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# Design and Development of IoT Based Remote Sensing System for Smart Farming

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**Abstract:** Now a day's a remote sensing system in IoT based environment widely used in smart farming. This system in smart farming is used to perform various farming task like soil sensing, temperature sensing, weather sensing, light sensing, and moisture sensing smarter and efficient for better yielding and production. The proposed system aims to design and develop a remote sensing tool that senses the current status of plant and disease in the plants in farm field using various sensors like temperature, humidity, pH sensors and water level sensors. Identification of plant disease is done through sensor readings data. The main aim of the research paper is to design and development of an Internet of Things (IoT) based remote sensing system tool to supervise and control the citrus plant in farm field. This proposed system consists of hardware setup with real-time sensors such as soil moisture, sunlight, humidity, temperature, water level, and camera module which are controlled by Raspberry Pi processor with Python and configured essential getaways to sense and stored data associated to parameters for supervising the dynamic plant growth. With the help of such kind of IoT based remote sensing system farmer can observe all the parameters of plant remotely and get real time analysis of data, so that they can increase the productivity.

**Keyword:** Internet of Things (IoT), Smart farming and Raspberry Pi.

## I. INTRODUCTION

In our country farming play vital role in the growth and development. Introducing new technologies in farming domain is one of the big challenges for developing nations [1]. The concept of smart farming systems enables farmers to identify crops, analyze the soil, provide real time status automatically and gain in production [2]. The major farming related task are land preparation, seedbed preparation, plantation, irrigation nutrition, plant/crop protection, and harvesting. All these tasks can be performed remotely with the help of remote sensing system by using modern technology as an Internet of Thing (IoT) [3].

The main purpose of this research work is to develop the efficient IoT based System is helpful to reduce the losses due to several factors while growing plant to the farmers [4].

The proposed system consists of hardware setup with real-time sensors such as soil moisture, sunlight, humidity, temperature, water level, and camera module which are controlled by Raspberry Pi processor with Python Script and configured essential getaways to sense and stored data in database associated to parameters for supervising the dynamic plant growth. The farmers can monitor the sensor data and plant fruit disease and status using an Android-based mobile application, which is connected over IoT environment [3][5].

## II. SMART FARMING WITH IOT

Smart farming is a modern concept, because of adoption of IoT sensors. The smart farming platform has been proposed to sense, transmit and process the physical parameters such as Soil-Moisture, Air Temperature, Air-Humidity, Water-level, and Water-flow for security of crops of farming land along with the weather forecast information to operating the irrigation effectively which leads to give time to farmer for resolve the issue and produce crops in efficiently. Remotely platform oriented system is capable for supporting information about farm fields to the farmer with the help of IoT and smart sensors [5].

The proposed system with IoT based environment consists of two modules, where the first phase is design and develop setup with real-time sensors such as soil, sunlight, humidity, temperature, water level, and camera module which are controlled by Raspberry Pi processor with Python Scripts.

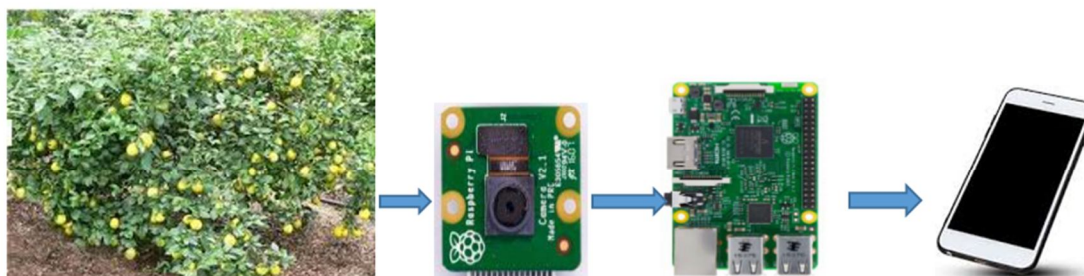
The second modules develop for farmers to supervise the sensor data and plant fruit disease status using an Android-based mobile application, which is connected through IoT environment. In this way, the farmer can continuously record the status of his field using the mobile app remotely.

