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IOT BASED SMART FARMING SYSTEM

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Abstract - *India being developing country, agriculture is still the primary occupation of majority of people. Currently the supply and demand of agricultural products has not been controlled properly because of manually measuring the environmental parameters by the farmers. Hence, adaption of technology based farming is necessary to increase the revenue. Even the climatic changes and rainfall has been erratic over the past few decades. Lack of rainfall and excessive rainfall both are dangerous to the cultivation. The correlation analysis between the crop statistical information and agricultural environment information enhances the ability of the farmers to analyze the current condition and predict the future harvest. In this paper, the sensor technology and wireless network in integration with IoT has been studied and reviewed based on the actual agricultural system. Here a distributed wireless network of sensors is used to collect the real time data of the various environmental parameters. The system involves image processing technique to identify the leaf diseases. The microcontroller handles this data and triggers the actuators based on the threshold defined for a particular crop to control the water quantity. The wireless data transmission is carried out by Bluetooth module. An android application is designed to monitor this system remotely.*

Key Words: **Smart Farming, IOT, Cloud, wireless sensor network, Android, Arduino, Thingspeak**.

1. INTRODUCTION

Agriculture is the basic source of livelihood of people in India. In past decade, it is observed that there is no much crop development. Some of the factors which are responsible for this may be wastage of water, low soil fertility, fertilizer abuse, climate change, diseases, etc. Agriculture uses 85% of available fresh water resources worldwide. As the demand on water consumption is increasing, there is an urgent need to create strategies for sustainable use of water. As the world is trending into modern technologies it is necessary to trend up in agriculture also. Latest technologies such as Internet of Things and Cloud in combination with Wireless Sensor Networks can lead to agricultural modernization. IoT can benefit from virtually unlimited capabilities and resources of cloud. Cloud can offer an effective solution for IoT service management. IoT is an ecosystem of connected physical devices that are accessible through the Internet. It consists of objects, sensor devices, communication infrastructure, computational and processing units. The objects have certain unique features and are uniquely identifiable and accessible to the Internet. These physical objects are equipped with Radio Frequency Identification (RFID) tags. The sensors communicate the information over the Internet to the cloud server which is a computational and processing unit. The result of processing is then passed to the decision- making and action invoking system that determines an automated action to be invoked. The mobile application developed in android helps to monitor the field from anywhere through the use of internet.

2. LITERATURE SURVEY

Wireless sensor based automated irrigation system is proposed in [1] to optimize water use for agricultural purpose. The system consists of distributed wireless sensor network of soil moisture, and temperature sensors mounted in the crop field. Zigbee protocol is used to handle the sensor information and water quantity programming using algorithm with threshold values of the sensors sent to a microcontroller for irrigation system. Arduino Uno along with Raspberry Pi[2] requires only one time implementation. Threshold values are set after experimentation on different types of soil under varying temperature conditions. Raspberry Pi monitors this system and keeps log of moisture level of the soil. It uploads the log file to the server and hence, can be viewed from any remote location by the user. Plant Watering System [3] according to Soil moisture, water pumping motor turned on or off via the relay automatically. This saves water, while the water level can be obtained in a preferred aspect of the plant, thereby increasing productivity of crops. Servo motor from vegetation water uniformly dispersed in soil, in order to ensure the maximum utilization of absorption. Thus, there is minimal waste of water.

3. METHODOLOGY

Proposed system developed an automated irrigation system and rooftop management system for the farmer on the basis of wireless sensor network. This system monitors the parameters temperature, humidity, rainfall and moisture of the soil. An algorithm is used with threshold values of soil moisture to be maintained continuously. System starts or stops the irrigation based on the moisture content of soil. Soil moisture Sensors work on the change of impedance between two electrodes kept in soil. Arduino Uno is a platform independent open source hardware and software which is used as microcontroller. It collects the analog input from the sensors, analyzes it and activates the actuators. Meanwhile, the data gather by the sensors will be sent to an android app via the Bluetooth module. Timely updates regarding the status of the field is sent to the user's device for monitoring.

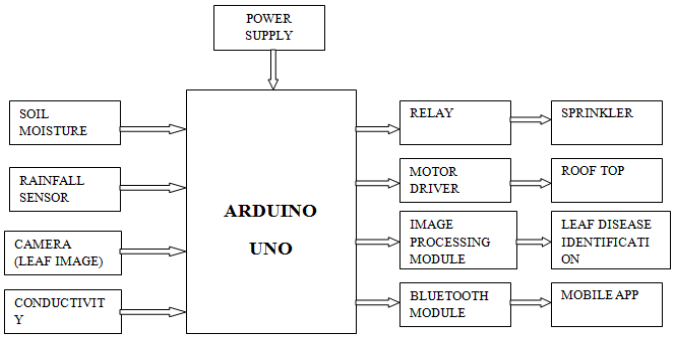


Fig -1: Block Diagram

3.1 Sensors

The system consists of four major sensors which are soil moisture, rainfall, temperature and humidity sensors that measure the respective environmental parameters. All the values sensed will be sending to the microcontroller embedded on Arduino Uno Programmable board.

