Early Crop Disease Detection Using Image Processing and Monitoring and Controlling soil Moisture, Salinity and PH Using Sensor

Kavitha K K [1], Payal Jain C [2], Rupendra Pratap Singh [3], Nishant Kumar [4]

[1]Senior Assistant Professor, [2,3,4]Students
Department of Information Science and Engineering, New Horizon College of Engineering
Outer Ring Road, Marathahalli, Bengaluru- 560 103

***Abstract*: Nowadays many of the farmers and agro help center use the different new technology to enhance the agriculture production. Plants have become important source of energy. There are several diseases that affect plants with the potential to cause economic and social losses. Disease detection along with proper monitoring of soil moisture, salinity and pH is very important for high yield and increasing the production. Thus, this paper provides the best method for detection of plant diseases using image processing and alerting about the disease caused by sending email. It also discusses about how the moisture of the soil, pH and salinity of water is monitored and controlled using soil moisture sensor, pH sensor and salinity sensor.**

***Keywords*: Raspberry pi, disease detection, soil moisture, salinity, pH.**

Introduction:

The prime need of this world is best agriculture which decides the development of each country as the survival of human being is completely dependent on farming and it best production. The main problem that is observed in most of the regions of farming is the early diseases in crops, no proper monitoring of soil moisture, water level and pH, because of which the production results in low level identification of diseases on plant and is the very important research topic in agriculture fields and It is also important to take the primitive measures in monitoring of water, salinity and PH of the growing crops.

In India, Farmers have a great diversity of crops. Various pathogens are present in the environment which severely affects the crops and the soil in which the plant is planted, thereby affecting the production of crops. Various disease is observed on the plants and crops. The main identification of the affected plant or crop are its leaves. The various colored spots and patterns on the leaf are very useful in detecting the disease. The past scenario for plant disease detection involved direct eye observation, remembering the particular set of disease as per the climate, season etc. These methods were indeed inaccurate and very time consuming. The current methods of plant disease detection involved various laboratory tests, skilled people, well equipped laboratories etc. These things are not available everywhere especially in remote areas. thus, this paper illustrates the mechanism for early detection of crop using image processing and it also illustrates, how basic requirements of growing plants are controlled and monitored. In first section the methodology of crop detection is mentioned where the disease from the crop is detected using image processing technique. Soil moisture monitoring along with the water level and PH value is explained in second section

Methodology:

The system which is been proposed consists of an artificial vision system (camera), a combination of classifier and image processing algorithms for disease detecting and monitoring and controlling the content of moisture in soil, water level and PH value.

