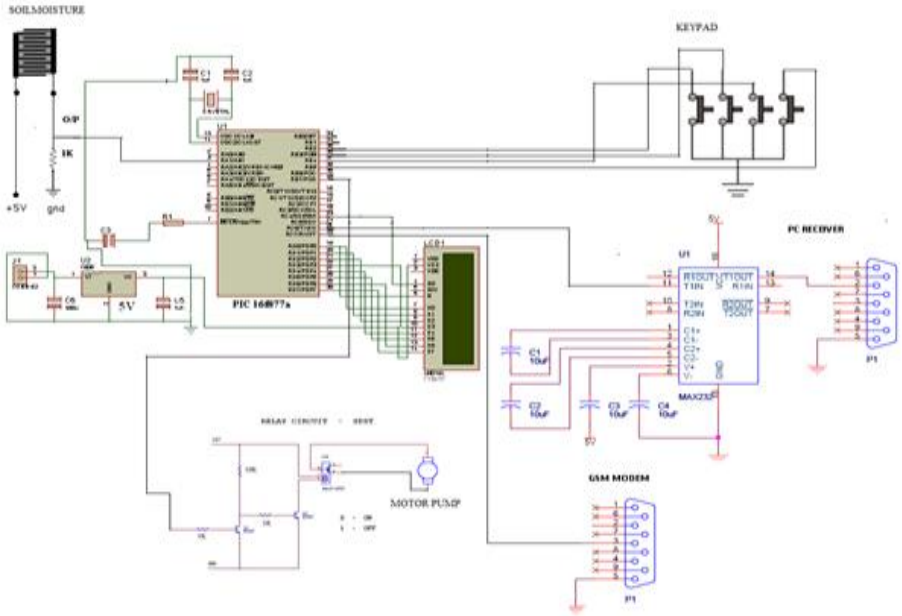

Fig-15 Schematic diagram

SIMULATION RESULTS

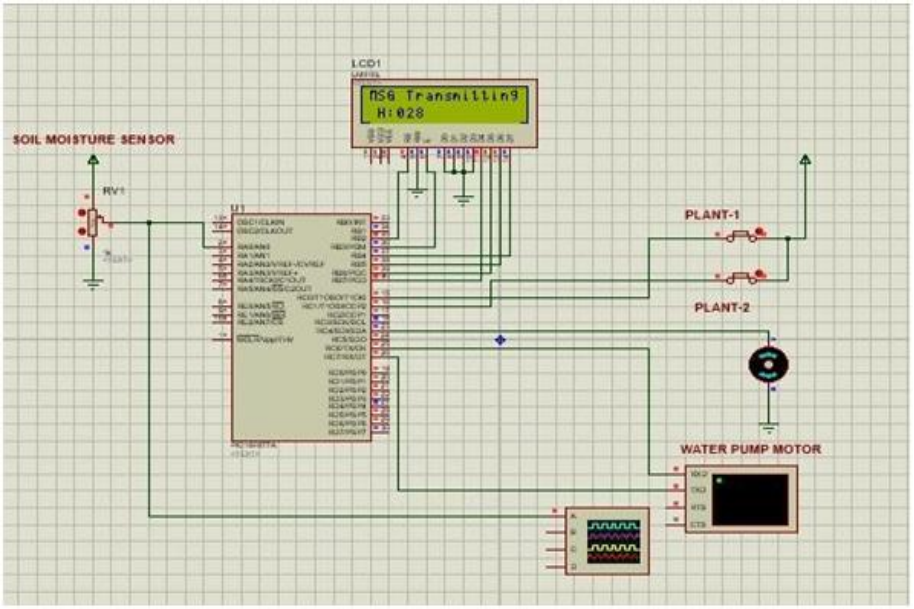

Fig-16 Simulation Results

© www.ijarcsse.com, *All Rights Reserved*

Fig-16 shows the monitoring process simulated in Proteus Professional software version 8. LCD display status the results and message is transmitted.