Some specific thresholds have been defined for each sensor based on the selected crop. Once the particular threshold is reached by a sensor/group of sensors, then controller takes respective decision which triggers corresponding actuator. Here, if the soil moisture drops below the threshold and there is no rainfall, then a motor pump will turn on supplying water to only that level till the moisture level is brought back to the desired level. The flow diagram is as follows:

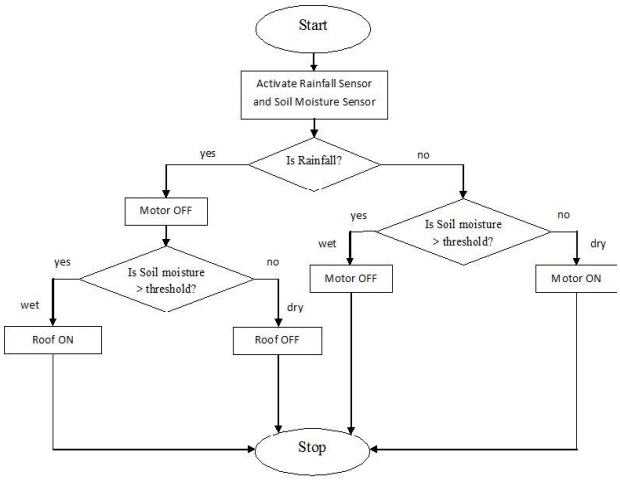


Fig -2 Flow diagram of different sensors used

3.2 Image Capturing Module

The Uno camera connected with arduino captures the leaf image. Once the image acquisition is done, background is removed. Region of interest is extracted.

Color, shape and texture are selected as feature for feature extraction. KNN classification is used to classify the leaf as healthy or disease. The flow diagram is as follows:

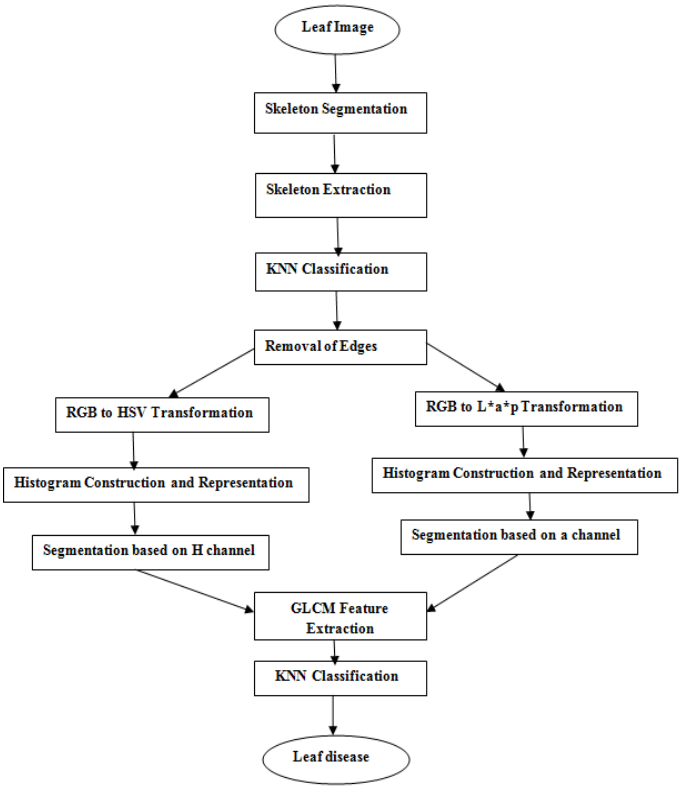


Fig -3: Flow diagram of Leaf disease detection module

3.3 Bluetooth

HC-05 is a short range wireless communication Bluetooth module, which uses SPP (serial port protocol for communication). It has qualified Bluetooth V2.0+ Enhanced Data rate, radio transceiver and baseband of 2.4GHz and modulation of 3Mbps. The main task of the Bluetooth module is to transfer the data from the microcontroller to the cloud for storage.

3.4 Mobile Application

The mobile application is developed in android. It has an easy to use graphical user interface (GUI) which helps to monitor the field.

The soil moisture sensor value and rainfall value is collected and sent to the Arduino Uno which decides whether to turn the motor on or off, by comparing it with the threshold value that is programmed into Arduino.

Rainfall sensor gives a Boolean value, True or False. If the sensor value is true, then the signal is passed from Arduino to turn the rooftop on, so that field is protected from heavy rainfall. Bluetooth module collects sensor data, rooftop and motor conditions and uploads it to the android application.

4. EXPERIMENTAL RESULTS

Fig 4 shows the experimental setup used. Fig 5 shows the Roof Top management module implemented. Figures 6 and 7 are the samples of the Android app developed.