### III. RASPBERRY PI

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting an updated 64-bit quad core processor running at 1.4GHz with built- metal heatsink, dual- in band 2.4GHz and 5GHz wireless LAN, faster (300 mbps) Ethernet, and PoE capability via a separate PoE HAT

### IV. PROPOSED METHODOLOGY

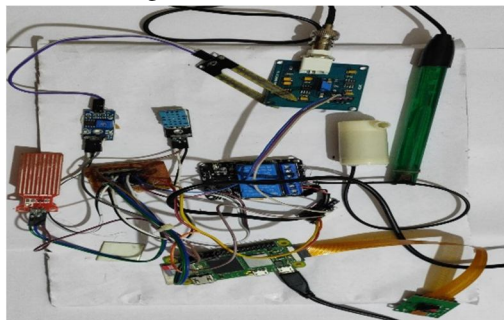
In this section the detailed development strategy discussed, which is developed by combining the Raspberry Pi processor, IoT environment with mobile application. Figure 1 shows the Processing flow for proposed system design. Figure 2. Shows Raspberry Pi Board Hardware Setup involving different sensors with proper connection. The proposed system is developed with the Raspberry Pi controller by using different types of sensors and camera module for data collection. The Raspberry Pi controller-based hardware system is placed with citrus plants, which supervise the status of plants using different sensors. All these sensors' data is uploaded into cloud based IoT environment.



**Figure 1. Processing flow for proposed system design**

### V. SYSTEM MODULE AND STRUCTURE

In this research work the first phase is use to supervise the sensor data and in the second phase, first image is capture by pi camera and detected and image infection is shown, then farmers take the collective action after disease identification in fruit using an Android-based mobile application, which is connected through IoT environment. The proposed system controls the parameters such as temperature, water level, humidity, soil moisture. Then, sensor data are regularly updated to IoT cloud environment remotely through cloud services. The DHH-22 sensor is used for parameters such as temperature and humidity of atmosphere. In farming, it is important to measure the minerals present in water regularly, because the nutrients are provided to the plants through the water only. pH sensor used to sense the pH level of the soil. pH sensor will help to get readings from the soil. Using these readings, we can track the health of the soil. It can help us to find the efficiency or deficiency of pesticides or fertilizers. In addition, hydrostatic pressure level sensor also used for measuring the different water levels.



**Figure 2. Working Hardware setup**



**Figure 3 Hardware setup with citrus plant**

### VI. RESULT AND A NALYSIS

The proposed research work classifies plant fruit diseases gaining images through the Raspberry pi microprocessor which prepare IoT based system with essential environmental parameters from different locations in farm. Using this IoT sensor device, images are sent to the database and DLCNN algorithm is implemented for segmenting the affected part after resizing model is used to identify the different types of plant fruit diseases form the camera captured images.

### The Growth Conditions of Used in proposed system

Parameters	Best growth state
Temperature	15°C ~ 30°C
Humidity	30% ~ 70%
Soil moisture	40% ~ 90%
PH value	7

