IOT BASED DISEASE DETECTION AND PREDICTION OF POMEGRANATE LEAF

Dipali C. Kothavale
Department of Computer Science &Engineering ,FTCOER, Sangola
dipalikothavale11@gmail.com

Swati M. Raut
Department of Computer Science &Engineering ,FTCOER, Sangola
Raut.swati142@gmail.com

ABSTRACT
Agriculture is one of the important parts of human life. Precision farming is very essential in today's world. In the process of production of plant food, leaf plays an important role in the growth of plant. Diseases on leaf affects on the food of the plants and quality of the product. Geological condition is extraordinary for farming in light of the fact that it gives numerous good conditions .We have to detect the disease of leaf but it is difficult task to monitor the whole farm. Now a day the use of IOT is increased rapidly. In IOT domain we can collect data from different devices. We can overcome this problem by using the automatic leaf disease detection using IOT. By applying image processing we can easily work on different types of images. By collecting, the information from various types of sensors predicts the diseases that can be affect the leaf. In this thesis we have used four different sensors. 1. PH Sensor, 2. Temperature sensor, 3.Humidity sensor, 4.Soil Moisture Sensor.
We can collect data through Raspberry pi as well as collect plant images through camera. The main goal of the proposed work is to monitor the plant leaf, detect and classify them according to the diseases using the data mining and image processing techniques. By collecting, the information from various types of sensors predicts the diseases that can affect the leaf. We have implemented the classification and clustering algorithm to sort out good quality and bad quality plant detection. Image is first captured from farm of plant leaf and then it passes to further Image processing. Image pre-processing to be does on the acquired images. Image segmentation is used for segmentation of plant leave images and lastly features extracted for detection of diseases for the classification and classification done using the SVM classifier. Our segmentation approach and utilization of support vector machine demonstrate disease classification over 400 images with an accuracy of 90%.

I. Introduction

Agriculture is the main source of employment the large folks in the India and backbone of the national economy. As the large population nation, country needs the large amount of production of crops. Large amount of people dependent on cultivation in India. In India most of the people prefer pomegranate farming. Some people face failure due to lack of knowledge. Diseases on plants cause major production and financial damages as well as decrease in both quality and quantity of agricultural products. The farmer doesn't predict the climate and he cannot control the weather, if weather is changed .Climate automatically affects on plant, which results in decreasing the production. Geological condition is uncertain for farming now days. So there is need to tackle it. Every plant suffers from N number of diseases, if uncertain changes occur in the climate. When plant suffers from some disease then automatically it affect on the production of the food. The leaf plays an important role in the

plant. The diseases on leaf affect on the food of plant. It is received increasing attention in monitoring in the field of farming to disease detection. It is realizing that as it can cause significant reduction in both quality and quantity of agricultural products. Naked eye observation of specialists is the main approach adopted in practice for discovery and identification of plant infections. Geological condition is extraordinary for farming in light of the fact that it gives numerous good conditions. In some countries farmer have to travel long distance to consult experts this is too expensive and time consuming. Sometimes Farming land can be much bigger and farmers cannot observe each and every plant, every day. This is vital task for the farmers as they need to regularly offer care on crop progress for higher crop. The main aim is to accomplish the disease and insect pests monitoring with help of the IOT. Automatic methods for an early detection of plant diseases are vital for correctness crop protection. Detection part comprises various step image acquisition, image pre-processing, segmentation, features extraction and neural network based classification. Therefore identification of plants, leaves and finding out the pest or diseases, symptoms of the pest or disease attack, plays a key role in successful cultivation of crops. Objective of system understands protocols, algorithms, proposed solutions and what still remain to be addressed, as well as which are the enabling factors of this evolutionary process. Ability to measure, infer and understand collaborating activating network creates the Internet of Things. Machine learning based recognition and detection of plant diseases can provide actions to recognize disease. The representation of an image into something that is more significant and easier to analyses. K - Means clustering is a partitioning method and masking of the mostly green color pixels.

II. Proposed System:

The proposed system provides us a solution for automatic detection and classification of pomegranate plant leaf diseases and prediction using the Climatic Parameter Monitoring of Plants Using IoT.

