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Application of Raspberry Pi in IoT Based Smart Irrigation and Agriculture Monitoring System

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ABSTRACT: In today's world agriculture plays a predominant role. Many new advancements have been made in the agricultural field so as to get a better yield of crops. However constant monitoring of the agricultural field is a tough task. Farmers need to manually keep a watch on the water supply in the field so as to provide right amount of water to the crops as per their need. This project aims at developing an automated irrigation and monitoring system that will help the farmers to reduce their manual work. Focus area will be parameters such as temperature and soil moisture. Raspberry pi is the main heart of the whole system. The system will constantly check for the moisture content in the soil. In case of less moisture, water will be supplied automatically in the field and if the water content in the soil is very high than the farmer will be notified through the app, so that he takes the necessary steps. This system will be a substitute to traditional farming system. Nowadays the industries are using automation and control machine which are high in cost and are not suitable for using in farm field. This system is designed in such a manner that it can be used in farm field and is low cost. A complete automated irrigation system is developed to optimize water use for agricultural crops.

KEYWORDS: IOT, Raspberry pi, Soil Moisture, Irrigation

I. INTRODUCTION

In India, Agriculture is a major part of the GDP of the country. Most of people are doing farming in India. The agriculture field is involved in many industries in India. Let's say to make raw material for clothes we need cotton. So, to get a cotton, people need to contact farmer or company that collect cotton from farmers. This is only one example there are many examples like this. So basically, agriculture is a backbone of the country. The growth of industries depends on the various fields. To make a vast amount of production in agriculture field farmer should know many things like moisture of soil, humidity, temperature, rain fall, etc. To make a cultivation smart we will make a fusion of traditional farming and modern technologies.

In agriculture there are more labour work, so using automation we can save labour work and also reduce the size of human resources in cultivation. It also improves quality and accuracy, saves lots of energy, material. To make this happen researcher and scientist collaborate with large industries and try to make automatic system which is very efficient and effective. Using automation machine like fan, fridge, AC, lights can be run automatically i.e. depends on environment. It makes a great use of available resources, like in home it saves electricity and in agriculture it saves water.

II. PROBLEM DEFINITION

To design a system that monitors the basic requirements of irrigation in agriculture and takes action to retain optimal conditions. The system keeps the the track of moisture present in the soil and also updates the farmers about the conditions of the water level.



III. LITERATURE SURVEY

Raspberry Pi is a high-performance machine with dynamic possibilities and infinite outcomes. It serves as an efficient option for projects on raspberry pi[1]. It gives the idea of what kind of sensors would prove useful in our problem statement and what are the resources to be looked into to achieve the outcomes[2]. The implementation of smart irrigation system which will notify the farmer about the farm conditions[3]. The monitoring while integrating Wireless Sensor networks and different Communication protocols. It makes use of LPC2148, R-Pi, and Arduino[4,5]. Using different sensors and zigbee modules how human efforts are reduced when sensors that give precision values are put to work. This gives us future development ideas wherein we can monitor the fields over long distances. [6]. Using IoT, an attempt is made to automate the irrigation. Farmers face some difficulties in switching on/off the motor. Any delay in watering may reduce the production[7].

IV. SYSTEM

A. EXISTING SYSTEM

Existing irrigation controllers are based on fixed schedule. From time to time a technician may manually adjust the watering schedule, but such adjustments are usually only made a few times during the year, and are based upon the technician perceptions rather than actual watering needs. In conventional irrigation control technology, irrigation is done in the way in which large amount of underground or surface water is wasted. The simple irrigation control technology don't consider the plant productivity which is not based on efficient irrigation. It is based on perception of technician[8].

B. PROPOSED SYSTEM

In this system, an automatic smart irrigation system is developed which will automatically start the water pump when the moisture content in the soil is found to be low. First of all, an android app is been created which first takes the important information from the farmer such as area of the field and the crop grown with other basic information. By knowing the crop grown by the particular farmer we can set the threshold value. For example, to grow a sugarcane crop there must be 50% of moisture content in the soil. So ,50% will be the threshold value for sugarcane crop. If there is less than 50% of moisture content in the soil, than our designed system will automatically on the water motor. The motor will be on until the threshold value is reached[9,10]. Once the threshold value is reached, the designed system will automatically off the motor. In case, of moisture content more than the threshold value than the farmer is informed about it, so that he takes the necessary action. Here Raspberry Pi is the main heart of the whole system. Even the temperature of the field can be known to the farmer through the system. Raspberry Pi sends the data to the app needed by the farmer. The system is full automated and efficient.

C. Block Diagram

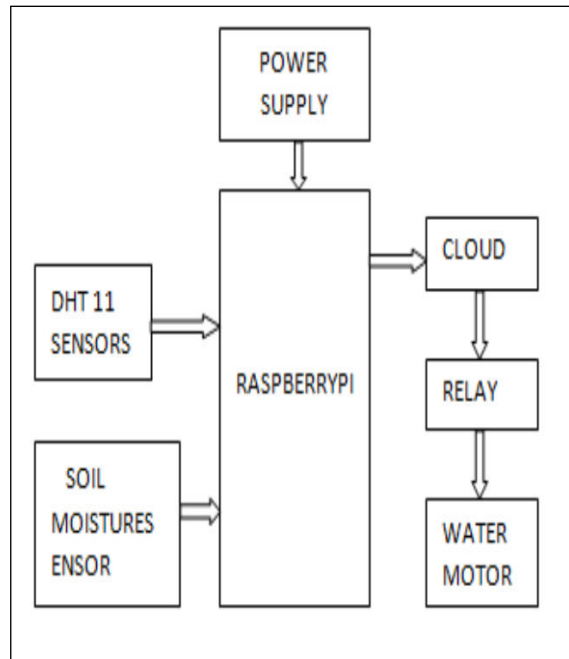


Fig 1. Block Diagram

D. IMPLEMENTATION

The project mainly consists of two modules,

1. Hardware Module.
2. Software Module.

Hardware Module(as per Fig 1 Block Diagram and Fig 2)