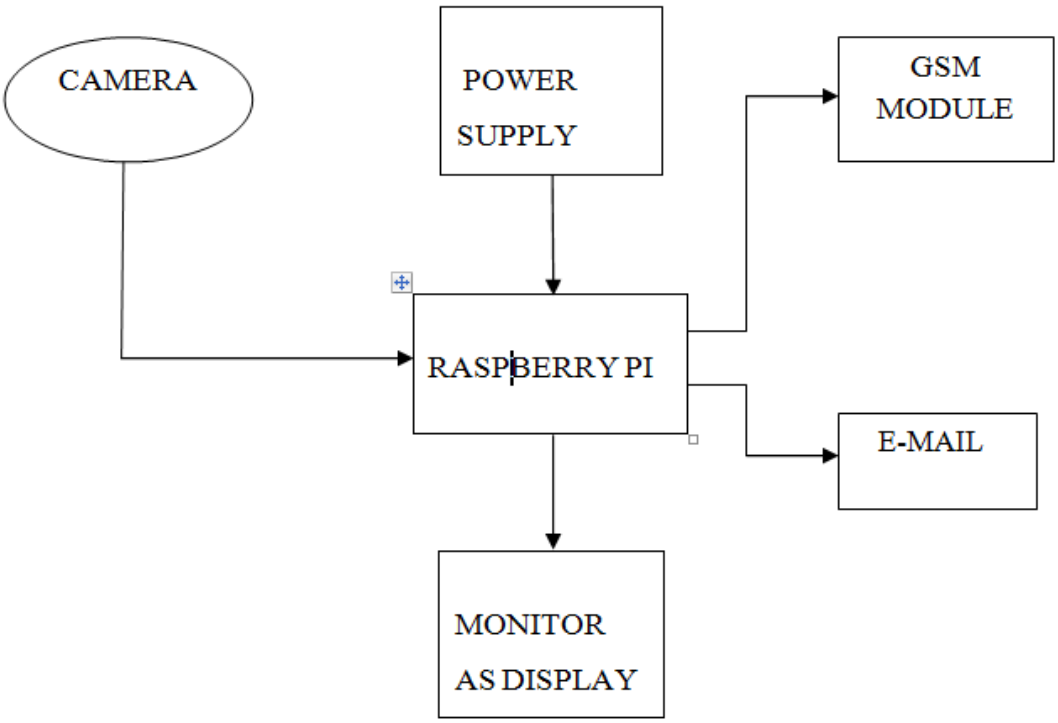


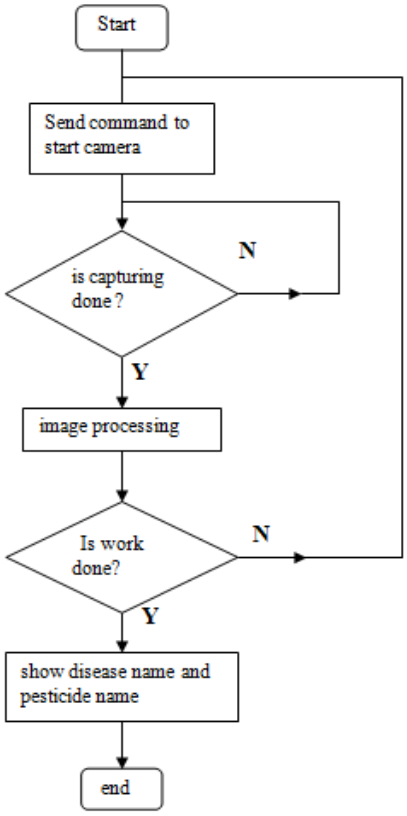
Fig.1 Block Diagram

a) Steps for plants disease detection

We propose and automatically evaluate a software solution for automatic detection and classification of plant leaf diseases.

Algorithm: Basic steps describing the proposed algorithm

1. RGB image acquisition
2. Create the color transformation structure
3. Convert the color values in RGB to the space specified in the color transformation structure
4. Apply K-means clustering
5. Masking green-pixels
6. Remove the masked cells inside the boundaries of the infected clusters
7. Convert the infected (cluster / clusters) from RGB to HSI Translation
8. SGDM Matrix Generation for H and S
9. Calling the GLCM function to calculate the features
10. Texture Statistics Computation
11. Configuring Neural Networks for recognition.



Then image-processing techniques are applied to the acquired images to extract useful features that are necessary for further analysis.

Step are as follow:

- Image acquisition
- Image preprocessing
- Image segmentation
- Feature extraction
- Statistical analysis
- Classification based on a classifier

b) Monitoring the moisture of soil, salinity and pH value

When moisture sensor is placed in soil, sensor takes soil as input and gives output in measure of moisture content. Soil moisture sensor is connected to an arduino which is in turn connected to Raspberry PI which is in turn interfaced with GSM Module. Soil moisture is continuously being monitored by the sensor and the output values are sent to the farmer via an email. If the soil moisture

is found to be less than the required level then automatically pump will be on and once the moisture reaches the required level pump will be off automatically. The same process is carried for measuring the salinity and PH value.