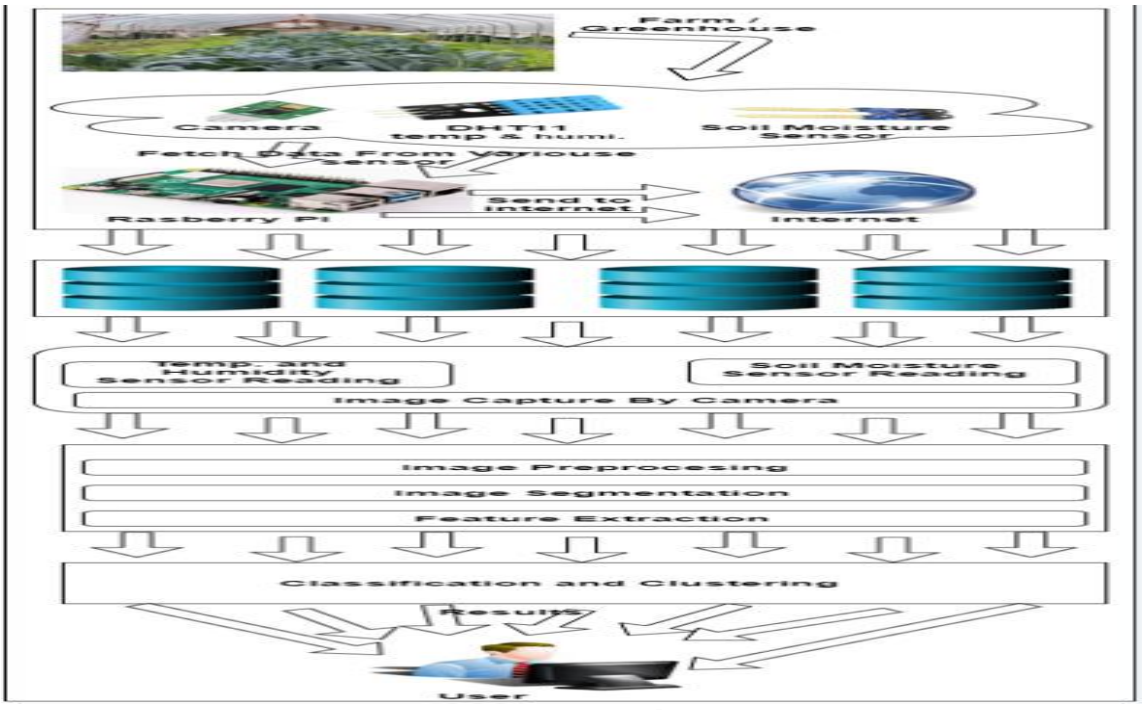

Figure 1 System Architecture

The system architecture is consist of two parts first is the IoT part and second is software part. IoT part consist of Raspberry pi which is used to take the data from various sensors like DHT11 which gives current temperature and humidity reading, soil moisture sensor which gives moisture or water level present in soil and camera which gives images of leaves. All this data which is gathered by Raspberry pi is then send over internet which is stored in database for further processing and observation.

In the second part i.e. software part, it shows the various sensors reading from the database on web page to user. To detect the disease on plants, images captured by user is given to the image processing module. Image processing operation is consisting of image pre-processing which include gray scale conversion of images. After pre-processing image is passed to segmentation block which gives image pixel wise data and after that feature extraction is done on the images. After feature extraction classification and clustering is done on images which gives disease detected plant images.

- **Experimental Setup:**

Leaf disease detection system is implemented in JSP Servlet. It can be run on Windows XP/Windows Vista or on Windows 7 operating system or any other operating system. MySQL database is used to store data generated by the sensors and by user. To run web application locally we have used apache tomcat server. There are sensors required for the getting information.

- **Wireless Sensor Network:**

In internet of things we have used the Raspberry pi controller. The Raspberry Pi is a small computer, same as the computers with which you're already familiar. It uses a many different kinds of processors, so can't install Microsoft Windows on it. But can install several versions of the Linux operating system that appear and feel very much like Windows. Raspberry Pi is also used to surf the internet, to send an email to write a letter using a word processor, but you can to do so much more. Simple to use but powerful, affordable and in addition difficult to break, Raspberry Pi is the perfect device for aspiring computer scientists.
Sensors are used to get environmental information and based on that information we can predict the chances to diseases.

