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A Review on Smart Irrigation System: Sugarcane Diseases Detection Using Raspberry-pi

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ABSTRACT

Sugarcane is the one of the most important commercial crop of India. It is widely grown by the formers for their big margin profit. It has lot of by-products. India stands second in the product of sugarcane followed by Brazil. It requires lots of water for their cultivation and it is highly fragile to the diseases like fungal infection. In India it is highly grown in UP. Identification of sugarcane diseases is the key to preventing the losses in the sugarcane products [6]. If proper care is not taken then it causes serious effects on sugarcane plants due to which effects 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 present automated irrigation system in this system raspberry pi used as embedded Linux board. The system has 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 particular vale then owner make pesticide motor ON or OFF on his smart phone or on web page.

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

I. INTRODUCTION

Agriculture has been an important natural food source for humans and animals for millions of years. Agriculture does not only playing an important role in 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 to the quality of plants including water level, temperature, soil moisture and humidity from the surrounding environment [2]. Therefore, detection and treatment of diseases to produce high quality plants for the community is one of the key components in agriculture, to build an

automatic system for diagnosis of plant leaf diseases using Image Processing [15] and an automatic pesticide spraying mechanism using embedded system. This provides an automation of farm irrigation system. The whole system provides a web interface to the user so that the user can control and monitor the system remotely [1].

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 user 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[4].

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 is attack to the sugar plant it reduces photosynthesis process. Former's facing many problems for detection and classification of plant disease. This problem can perfectly rectify if we use image processing tool for detection and classification of plant disease.

II. LITERATURE SURVEY

In 2014 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 a sent to the farmer's mobile using GSM [1].

In 2014 Nattapol Kaewmard et al., developed a portable measurement technology including soil moisture sensor, air humidity sensor and air temperature sensor. Moreover, irrigation system using wireless sensor network has installed these sensors, with the purpose for collecting the environment data and controlling the irrigation system via smart phone [2].

In 2015 Pravina B. Chikankar et al., Proposed an irrigation system which is automated by using controllable parameter such as temperature, soil moisture and air humidity because they are the important factors to be controlled in PA [3].

In 2015 Pandurang H. Tarange et al., Proposed an 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. Embedded Linux board makes the communication with all distributed sensor nodes placed in the farm through ZigBee protocol and itself act as a coordinated node in the wireless sensor network. The goal of coordinator node is to collect the parameters like soil moisture and soil temperature wirelessly [4].

In 2015 Jagadeesh D. Pujari et al., Proposed the image processing techniques used to identify and classify fungal disease symptoms affected on different agriculture/horticulture crops. Many diseases exhibit general symptoms that are be caused by different pathogens produced by leaves, roots etc [5].

In 2014 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].

In 2015 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 the plant disease detection [7].

Here we detecting new kind of sugar cane leaf disease like white fly and pesticide spraying mechanism using embedded system
Here we are detecting Sugar cane leaf diseases as shown in below:

1. White fly

Fig. 1 Sugar cane white fly leaf disease

2. Mosaic disease (Yellow spot)

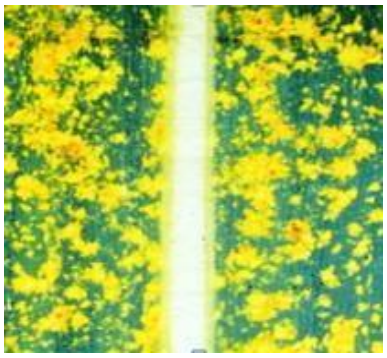


Fig. 2 Sugar cane mosaic leaf disease

3. Eye spot

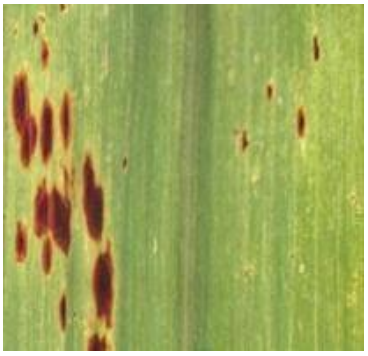


Fig. 3 Sugar cane Eye spot disease

III. EXISTING SYSTEM

Some existing system proposed a detection of sugar cane leaf spot diseases like rust spot, yellow spot, and ring spot.
All existing system only detection of plant leaf diseases using image processing