- In this module, Raspberry Pi is the heart of the system. Both the sensors i.e., Soil Moisture sensor, DHT 11 sensor are connected to the Raspberry Pi.
- The cloud, relay and all the motor are connected to the Raspberry Pi.
- The cloud is used to store the sensor data.
- The relay acts like a switch to on and off the motor.
- The motor pumps water when required.
- The Soil Moisture Sensor is used to know the moisture content in the soil.
- The DHT 11 sensors are used to know the humidity and temperature around the field.

Once all the components along with the Raspberry Pi are integrated together than,

- The threshold value is set. This threshold value depends on the ideal value of the moisture content needed by a particular crop.
- The main part of the system is to manage the moisture content in the soil. Excess of water in the soil destroys the crops and lower moisture content degrades the growth of the soil. So, the threshold value is decided on the fact that, there proper moisture content in the soil for proper growth of the soil.
- When the Soil moisture sensors detects the moisture to be less than the threshold than the relay switches on the motor.

- Motor pumps the water in the field until the threshold value is reached. Once the threshold value is reached, the relay automatically switches of the motor.
- In case there is excess of moisture content, exceeding the threshold value than the farmer is informed to take the precautionary measures.
- The humidity and temperature value are constantly updated to the farmers through the android app.

Software Module

1. Android application is developed in Android Studio Software, where Extended Markup Language (XML) is used for front-end development and Java is used for back-end development.
2. Navigation Bar is the major component used while designing the pages, where all options are shown in the form of list. Major advantage is the user can go to any page they want to. This avoids adding back buttons or home buttons.
3. Some image views, text views, buttons, are also used in various layouts (pages) and the back – end has been coded in java files.
4. The main work of the app is to show the latest readings of the sensors set up in the field like temperature, humidity, and soil moisture.
5. The app retrieves the sensors data from thingspeak and is shown in the app. Once refresh button is clicked, the latest readings will be retrieved.
6. Even app shows some basic information about the crops in the information page. Where the user can select the crop from drop down menu, accordingly the information below the crop changes.
7. Now only three crops have been added and information about those will be displayed.
8. The user registers from registration page and they can view their profile as well. While registering the crop they are cultivating will be out according to that threshold value of the sensor will be changed.

V.RESULTS



Fig 2 Hardware Model



Fig 3 Registration Page

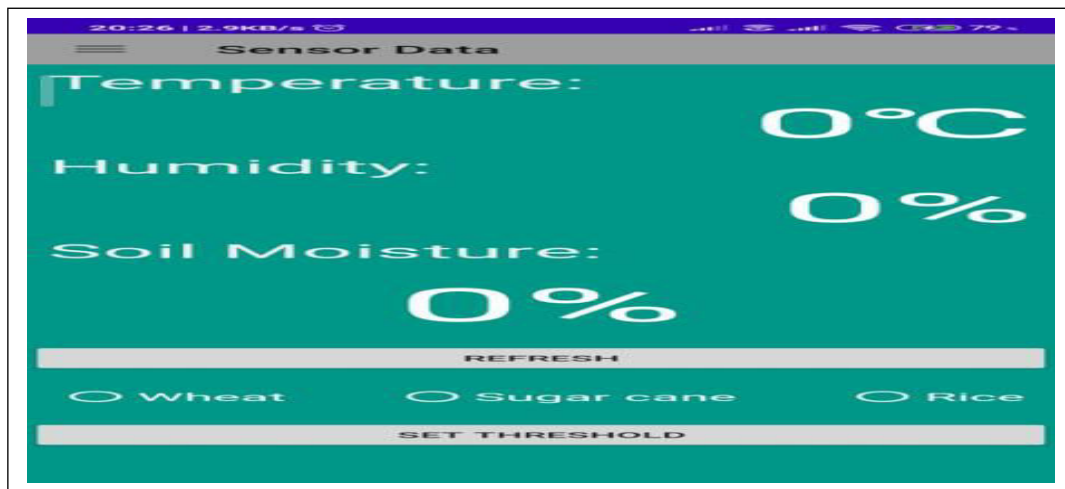


Fig 4 Sensor data page



Fig 5 Crop Information Page

VI. CONCLUSION

Overall, this project provides a novel approach to save a water usage and make irrigation system better. Raspberry pi is an important part of system which handles the processing and working. In this proposed system we used many sensors like soil moisture to measure moisture of soil, DHT sensors to sense the humidity and temperature around the field. If soil needs water, then motor starts automatically in order to provide sufficient water to the soil. To notify the farmer about dryness we set threshold value. If count beyond that count system will notify the farmer. The system is completely automated.

Future Scope

This system provides very huge future scope. It can be comprehend in many ways. One way is to add camera module and fire detecting sensor to it. When flame sensor detect fire, camera module click picture and put it in website or send it in mail. And take input from user that there is fire or not if it is there, send message to fire bridge. This type of agriculture application of Internet of things in real world environment is necessary to know the effect of the environment on such system. So is always better to know the risks beforehand.

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