- **A. Methodologies Used:**

1. User Module: The first module in our project is the user module. User can register and login here.

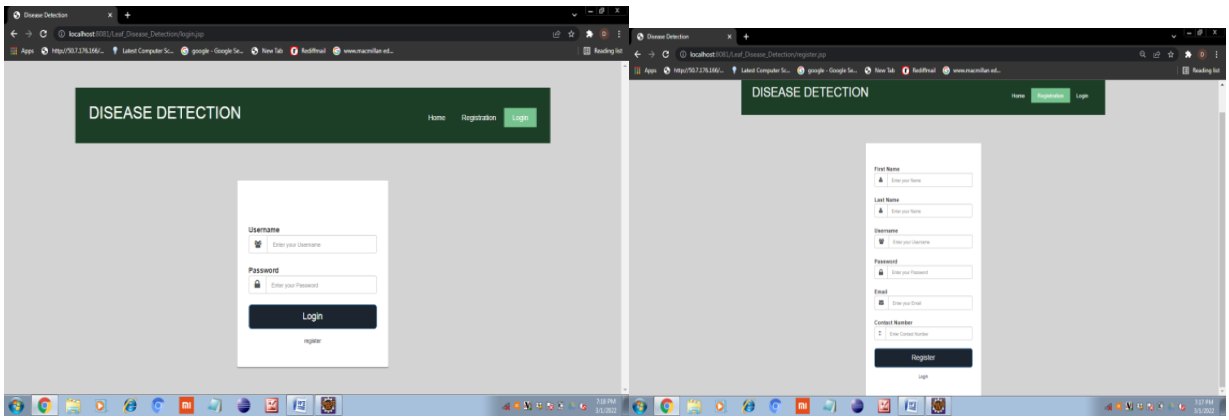

Figure 2 Snapshots of Registration Form

2. Readings: In this module sensor data read from the sensor and shown on the web pages and store in the data base for the further processing. There are four sensors used in our system, Temperature sensor which is used to get the temperature from the root of the tree. Humidity sensor and moisture sensor gets the humidity and moisture from the roots. pH soil meter can be especially useful in lawn care in determining the soil conditions, this data is given to the micro-controller and all sensor readings show on the WebPages.

3. Image Processing: All image processing operations are done in this module. The first phase in our system is the collection of the images of infected leaves. The images were getting from the system using the camera. Second phase is the processing of the images for the segmentation of the image which helps in the segmentation and analysis. Image is filtered to reduce the noise in the image. Noise occurs at the time of image acquisition. Next step is the segmentation, which plays an important role in the detection. Segmentation is used to partition of the image to detect the infected part in the image. We use clustering algorithm to cluster images into number of parts. The next necessary step is to carry out the features extraction is. It consists of representing the segmented image on a vector of fixed features. They should be distinct and relevant for the classifier performance. The adopted features in this study include color, texture and shape. These features are used to find the exact shape of the defected image.