IV. PROPOSED ARCHITECTURE

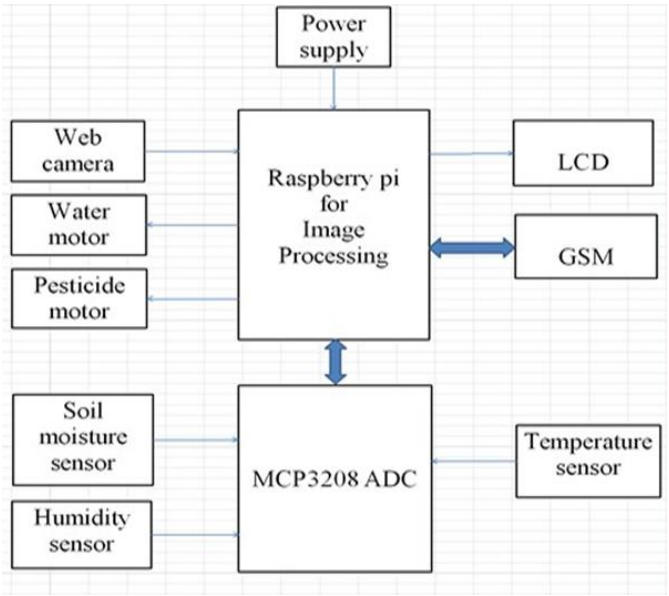


Fig. 4 Complete block diagram of a system

WORKING:

The complete block diagram is as 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 below threshold value than water motor automatically ON. If temperature and humidity increases means any disease development environment created than owner can make pesticide motor ON or OFF manually. GSM module interface to rasp-pi using UART protocol. The Whole data monitor on 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 disease like black/yellow/white spots from the leaf. Each characteristic of disease such as color of the spots represents different diseases.

V. FLOW CHARTS

a. Irrigation system flow chart

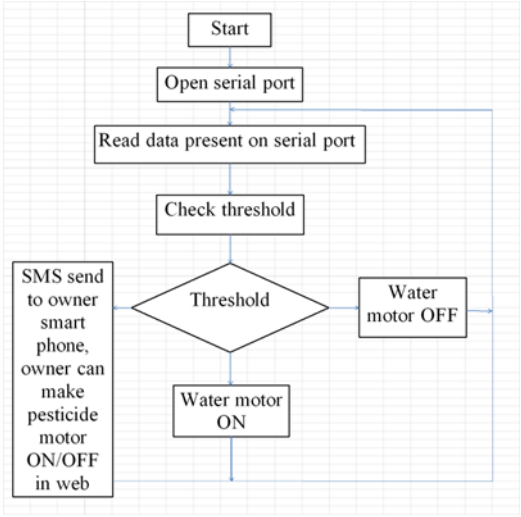


Fig. 5 Irrigation system work flow chart.

The Flow chart of sensor work as show above Fig. 5, in this soil moisture, humidity and temperature sensors are interface to raspberry pi via MPC3208 analog to digital converter. The soil moisture sensor measures the content of moisture in soil. If soil moisture reaches a bow threshold value than water motor OFF, if less than threshold value than water motor ON. If a temperature and humidity value reaches a bow threshold value than SMS send to owner smart phone, owner can make pesticide motor ON/OFF on this smart phone or in web page. The process is continuously goes on.