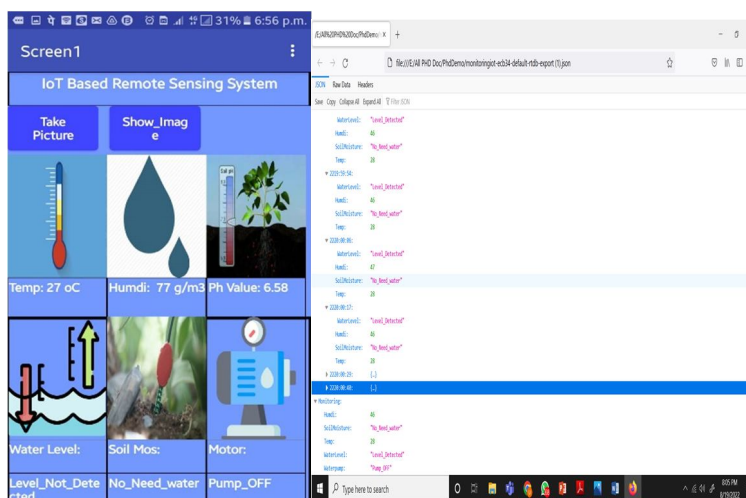


Figure 4. IoT based App

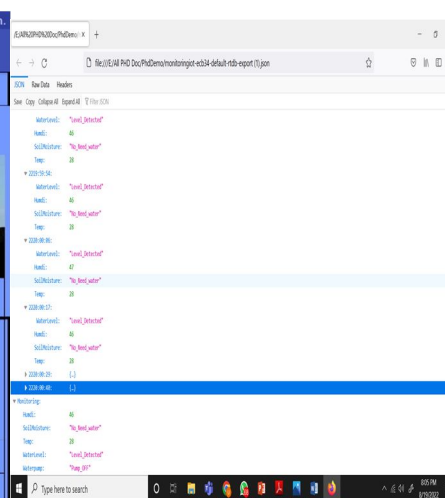
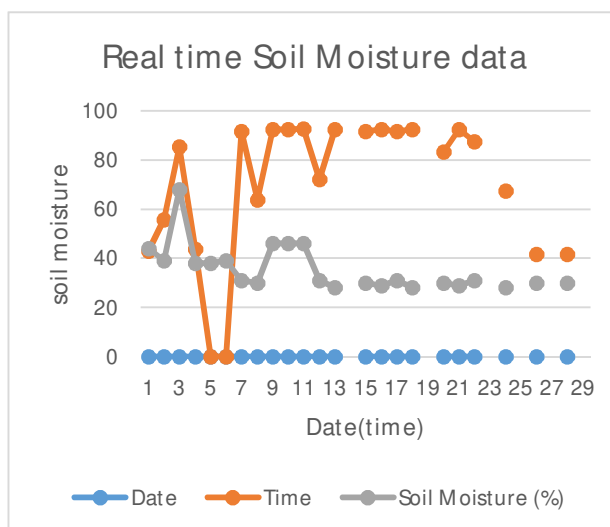
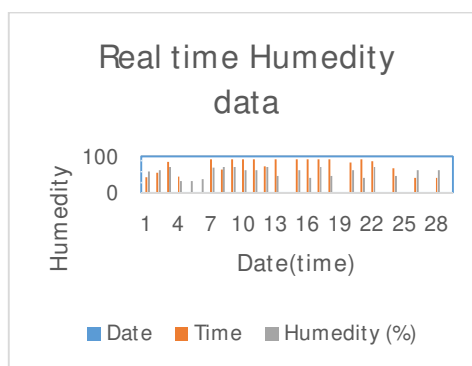
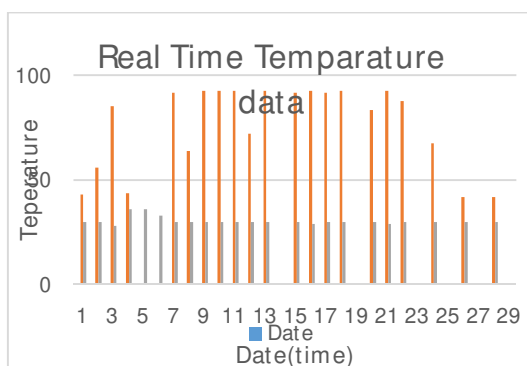


Figure 5. Output



## VII. CONCLUSION

This paper presented the design and development of remote sensing system with IoT, which is developed by integrating the Raspberry Pi with Python. IoT environment with mobile application to supervise the citrus plants condition in growing stages. The farmer observes and manages his farm field using this system, which has manual and automated control modes. A Raspberry Pi processor-based hardware design to monitor plant status using various sensors. The data from these sensors is transferred to a cloud based IoT system. A system is deployed in the cloud serviced by which continuously analyzes sensor data, plants present condition, and gives alerts to farmers via the Monitoring Agri application. Finally, the farmer operates his farm field in manual mode, ensuring that sufficient number of things are provided to plants by the farmer. Now this system is under construction. In future research work can be extended with integration of deep learning methods for more accuracy and high performance of the system. Citrus fruit disease identification with DLCNN technique.

## APPENDIX

## ACKNOWLEDGEMENT

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