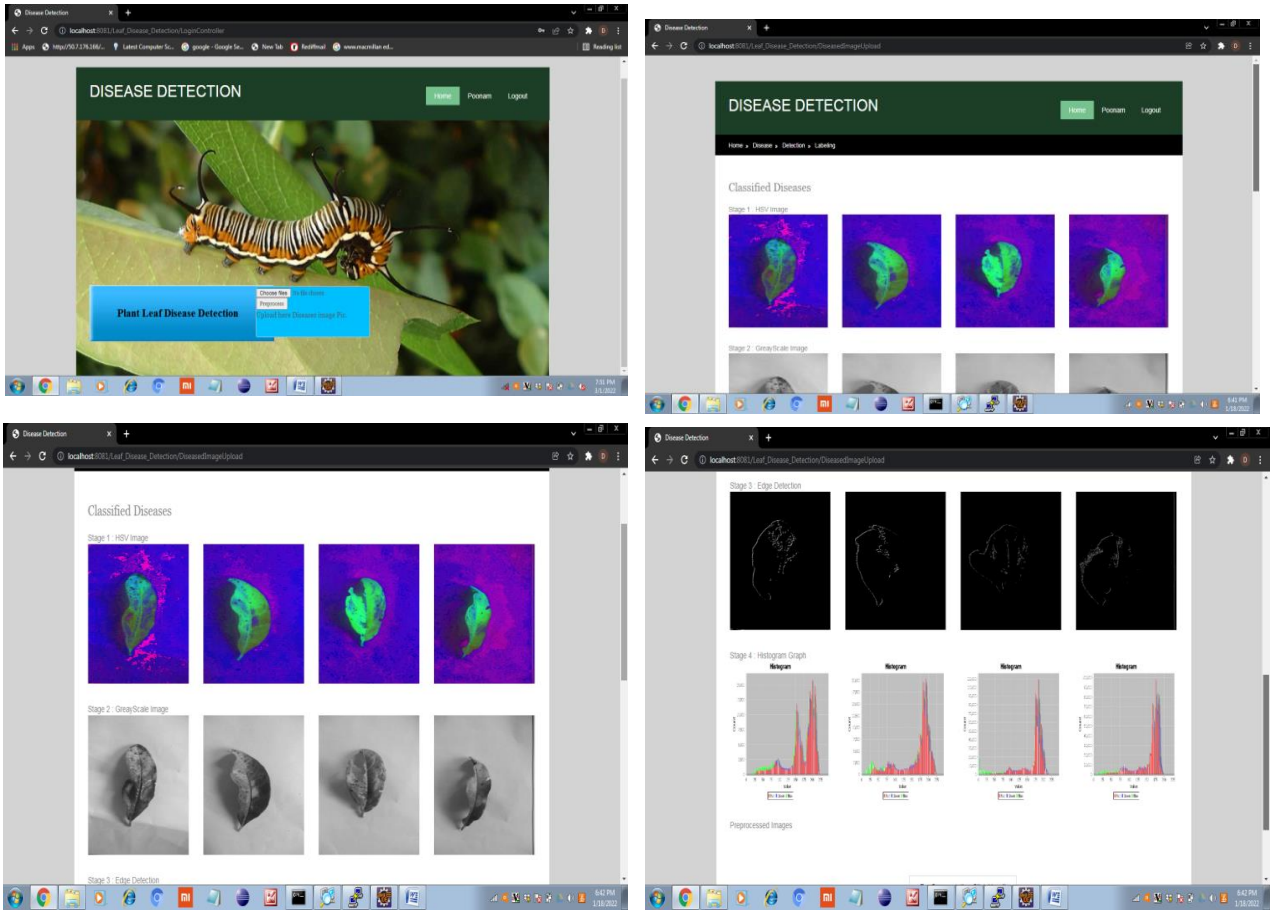

Figure 3 Snapshots of Image Upload & processing

4. Classification: Analysis and classification of images. The classifier SI uses the colour to classify the images; it considers the diseases with similar or nearest colour, belonging to the same class. The sensor readings considers in this module. The remote measurement and controlling of different soil parameters along with leaf diseases detection over the Internet can be mechanized in this system. Images are then matched with dataset for diseases and find the top k nearest images. Finally disease and images shown in the ranking order are shown on the web page.

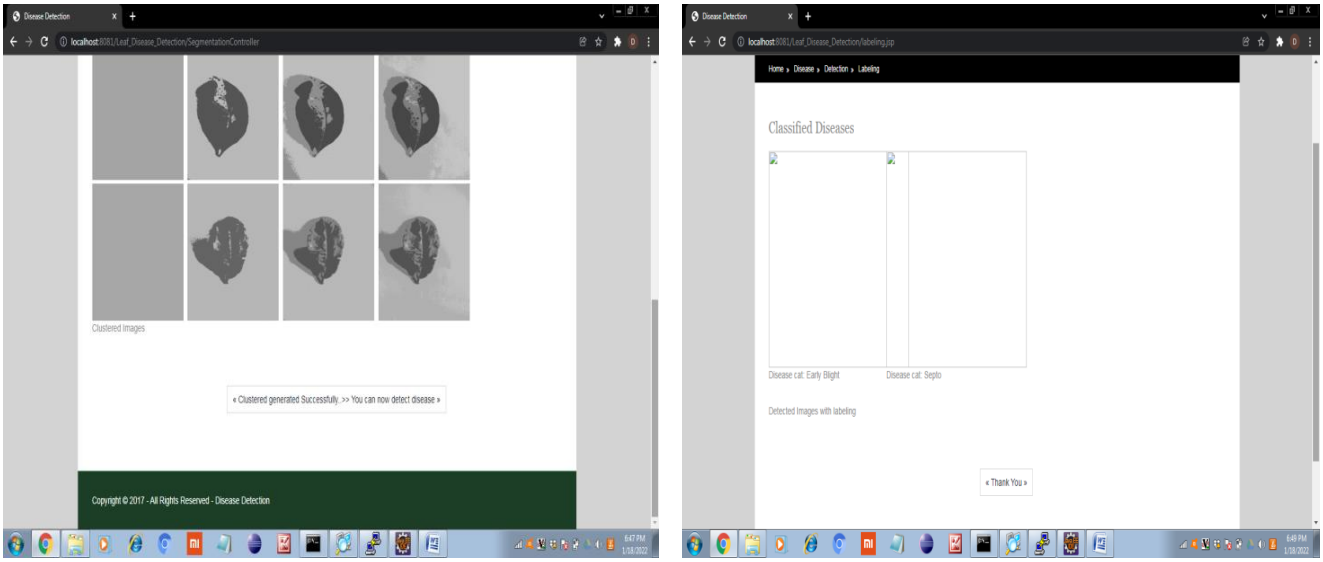

Figure 4 Snapshots of Image classification

B. Algorithms:

1. Feature Extraction.
2. Segmentation.
3. Clustering(Any one of Clustering)
4. Classification.

Algorithm1: Color Feature Extraction

1. Read input RGB image.
2. Convert RGB image to HSV image
3. Find histogram of H image.
4. Find mean vale histogram in step 3 and store it as a Color Feature.