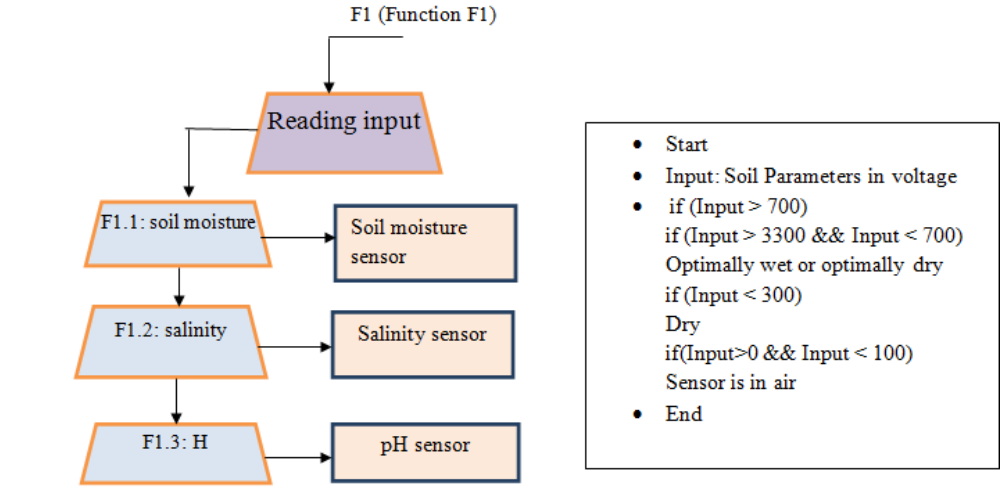


Fig.2 The Function 1 in Function Means Tree

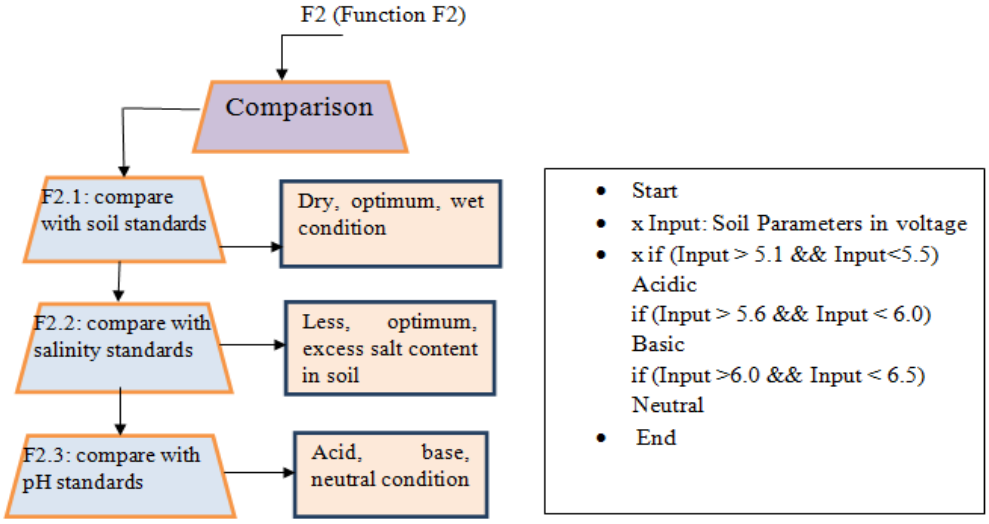


Fig.3 The Function 2 in Function Means Tree

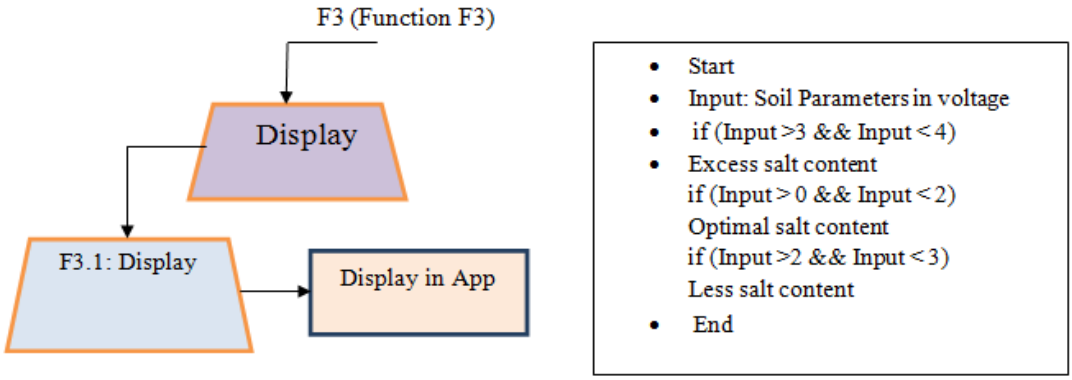


Fig.4 The Function 3 in Functions Means Tree

Monitoring System Methodology:

i) Raspberry PI

Raspberry Pi is a small computer board working on the Linux operating system which connects to a computer monitor, keyboard, and mouse. Raspberry Pi can be applied to a electronic structure and programming network work, it can also serve as a personal computer and Apache Web server, MySQL could be installed in the board.

