Diagnosis of Sugar Cane Leaf Diseases and automated control of spray pesticides, controlling through gadgets

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Abstract: Sugarcane is one of the most important commercial crops of India. It is widely grown by the formers for their big margin profit. It has a lot of by-products. India stands second in the product of sugarcane followed by Brazil. It requires lots of water for its cultivation and it is highly fragile to the diseases like a fungal infection. In India, it is highly grown in UP. Identification of sugarcane diseases is the key to preventing the losses in sugarcane products. If proper care is not taken then it causes serious effects on sugarcane plants which affect on quality and quantity of sugarcane products. The identification of sugarcane disease through some automatic technique is beneficial it reduces large work of monitoring in big forms of crops. This paper also presents an automated irrigation system, in this system raspberry pi is used as an embedded Linux board. The system has a sensors network of soil moisture, temperature, and humidity sensors. Soil moisture reached particular vale then message send to the owner and automatic water motor ON. If Temperature and humidity reach a particular value then-owner makes the pesticide motor ON or OFF on his smartphone or on the web page.

Keywords—Raspberry Pi (Rpi); Sensors; Web camera; Web Design; Irrigation; sugarcane Leaf disease detection; OpenCV; Qt; pesticide spray;

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1. Introduction

Agriculture has been an important natural food source for humans and animals for millions of years. Agriculture does not only play an important role in the food supply at present but also is a part of the economic development of a country by providing employment. However, plants have been seriously affected by climate change and diseases. There are lots of causes that might affect the quality of plants including water level, temperature, soil moisture, and humidity from the surrounding environment. Therefore, detection and treatment of diseases to produce high-quality plants for the community are one of the key components in agriculture, to build an automatic system for diagnosis of plant leaf diseases using Image Processing and an automatic pesticide spraying mechanism using embedded system. This provides automation of farm irrigation systems. The whole system provides a web interface to the user so that the user can control and monitor the system remotely.

The Raspberry Pi board received data and decides the water required for the soil. If the analyzed data shows that water is required, automatic water motor is ON make Irrigation on. Rpi has an Ethernet interface and it runs a simple data web server. And data monitoring and system control from web browser remotely. Allow users to monitor the data from a web browser. The system will reduce the water consumption and giving uniform water to the crop results in increasing yield.

About 15% of sugar cane leaf is defective because of diseases it reduces the quantity and quality of sugar cane production significantly. Once the disease attacks the sugar plant it reduces the photosynthesis process. Former's facing many problems for detection and classification of plant disease. This problem can be perfectly rectified if we use image processing tools for the detection and classification of plant disease.

2. Literature Survey

M.Usha Rani et al., Proposed the automatic irrigation system using the Arduino microcontroller with grove moisture sensor and water flow sensor. The owner of the agricultural field can any time check the moisture

level and the motor status. The motor's functionality status will also be sent to the farmer's mobile using GSM [1].

Nattapol Kaewmard et al. developed a portable measurement technology including a soil moisture sensor, air humidity sensor, and air temperature sensor. Moreover, an irrigation system using a wireless sensor network has installed these sensors, to collect the environmental data and control the irrigation system via smartphone [2].

Pravina B. Chikankar et al., Proposed an irrigation system that is automated by using controllable parameters such as temperature, soil moisture, and air humidity because they are the important factors to be controlled in PA [3].

Pandurang H. Tarange et al., Proposed automation of farm irrigation system using a wireless sensor network (WSN) and embedded Linux board. The system provides a web interface to the user so that the user can control and monitor the system remotely. In this paper, Raspberry Pi is used as an embedded Linux board which is designed based on the arm 11 microcontroller architecture. The Embedded Linux board makes the communication with all distributed sensor nodes placed in the farm through ZigBee protocol and itself acts as a coordinating node in the wireless sensor network. The goal of the coordinator node is to collect the parameters like soil moisture and soil temperature wirelessly [4].

Jagadeesh D. Pujari et al., Proposed the image processing techniques used to identify and classify fungal disease symptoms that affected different agriculture/horticulture crops. Many diseases exhibit general symptoms that are being caused by different pathogens produced by leaves, roots, etc [5].

Evy Kamilah Ratnasari et al., Proposed a model to identify the severity of certain spot disease which appears on leaves based on segmented spot. [6].

Sachin D. Khirade et al., Proposed the detection of plant diseases using their leaves images. This paper also discussed some segmentation and feature extraction algorithm used in plant disease detection [7].

3. Existing System

Some existing systems proposed detection of sugar cane leaf spot diseases like rust spot, yellow spot, and ring spot.