Fig -4: Experimental Setup

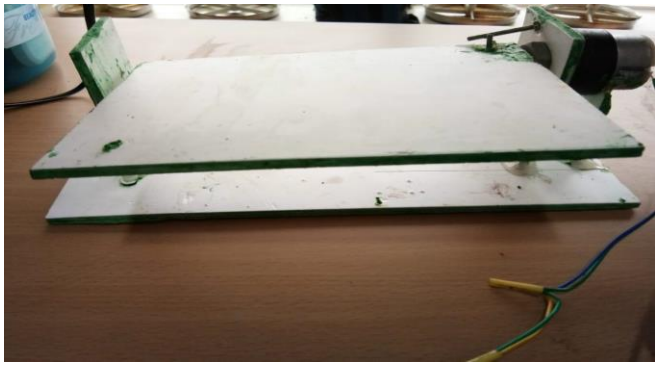


Fig -5: Roof Top Management

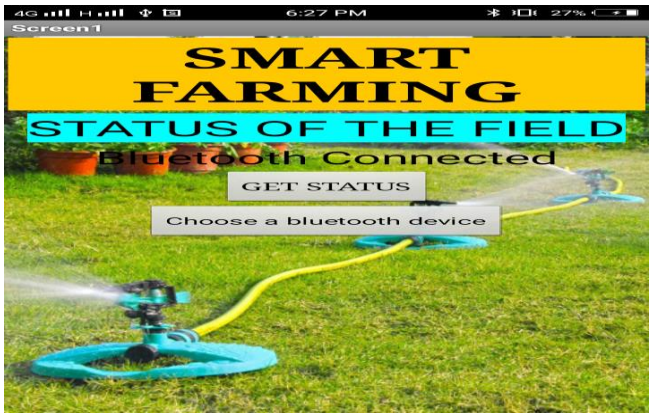
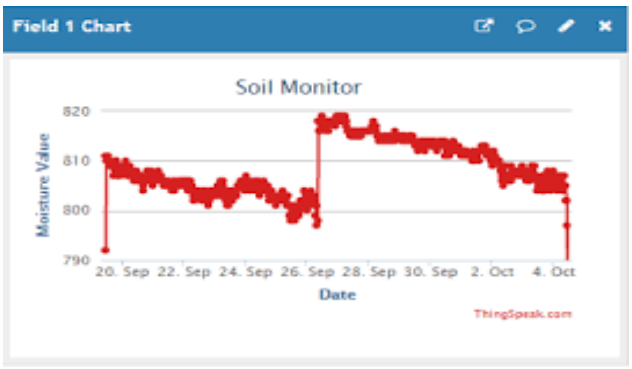


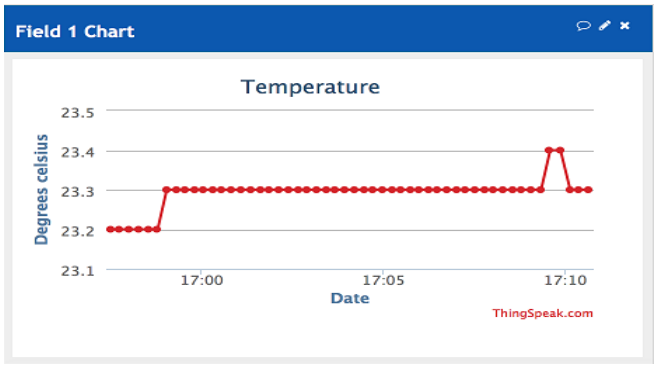
Fig -6: Android App

Fig -7: Status of the field

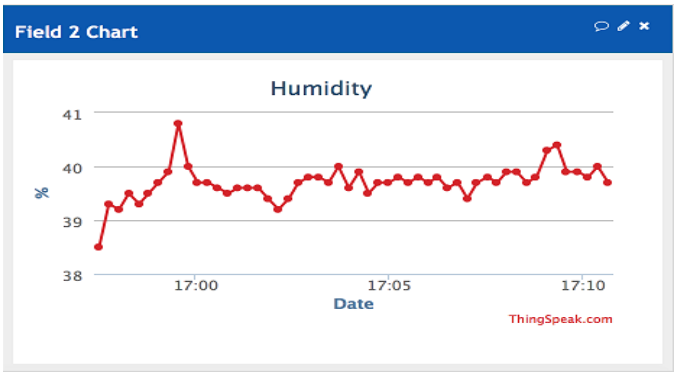
Bluetooth module collects sensor data, rooftop and motor conditions and uploads it to the Thing Speak cloud, which is then used to plot the graph. Behavior of soil, rainfall and weather can be analyzed.



Graph for Soil moisture



Graph for Temperature



Graph for Humidity

5. CONCLUSION

The entire system gives the field automation in agriculture, which makes farmer's work easier. It helps in increasing the agricultural production and reduces the time and money of the farmer. Rooftop is useful for smaller farms as it is costly to implement. Graphs are used to analyze present conditions and take necessary actions in future. Android application can be further developed for easier access to all elements in the field and can be used to control the field. Temperature and Humidity values can be used to make statistical analysis regarding the weather conditions in the past and predict the future.

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