A GPIO pin can be used as either a digital input or a digital output, and both operate at 3.3V. Unlike the Arduino, the Raspberry Pi which does not have any analog inputs. For that you must use an external analog-to-digital converter(ADC) or connect the Pi to an interface board must be used.

ii) Arduino

Arduino is an open-source microcontroller compatible with developed platforms. The controller appears not to be expensive and uses low electrical power, 5.5 volts. Arduino can connect to a computer via the Universal Serial Bus (USB) and perform with compatible connected accessories in both analog signal and digital signal. The Arduino is a microcontroller platform, mounted on a board that plugs easily into most computers.

iii)Relay

A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low power signal, or where several circuits must be controlled by one signal.

iv)Soil Moisture Sensor

It measures the volumetric water content in soil. since the direct gravimetric measurement of free soil moisture requires removing, drying and weighing of a sample.

Hardware Connection:

The Raspberry Pi and Arduino were connected via UART (Universal asynchronous receiver transmitter). The connection was a serial communication as Full Duplex since there was two-ways that data could be transmitted via pin TX and RX. A direct connection between the Raspberry Pi and Arduino was prohibited, because of its electrical potential differences, which is 3.3 volts for the Raspberry Pi and 5 volts for the Arduino. Bi-directional Logic Level Converter should be used to separate them. A connection between a camera and Raspberry Pi by applying Common System Interface (CSI) serves as a point to point connection, providing a fast data transmission and low energy consumption. MJPG-Streamer is a basic program command copying data from a single input to multiple outputs. A photo could be presented in a network system accessing from a web browser on a computer. In this study, a photo from a camera would be taken to demonstrate on a smart phone. All sensors would be connected via Board Arduino and the data would be transmitted from UART to Board Raspberry Pi. Raspberry Pi works as a controller of a ventilator, notifying a working condition to the smart phone and served as a data sender to store in a server computer. Then the soil moisture sensor and Arduino is connected and a pump is connected to the relay.

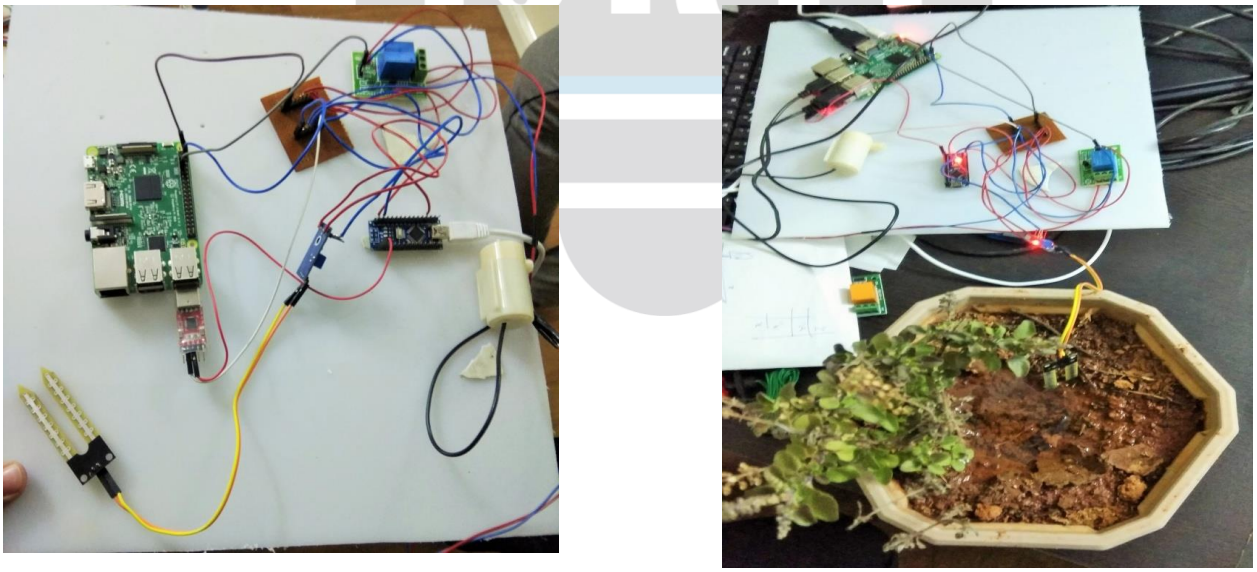


Fig.5 Hardware components and Demonstration

Expected Result:

A)

For the detection of the crop disease, leaves of diseases powdery mildew, downy mildew, black rot are selected. The database of healthy leaves and diseased leaves is created at the server. This is necessary to compare the images with diseased and healthy leaves. Hence by comparison, the disease type is classified and the output is sent to the farmer via an EMAIL along with the image of the diseased leaf.