All existing systems only detection of plant leaf diseases using image processing

Here we detect new kinds of sugar cane leaf disease like whitefly and pesticide spraying mechanisms using an embedded system

Here we are detecting Sugar cane leaf diseases as shown below:

1. Whitefly

Fig.1. Sugar cane white flyleaf disease

2. Mosaic disease (Yellow spot)

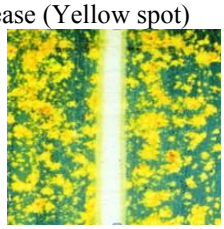

Fig. 2. Sugar cane mosaic leaf disease

3. Eyespot

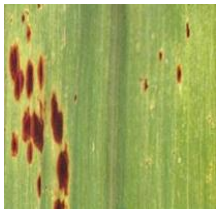

Fig. 3. Sugar cane Eyespot disease

4. Proposed Architecture

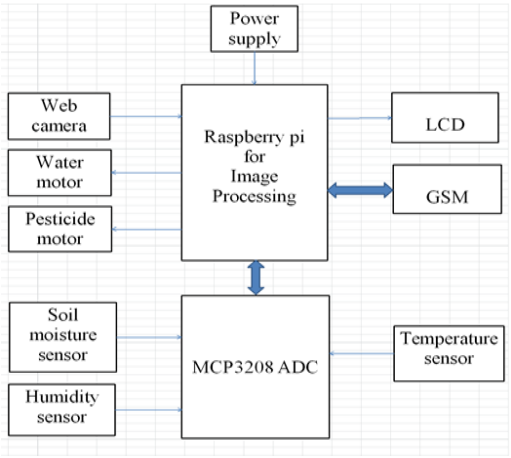

Fig. 4. Complete block diagram of a system

The complete block diagram is shown in figure 4. The system includes hardware that consists of raspberry-pi 2, SD memory card, Web camera, GSM module, DC motors, sensors, LCD, and ADC. The whole system works on 5v dc regulated power supply. The MCP3208ADC interface to rasp-pi with SPI protocol, the three sensors like temperature sensor, humidity sensor, and soil moisture sensor connected to ADC, these sensor data send to rasp-pi via ADC. The temperature sensor provides temperature per degree Celsius to rasp-pi. SD card for installing a raspberry pi operating system. We are using two dc motors one for water motor and another for pesticide motor. If soil moisture is below the threshold value then the water motor is automatically ON. If temperature and humidity increase mean any disease development environment created then the owner can make the pesticide motor ON or OFF manually. GSM module interfaces to rasp-pi using UART protocol. The Whole data monitor is on the web page.

Plant disease detection using the OpenCV, web camera would take in an image input of a plant leaf. This application would detect possible symptoms of the disease like black/yellow/white spots from the leaf. Each characteristic of disease such as the color of the spots represents different diseases.

5. Flow Chart

a. Irrigation system flow chart

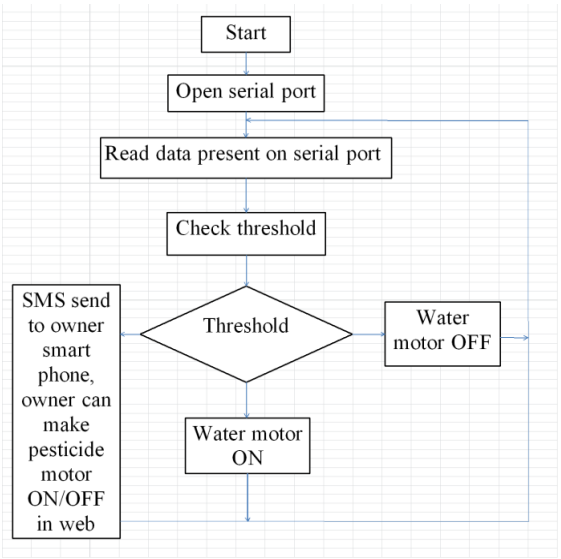

Fig.5. Irrigation system workflow chart.

The flow chart of sensor work as shown above fig5, in this soil moisture, humidity, and temperature sensors are the interface to raspberry pi via MPC3208 analog to digital converter. The soil moisture sensor measures the content of moisture in the soil. If soil moisture reaches a low threshold value then water motor OFF, if less than the threshold value then water motor ON. If a temperature and humidity value reach a bow threshold value then SMS send to the owner smartphone, the owner can make the pesticide motor ON/OFF on this smartphone or on web page. The process is continuously going on.

a. Plant disease detection system flow chart

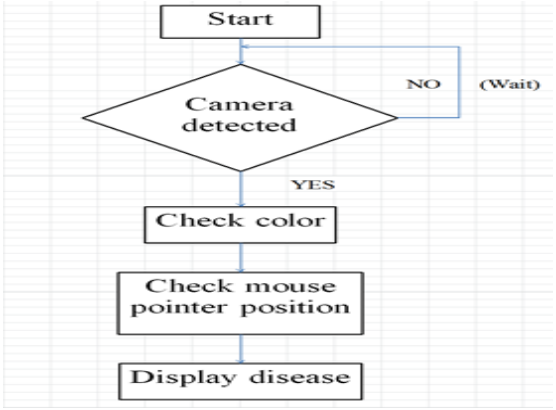

Fig.6. Plant disease detection workflow chart

The plant disease detection workflow chart is shown in fig6. In this web camera interface to the raspberry pi, if it detects it will check the color of a plant leaf. If it is not detected then wait a few minutes, once the camera is detected then check mouse pointer position on that color of a plant leaf. After it is displayed disease type on the window.