Algorithm2: Shape Feature Extraction Step (Edge Detection)

1. Read input RGB image.
2. Convert RGB image to Gray Image.
3. Find matching key points using HSV algorithm and store it as a Shape Feature.

4. Find dissimilarity score using matching key points of query image and database images.

Algorithm3: Texture Feature Extraction Step (HSV)

1. Read Query color image.
2. Convert RGB image to Gray image.
3. Compute LBP of gray image: LBP.
4. Apply gray image to Gabor filter.
5. Find histogram of LGGP image formed by process in step 5.
6. Find mean vale histogram and store it as a Texture Feature

Algorithm4: K-mean Clustering Steps:

1. Randomly select *'c'* cluster centers.
2. Calculate the distance between each data point and cluster centers.
3. Assign the data point to the cluster center whose distance from the cluster center is minimum of all the cluster centers.
4. Where, *'c_i'* represents the number of data points in i^{th} cluster.
5. Recalculate the distance between each data point and new obtained cluster centers.
6. If no data point was reassigned then stop, otherwise repeat from step 3.

Algorithm5: Disease detection (SVM Classification)

1. Create feature database using algorithm 1 through 3.
2. Read Query image.
3. Extract features of Query image using algorithm 1 through 3 to create query feature vector.
4. Compare the feature vector of query image with feature vectors of database images using Euclidean distance.
5. Arrange Euclidean distances in ascending order and retrieve first five images.
6. Observe the retrieved images. The disease of the query image is same as that of the disease of the maximum retrieved images.

C. Mathematical Module

S is the set of sensor dataset of disease and the number of users. Sensor send the reading from the root of the plant eq.1 shows the set of sensors. eq. 2 and 3 are the values and diseases data. s is the segmentation of the images of the plant leaf images

are segmented on the edge based or the region based. Values are stored in s then important features are extracted from the segmented parts through pattern recognition. Classifier c is applied on the image to classify parts these then compared with the disease name DN in the dataset to get final result or the type of the disease.

Let,S={SEN ={Temps, Hums, PHs, Soils}, RESEn , U={u1,u2,..un},
D, s, f, c, DN,DD, DN,G}}

S is set of sensor such as temperature, humidity, ph, soil moisture sensors start to read data from atmosphere.

Where,

$$SEN = \text{Set of Sensors}$$
$$Temps = \text{Temperature Sensor}$$
$$HUMs = \text{Humidity Sensor}$$
$$PHs = \text{PH Sensor}$$
$$Soils = \text{Soil Sensor}$$
$$RESEN = \text{Reading of Sensors}$$

$$F(RESEN) = \int_0^4 (Temps + HUMs + PHs + Soils) - - - \qquad (1)$$

$$D = \text{Dataset}$$

$$D = \sum_0^n (\text{Values of Scientific results})$$

$$U = \text{set of user}$$
$$DN = \text{Disease Name}$$
$$DN \in D \approx F(RESEN)$$
$$DV = \text{Dataset Values}$$

s={es , rs }

s = segmentation of image

es = edge based segmentation

rs = region based segmentation

f=feature extraction

C = Classifier

$F(C) = \int_0^\infty (s + f + DN)$ ----------2

DD = Detection of Diseases

DD ∈F (RESEN) ≈F(C) ----------3

III. Results

- **Test Cases and Test Results**

LOGIN FORM:

Sr. No	Test Case	Excepted Result	Test Result
1	Enter valid username and password	System should display welcome window	Successful
2	Enter invalid	System should not display welcome window	successful

Input:

Sr. No	Test Case	Excepted Result	Test Result
1	Capture Images	In runtime capture images and stored in specific location and get images.	successful
2.	Capture Images	In location images not available	Unsuccessful
3.	Sensor Data	Get data from sensor	Successful

IV. Conclusion

In this system we analyzed the climatically parametric condition and successfully tried to detect disease based on image processing techniques, and classify plant leaves using classifiers. By getting readings from sensor through controller predict the diseases that will occur on plant. Improved the disease detection accuracy, shows the efficiency of proposed algorithm in recognition and classification of the leaf diseases. This helps to the farmers to detect diseases and analyze large farm field's saves time and cost and increase the yield. In future we can try to reduce the ambiguity problem up to maximum extent. Sometime disease symptoms generates ambiguity problem. So we work on find out the specific disease as well as improve to detect or analyze all types of disease.

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