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IOT BASED SMART IRRIGATION SYSTEM

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ABSTRACT

Nowadays, the Internet of Things (IoT) technology is very much used in agriculture. Therefore, this paper is about a project that focuses in the field of agriculture with the objective of controlling the water consumption in agriculture field which is based on IoT where all information is viewed and controlled in fingertips. As a part of the system development, few sensors applied such as: (i) a soil moisture sensor to detect the water level in soil; (ii) the humidity and temperature sensor to trace early signs of temperature changes; and (iii) the pressure sensor to measure the pressure of the surrounding. These sensors are connected to a Wi-Fi module and they are interdependent to give extra sensitivity to the irrigation system..

Keywords: DTH 11, Automation, Microcontroller, Arduino, IOT, GSM- GPRS SIM900A, Thingspeak.

INTRODUCTION

Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers.

Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively. In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (e.g. sensors, faming machinery etc.) in order to become more efficient in production and communicating appropriate information.

LITERATURE REVIEW

In a Remote Measurement and Control System for Greenhouse Based on GSM-SMS the proposed system introduced a GSM-SMS remote measurement and control system for greenhouse based on PC-based database system connected with base station. Base station is developed by using a microcontroller, GSM module, sensors and actuators. In practical operation, the central station receives and sends messages through GSM module. Criterion value of parameters to be measured in every base station is set by central station, and then in base stations parameters including the air temperature, the air humidity. It mainly focuses on reviews in the field of remote monitoring and control, the technology used and their potential advantages. The paper proposes an innovative GSM/Bluetooth based remote controlled embedded system for irrigation. The system sets the irrigation time depending on the temperature and humidity reading from sensors and type of crop and can automatically irrigate the field when unattended. Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke parameters such as air temperature and air humidity.

What can I measure with Smart Agriculture / IoT sensors?

Smart Agriculture is focused on soil, weather and crop conditions. Given the importance of weather and irrigation, many Smart Farming solutions are coupled with Smart Environment (Air Quality) and Smart Water (Pollution, Turbidity, Nutrients) for a complete solution. The most common IoT sensors are listed below:

Soil Temperature

Smart Agriculture Node – monitoring moisture, conductivity, surface temperature and soil temperature.

Soil temperature is an essential factor in belowground plant activity, influencing root growth, respiration, decomposition and mineralization of nitrogen. IoT sensors can estimate soil temperature by measuring air temperature and other factors; however, the most accurate measurement is to use a probe buried in the soil.

Depending on the root structure of the plant in question, multiple probes can be installed at different depths. Surface soil temperature can be monitored using a different type of IoT sensors.

Soil Moisture

The moisture content of soil can also be monitored using buried probes with electrodes. In hydrology, soil science and agricultural moisture content play a vital role in soil chemistry, plant growth and groundwater recharge. Soil moisture content is essential for several reasons:

- Water in the soil serves as a critical nutrient for all crops and plants.
- Water is an essential component of photosynthesis.
- Crop yield is heavily influenced by the availability of water in the soil.
- Soil water is an important carrier of soluble food nutrients for plant growth.
- Soil water helps regulate soil temperatures.

What is a DHT Sensor?

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can easily interfaced with any microcontroller such as Arduino, Raspberry Pi, etc… to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor are available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor.

How it works?

The working of the DHT sensor is pretty simple. DHT11 sensor consists of a capacitive humidity sensing element and a thermostat for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture-holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form.

For measuring temperature this sensor uses a Negative Temperature coefficient thermostat, which causes a decrease in its resistance value with an increase in temperature to get a larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers.

The temperature range of DHT11 is from 0 to 50 degrees Celsius with a 2-degree accuracy. The humidity range of this sensor is from 20 to 80% with 5%

accuracy. The sampling rate of this sensor is 1Hz .i.e. it gives one reading for every second. DHT11 is small in size with an operating voltage from 3 to 5 volts.

METHODOLOGY

Water sprinkler control was achieved by setting a threshold value at which irrigation should begin. When the sensors switched on when the moisture content is low. The threshold values depend on the type of soil used.

Readings from the two sensors were also transmitted to a THINGSPEAK channel to obtain graphs. Thing Speak is an open data platform and API for the Internet of Things that enables you to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino.

RESULTS ANDDISCUSSION

The values obtained through sensors enable the system to switch the sprinkler on and off. A farmer can remotely monitor the irrigation process on the farm. Hence, the system contributed in making a smart farm. Table 2 depicts the readings of the two YL-69 soil moisture sensors taken over a period of one hour.

Table depicts readings from two YL-69 soil moisture sensors one of which was inserted in over irrigated soil and the other in soil with initial moisture content 79%. The readings were taken over a period of one hour to observe the rate at which moisture content in soil is reducing when the sprinklers are off. These readings are transmitted to the website and thing speak channel. Figure 5 and 6 display the graphs plotted.

Table: Sensor Reading

Time (IST)	Sensor A (%)	Sensor B (%)
15:53:21	79	100
16:00:22	74	100
16:11:23	70	100
16:16:44	69	100
16:30:05	67	100
16:34:45	66	100
16:43:06	65	98
16:48:07	65	97
16:56:08	64	95
16:59:48	63	93
17:00:08	63	93
17:05:49	62	92

CONCLUSION

A system to monitor moisture levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this project it can be concluded that there can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources.

FURTHER WORK

To improve the efficiency and effectiveness of the system, the following recommendations can be put into consideration. Option of controlling the water pump can be given to the farmer i.e. he can switch on/off the pump in order to start/stop the process of irrigation without being present at the farm. The farmer may choose to stop the growth of crops or the crops may get damaged due to adverse weather conditions. In such cases farmer may need to stop the system remotely. The idea of using IOT for irrigation can be extended further to other activities in farming such as cattle management, fire detection and climate control. This would minimalize human intervention in farming activities.

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