B)

The soil moisture, water level and PH value is monitored using the moisture, water level and PH sensor respectively. the database contains the standards of the moisture, water level and the PH value and hence the output values of the sensor are compared with the values stored in the database and accordingly the output is sent to the farmer via an Email. if the soil moisture is found less than required level then automatically pump will be On.

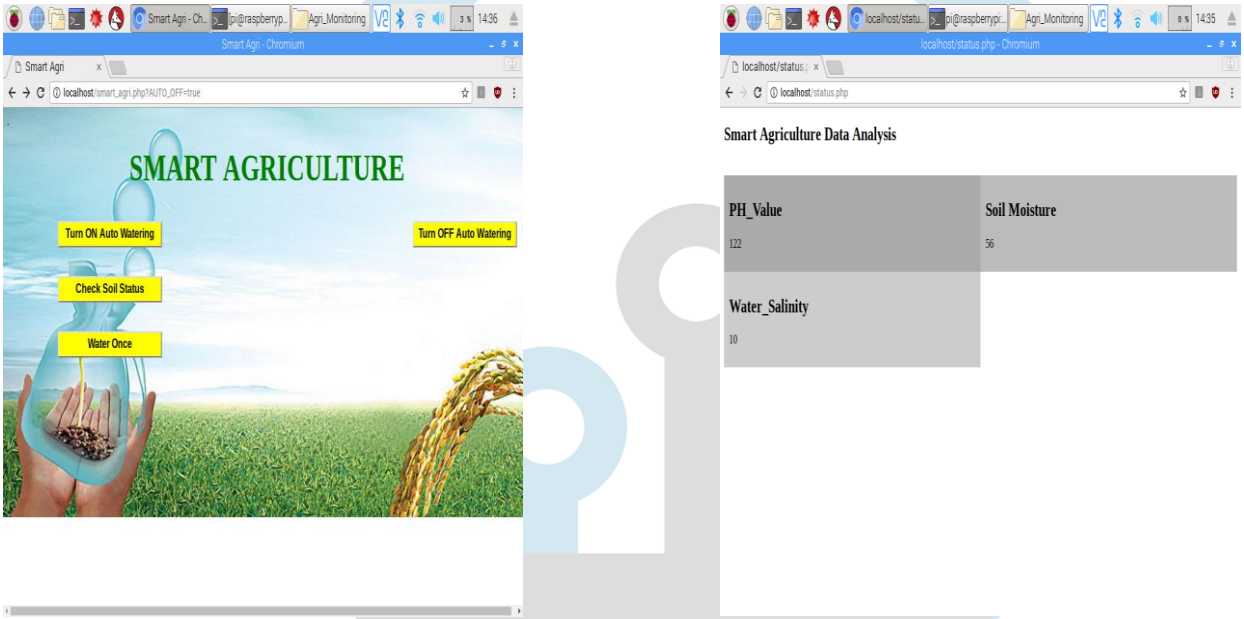


Fig.6 Screenshot of Output

Conclusion:

The objective of this work is the crop disease detection, classification of leaf diseases using image processing tools and also monitoring the important factors such as soil moisture, water level and pH value which are of course the important factors for high yield. All information about the disease and the important factors is sent to the farmer's mobile phone via mail. To increase the speed and accuracy of detection as well as classification of leaf diseases we are using Raspberry pi module. One more important benefit of this system is that it also sends the image of the affected crop or the leaf to the farmer, such that it becomes easier for the farmer to take the precautionary measures.

The accurate detection and classification of the plant disease is very important for the successful cultivation of the crops, this can be done using digital image processing. This project utilizes email facility so as to send the mail to the phone along with the image of detected leaf. This project utilizes various image processing techniques which provide accurate results. The proposed system is a demo version, so for a large-scale production the number of cameras and length of conveyor system can be modified. This work presents new integrated technique for detecting the disease and monitoring the soil moisture, water salinity and pH value. Generally, image capture is a big challenge as there is a chance of high uncertainty due to the external lighting conditions, so we are taking the advantage of gray scale image which are less effected to the external environment. This system will largely contribute in growth in the yield of the farms.

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