6. Result And Analysis

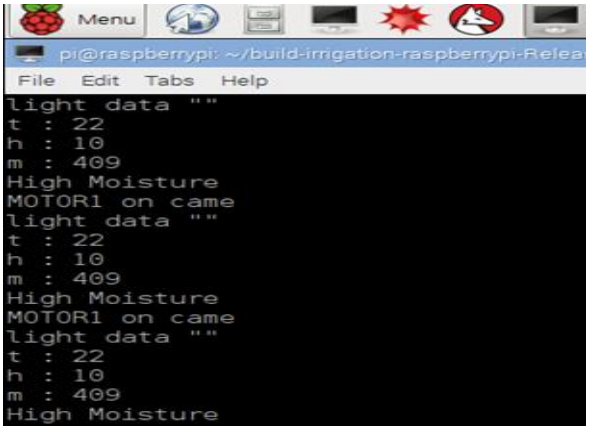

Fig.7. Received sensor data on window

The sensor data like so,il moisture, temperature and humidity values are display on LCD window as shown in fig 7.

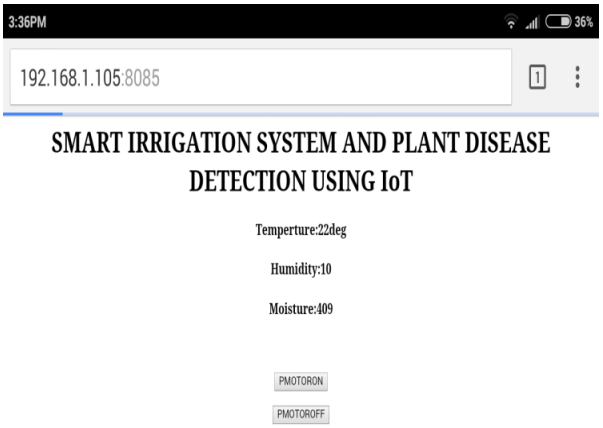

Fig.8. Sensor data display on HTML web page

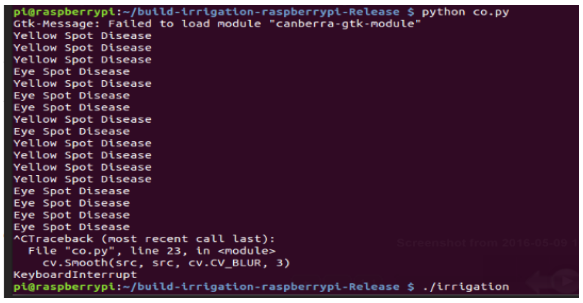

Fig.9. Sugar cane leaf diseases detection data display on window

A. Segmentation

In this stage, the concept of the intensity difference between leaf detected areas is used to segment leaf from the background. As shown below:

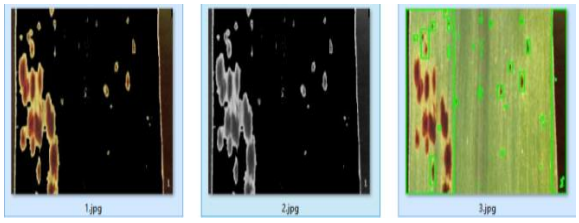

Fig.10. Sugar cane Eyespot disease

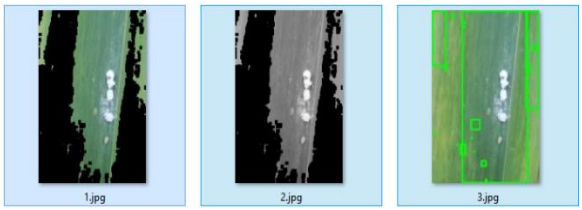

Fig.11. Sugar cane white flyleaf disease

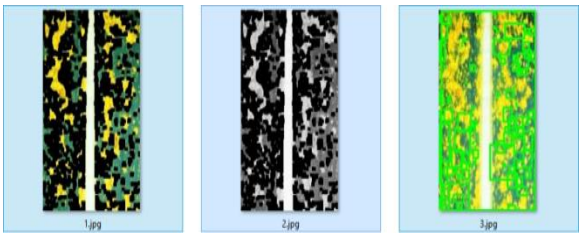

Fig.12. Sugar cane mosaic leaf disease

Fig 10, 11, 12 these all segmented images of sugarcane leaf based on that we are detecting sugarcane diseases.

Fig.13. System hardware setup

7. Conclusion

This paper designs the automated irrigation system using IoT and sugar cane plant disease detection using OpenCV. In this ,we have used raspberry Pi as an embedded Linux board which allows collecting the sensor information from the sensor node continuously and providing the web interface to the user. The system is watering to the crop uniform by analyzing the soil parameters; it will help to reduce the freshwater consumption. By providing the web interface and automation users can easily monitor the system and it will minimize human intervention. It also provides measures environmental parameters like temperature and humidity based on that owner can make pesticide motor ON/OFF. And

Identification of sugar plant diseases is the key to preventing the losses in the agriculture product.

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