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IoT Based Automatic Plant Watering System Using Raspberry-PI 3

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Abstract

This project deals with the automatic plant watering system which automatically senses moisture level in the soil. Raspberry Pi is used in this automatic plant watering system with a built in pump and a water tank. Automation allows us to control various appliances automatically. The objective of this project is to control the water supply to each plant automatically depending on values of soil moisture sensors. Mechanism is done such that soil moisture sensor electrodes are inserted in soil. Automatic plant watering system consistently has shown to be valuable in water use efficiency with respect to manual irrigation based on direct soil water measurements. The aim of the implementation is to demonstrate that the automatic plant watering system can be used to reduce water use. The implementation is an automatic plant watering system that consists of a soil moisture sensors which senses the soil humidity and automatically waters the field. This system is useful especially for user's who have a daily job and travel a lot.

Key words: ***Raspberry-Pi, Soil moisture sensor, Advance ip scanner***

1. Introduction

Since nowadays, in the age of advanced electronics and technology, the life of human being should be simpler and more convenient, there is a need for many automated systems that are capable of replacing or reducing human effort in their daily activities and jobs [1-2]. Here we introduce one such system, named as automatic plant watering system, which is actually a model of controlling irrigationfacilities that uses sensor technology to sense soil moisture with a microcontroller in order to make a smart switching device to help millions of people [3-5]. Can we automatically water our home and garden plants without bothering our neighbors when we decide to go on vacation or somewhere else for a long period? Since irregular watering leads to the mineral loss in the soil and may end up with rotting the plants, can we then somehow know if the soil really needs to be watered and if so, when exactly do we have to water the plants? [6-7]. Is it possible in any way from remote location to manage our plants to be watered ?These are some questions that can be heard quite often and answer on all of them is encouraging and affirmative , because advanced technology provides us very wide range of possibilities nowadays [8-10]. Actually, there is a very simple and economical solution for all these questions and perplexities. In the form of unique intersection between biological engineering and electronics, the solution requires only a little bit knowledge of electronics as well as that knowledge related to botany and plant physiology.

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2. System requirements and specification

System requirement specification gives the complete description of the behavior about the system developed by this project. This includes specification of functional and non functional requirements of the application. The interaction of the users with the application is represented with the help of use cases and there analysis. This also includes the description about feasibility, risk analysis and external interface requirements to accomplish this project.

2.1 Functional requirements

The functional requirements will describe the features and functionality of the system. Functional requirements record the operation that must be done. Functional requirements are based for non-functional requirements.

2.2 Non functional requirements

The non-functional requirements define how the system will do certain operation. Non-functional requirements are usually called as "quality attributes". The system should also meet the non-functional requirements along with the functional requirements.

2.3 Non-functional requirements for this project are:

Security

It is the feature of the system which ensures that system must be protected from the unintentional or malignant harm.

Performance

The way in which the system meets its performance targets is for it to be specified clearly and explicitly. The system itself might not need anything specifically for its basic operation, but the complete system along with the components connected may have some Performance requirements. □ User-friendly The graphical user interface (GUI) is user-friendly.

Usability

Usability determines how difficult it is to learn and use the system.

Availability

It means for how long the system is available for its users and for how long the system will be operational.

2.4 Raspberry Pi:

The Raspberry Pi is a low cost, credit-card sized computer. Its capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, making spreadsheets, and playing games. There are different models of Raspberry Pi from Raspberry Pi 0 to Raspberry Pi 3.

Fig. 1 Raspberry Pi 3

2.5 Soil moisture Sensor:

Soil moisture sensor includes comparator (LM393) which converts analog data to discrete. Two soil probes consist of two thin copper wires each of 5 cm length which can be immersed into the soil under test. The circuit gives a voltage output corresponding to the conductivity of soil. The soil between the probes acts as a variable resistance whose value depends upon moisture content in soil. The resistance across soil probes can vary from infinity (for completely dry soil) to a very little resistance (for 100% moisture in soil).

It consist of different types of sensing units such as Soil moisture sensor to measure water content of soil, temperature sensor to detect the temperature. DC motor based vehicle is designed for Irrigation purpose.

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Fig. 2 Moisture sensor

3. Working principle:

The main working principle behind this system is in connecting the soil moisture sensor, which was previously embedded into the plant, to the Raspberry-pi micro controller ,which is also connected to other electronic components Measurement of soil moisture is done by the sensor which forwards the information and parameters regarding the soil moisture to the microcontroller, which controls the pump. If the level of soil moisture drops below a certain value, the microcontroller sends the signal to the relay module which then runs a pump and certain amount of water is delivered to the plant. Once the enough water is delivered, the pump stops doing its work. Power supply has a task to power the complete system and the recommended voltage should respect the input supply range for the microcontroller, that is, from 7V to 12V. Relay module is a simple circuit consisting of a single transistor, several resistors, diodes and a relay and it is controlled digitally by microcontroller. Since the complete system should be embedded in a small box , Raspberry-pi is a perfect microcontroller for this purpose because of its dimensions and its work performance.

- For the automatic plant watering system, a moisture level sensor is attached to the soil of the plant and when the reading of the sensor is below the pre-set value, the pump will be activated
- The reading of the sensor is above the pre-set value, the pump will be deactivated

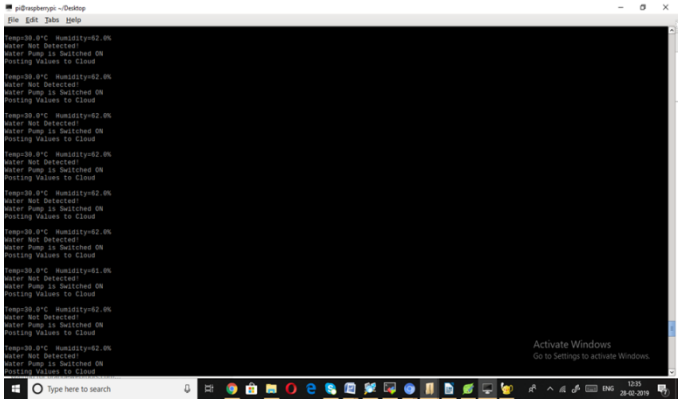

Fig. 3 Humidity and temperature values are stored in the cloud

4. Conclusion

Thus "IOT BASED AUTOMATIC PLANT WATERING SYSTEM USING RASPBERRY-PI" has been designed and tested successfully. It has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus, the IOT Based Automatic Plant Watering System has been designed and tested successfully. The system has been tested to function automatically. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level , the moisture sensor sends the signal to the Raspberry-Pi board which triggers the Water Pump to turn ON and supply the water to respective plant using the Pump. When the desired moisture level is reached , the system halts on its own and the Water Pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

- Using this system, one can save manpower, water to improve production and ultimately increase profit.
- The automated irrigation system is feasible and cost effective for optimizing water resources for agricultural production.

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- The system would provide feedback control system which will monitor and control all the activities of irrigation system efficiently.

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