HARDWARE

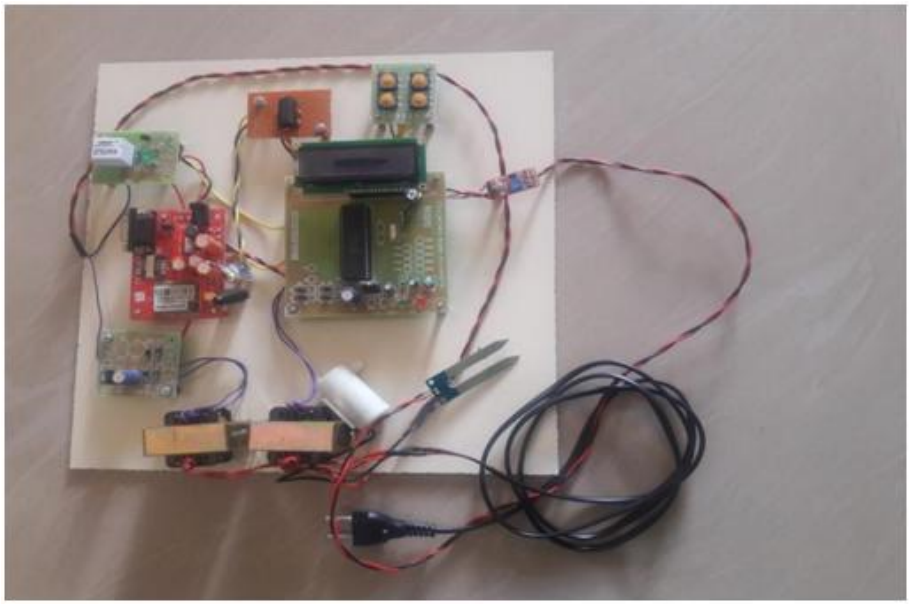

Fig-17 Hardware Output

Fig-9 shows the hardware assembly of all the components of the system which consists of microcontroller unit connected to moisture sensor, LCD, GSM and keypad to select the crop plant.

HARDWARE OUTPUT

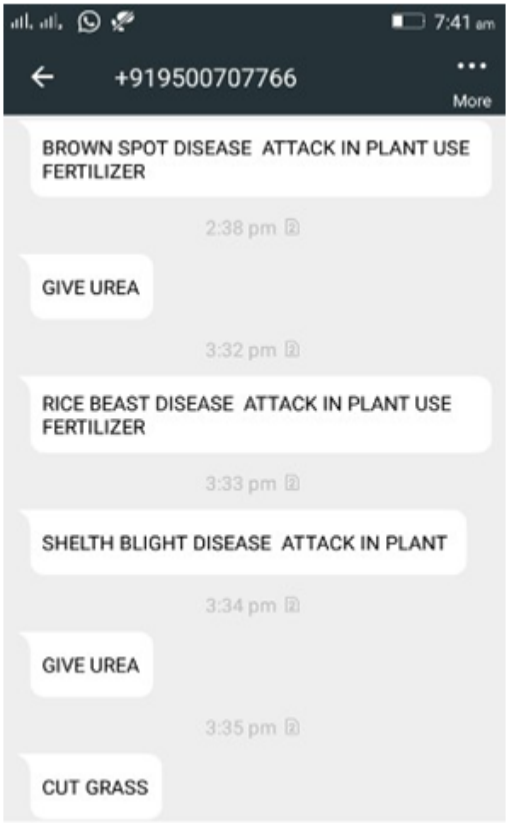

Fig-18 Hardware Output

The fig-18 shows the messages that are send to the authorised person for a particular period of time. Thus it helps to identify disease before it affects the entire field.