b. Plant disease detection system flow chart

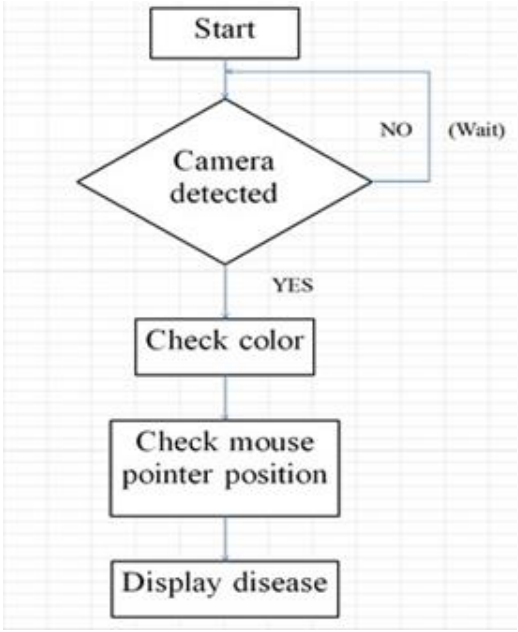


Fig. 6 Plant disease detection work flow chart

The plant disease detection work flow chart as show in Fig. 6, In this web camera interface to the raspberry pi, if it detect it will check color of plant leaf. If it not detected then wait few minutes, once camera is detected than check mouse pointer position on that color of plant leaf. After it is display disease type on window.

VI. RESULTS AND DISSCUSSION

The sensor data like soil moisture, temperature and humidity values display on LCD window as shown a bow Fig7. First the soil moisture sensor deployed in the farm. Moisture sensor is responsible for capturing the moisture present in soil. Temperature and humidity sensors measures the environmental temperature and humidity these data display on LCD window [Fig. 4]

Fig. 8 Sensor data display on HTML web page

From [Fig. 7] that data display on HTML web page as shown a bow Fig [8]

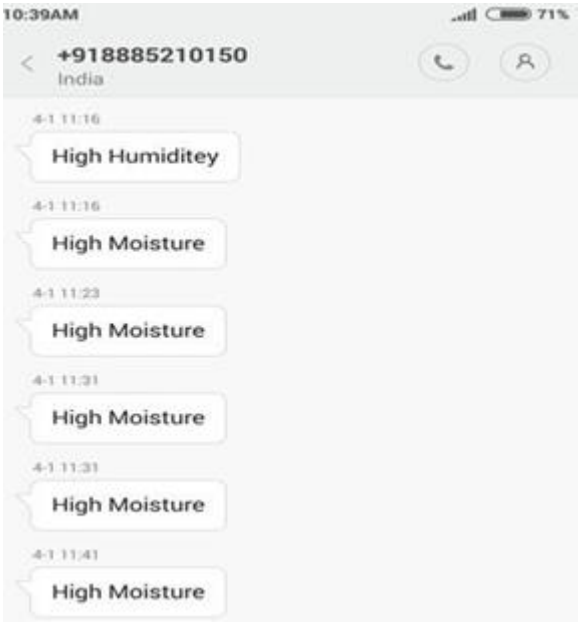
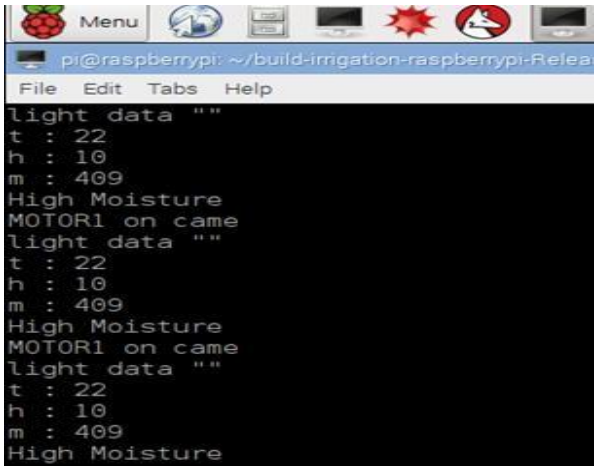


Fig. 9 GSM send SMS to owner smart phone

From Fig [7] if temperature, humidity and soil moisture value reach particular value than message to owner smart phone as shown a bow Fig. 9