© www.ijarcsse.com, All Rights Reserved

IV. CONCLUSION

In the proposed system, applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of diseases that affect on plant leaves [10]. Recognizing the disease is the main purpose of the proposed approach [10]. Thus, the proposed Algorithm was tested on five different diseases [10] which influence on the paddy plants diseases like rice Blast, Brown spot, stealth blight, bacterial leaf blight and bacterial leaf streach are detected. It is mainly based on the application of MATLAB software using k-means algorithm. This work evaluates the techniques in digital image processing for detecting, diagnosing, recognizing of crop leaf diseases. The K-means clustering algorithm is used for detecting the plant disease for moreaccuracy.

V. FUTURE WORK

The work can be extended by using hybrid algorithms such as genetic algorithm which helps to increase the recognition rate of classification process and estimating the severity of the detected disease[10].

REFERENCES

[1] Singh, V. and Misra, A.K., 2017. Detection of plant leaf diseases using image segmentation and soft computing techniques. *Information processing in Agriculture*, *4*(1),pp.41-49.

[2] Barbedo, J.G.A., 2013. Digital image processing techniques for detecting, quantifying and classifying plant diseases. *SpringerPlus*, *2*(1),p.660.

[3] Dhaygude, S.B. and Kumbhar, N.P., 2013. Agricultural plant leaf disease detection using image processing. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, *2*(1),pp.599-602.

[4] Arivazhagan, S., Shebiah, R.N., Ananthi, S. and Varthini, S.V., 2013. Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features. *Agricultural Engineering International: CIGR Journal*, *15*(1),pp.211-217.

[5] Naikwadi, S. and Amoda, N., 2013. Advances in image processing for detection of plant diseases. *International journal of application or innovation in engineering & management (IJAIEM)*,*2*(11).

[6] Rathod, A.N., Tanawal, B. and Shah, V., 2013. Image processing techniques for detection of leaf disease. *International Journal of Advanced Research in Computer Science and Software Engineering*,*3*(11).

[7] Kulkarni, A.H. and Patil, A., 2012. Applying image processing technique to detect plant diseases. *International Journal of Modern Engineering Research*, *2*(5), pp.3661- 3664.

[8] Bashir, S. and Sharma, N., 2012. Remote area plant disease detection using image processing. *IOSR Journal of Electronics and Communication Engineering*, *2*(6), pp.31-34.

[9] Chaudhary, P., Chaudhari, A.K., Cheeran, A.N. and Godara, S., 2012. Color transform based approach for disease spot detection on plant leaf. *International Journal of Computer Science and Telecommunications*, *3*(6),pp.65-70.

[10] Al-Hiary, H., Bani-Ahmad, S., Reyalat, M., Braik, M. and ALRahamneh, Z., 2011. Fast and accurate detection and classification of plant diseases. *International Journal of Computer Applications*, *17*(1),pp.31-38.

[11] Patil, J.K. and Kumar, R., 2011. Advances in image processing for detection of plant diseases. *Journal of Advanced Bioinformatics Applications and Research*, *2*(2), pp.135-141.

[12] Al Bashish, D., Braik, M. and Bani-Ahmad, S., 2011. Detection and classification of leaf diseases using K-means-based segmentation and. *Information Technology Journal*, *10*(2),pp.267-275.

[13] 20. Patil, S.B. and Bodhe, S.K., 2011. Leaf disease severity measurement using image processing. *International Journal of Engineering and Technology*, *3*(5),pp.297-301.

[14] Camargo, A. and Smith, J.S., 2009. An image-processing based algorithm to automatically identify plant disease visual symptoms. *Biosystems engineering*, *102*(1), pp.9-21.

[15] Kaundal, R., Kapoor, A.S. and Raghava, G.P., 2006. Machine learning techniques in disease forecasting: a case study on rice blast prediction. *BMC bioinformatics*, *7*(1), p.485.

[16] Bhanu, B. and Peng, J., 2000. Adaptive integrated image segmentation and object recognition. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and sReviews)*, *30*(4),pp.427-441.

© www.ijarcsse.com, All Rights Reserved