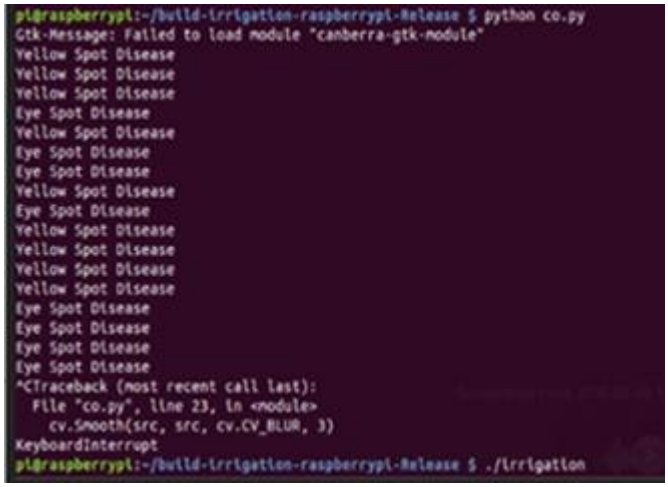


Fig. 10 Sugar cane leaf diseases detection data display on window

From Fig[4] web camera interface to raspberry-pi for continuous video processing, in this detection of sugarcane diseases based on color like white fly, yellow spot and Eye spot diseases based on pixel value it will detect the diseases and display on LCD window.

A. SEGMENTATION

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

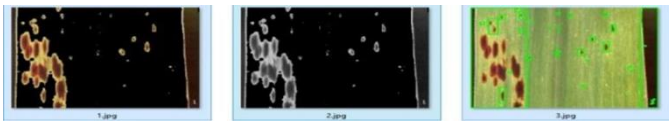


Fig. 11 Sugar cane Eye spot disease

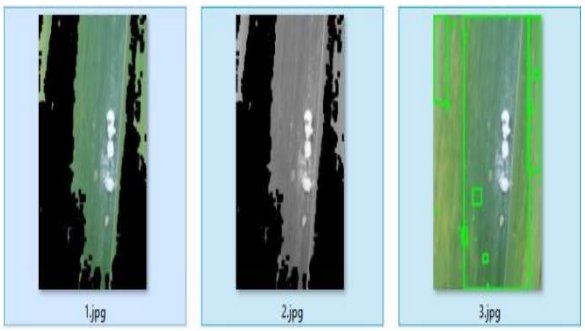


Fig. 12 Sugar cane white fly leaf disease

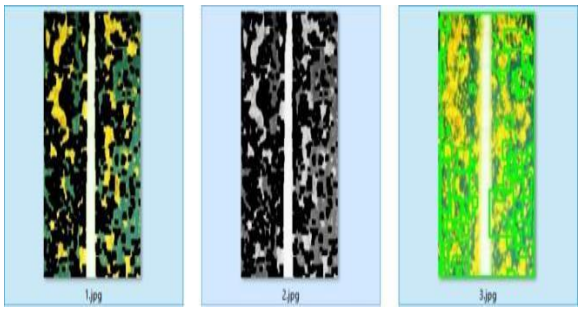


Fig. 13 Sugar cane mosaic leaf disease

Fig 11, 12, 13 these all segmented images of sugarcane leaf based on that we are detecting sugarcane diseases.

Fig. 14 System hardware setup

From Fig [14] the complete system hardware setup as shown a bow, the specification of all device as shown below table [1].

Table 1: Device specification

Sl. No.	Device	Specification
1	Raspberry-pi	Raspberry-pi 2 model b+
2	Sensors	LM-35, HR 202 Soil moisture(FC28)
3	GSM	SIM 900A module
4	Web camera	13 Mega pixel USB camera
5	ADC	MCP3208
6	Dc motors	5v dc motor
7	power	5v, 2Amp Micro USB charger

VII. CONCLUSION

This Paper describes design of an automated irrigation system using IoT and sugar cane plant disease detection using OpenCV, Raspberry-Pi as an embedded Linux board which allows collecting the sensor information from sensor node continuously, and providing the web interface to the user. The system can be used for watering to the crops uniformly by analyzing the soil parameters; it will help to reduce the fresh water consumption. By providing the web interface and automation user can easily monitor the system and it will minimize the human intervention. It also provide to measures environmental parameters like temperature and humidity based on that farmers can make pesticide motor ON/OFF.

And Identification of sugar plant diseases is the key to preventing the losses in the agriculture product. The future work can be done in pre-processing the images so lesion cane be detected more accurately and therefore disease can be identified more accurate or use more accurate segmentation method, so all spot area can be separated accurately from the entire leaf image.

VIII. FUTURE WORK

In Future, this system will be enhanced to monitor a large scale area and Detection of all type plant diseases in single module.

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