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Iot Based Smart Agriculture Field Monitoring and Control System

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Abstract:

Mostly in India, the people depend on Agriculture because it is the pillar. The growth of agriculture enhances the productivity of the plantation systems. For irrigation, water is a more precious resource. Normally the usage of water requires an hour. For productive irrigation as well as to save water, better use of soil moisture sensors, gets better plant yields, reduces dependency on fertilizers and improves crop quality. Various methods applied to help the farmer, but it gives less accurate crop production decisions, and makes slower. In the irrigation fields, it is necessary to continuously monitor the soil moisture content for successful irrigation. For smart farming, an IoT – based system is designed for monitoring the crop field with the help of soil moisture sensor and automating the irrigation system. The farmers can monitor the state of the field from anywhere at any moment. Therefore, an IoT-based smart farming is highly efficient when compared to the conventional approach.

Keyword: IoT, Soil Moisture Sensor, Microcontroller.

I. INTRODUCTION

"IoT-based Smart Agriculture Field Monitoring & Control System", which monitors the moisture content of the soiland controls the motor pump wisely. All human beings depend on agriculture for food. Without agriculture there wouldbe no hope of life. It is essential for the germination of seed, growth of plants and nutrition. So there must be a sufficientamount of water in the agriculture field.

Both excess water and lack of water will affect the yield of crops. Hence, it is important to maintain the water levelin the field. This proposed system will monitor the moisture content of the soil. If there is sufficient amount of water the motor pump will be turned off else, it will be turned on. To make this possible, soil moisture sensor (SMS) is used to measure the soil moisture.

The system will work with association between electrical resistance and water content to gauge the moisture level ofthe soil. When the water content in the soil is low, it has poor electric conductivity. Hence higher resistance reading is obtained which indicates low soil moisture content. In this situation, the motor pump is turned on. Motor-pump pumps out the water for irrigation. When the water content in the soil is high, it has high electric conductivity. Hence lower resistance reading is obtained, which indicates high soil moisture which leads to switching off the motor pump.

Therefore, this proposed system will help the agriculture field to maintain the proper moisture content in the soil which will help in proper irrigation.

II. RELATED WORKS

Balaji Bhanu et al [1], Describes a way to monitor the agriculture field using wireless sensor network in order to increase the yield as well as the quality of farming without keeping eye on it for all the time by hand. Temperature humidity and carbon dioxide level is measure periodically. When a change is observed, the farmer is intimated through text message and e-mail.

Joseph Haule and Kisangiri Michael [3], Using of IoT technology to collect information about scenario like weather, moisture, temperature, level of water, pest detection, crop growth. Here, wireless sensor network is used to monitor the condition of farm and microcontroller is used to automate the farm process. This reduces the investment and increases the productivity of farming.

B. Yahya et al [5], defines an irrigation system form an aging the irrigation and toproduce maximum yield as well as save water at the same time. This is achieved by using low-cost Bluetooth wireless radio communication.

W. Zhang et al [7], this paper focusses about wireless sensor network technology for environmental monitoring of soil moisture. In this paper, moisture change during rainfall is collected frequently in the form of data which improves the robustness and network life time. The sensor network delivers useful data over the time of rainfall.

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Navarro et al [11], says in detail about Using wireless sensor network for the purpose of water irrigation. In this paper the design and implementation of wireless sensor network featuring zigbee technology with IEEE 802.4 transceiver is proposed. The monitoring system provides low cost in terms of labouras well as flexibility in terms of distance.

Yunseop et al [12], gives the design as well as implementation of wireless sensor network for monitoring the temperature, humidity and ambient light intensity in the field which helps the end user or farmer to adopt for the crop management. This system has nodes which are made with small application specific sensorand storage of sensor data into EEPROM. This also can be altered in the terminal according to the need of the former or the end user.

Y. Kim et al [14], Using acoustic emission technology to detect water shortage information. PCI-2AEboard-card, R15sensor, temperature, humidity sensor, Co2 sensor and PCI-8333 DAQ were usedfor hardware detecting system. A virtual technology is used for software system. This system aims to make crop growthin optimum soil water environment as well as to increase the utilization of water.

III. METHODOLOGY

As Fig.1 shows the architecture of proposed system. It consists of two parts: monitoring and control parts. In the monitoring part, the soil moisture sensor is used. The microcontroller which is used to monitor the location of water flows in the soil. If there is any variation in the moisture level, it will be displayed on the LCD display. It automatically switches off the motor pump once the range of the water level increases.

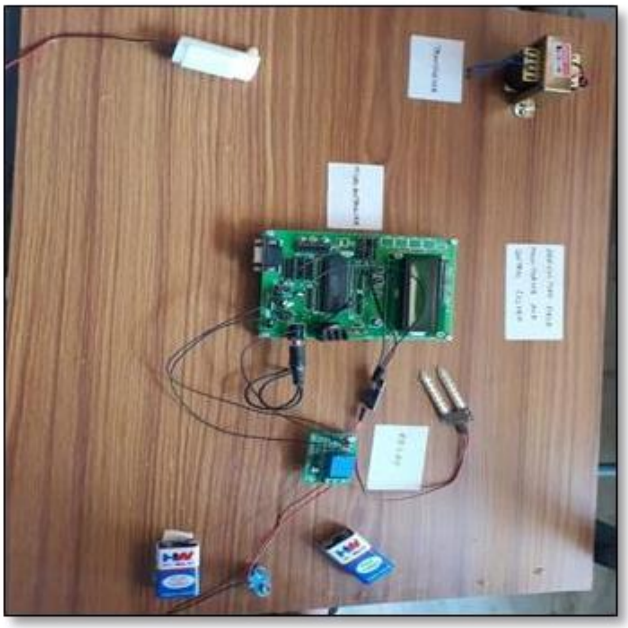

Fig 1: Architecture of Field monitoring and control system

Two stiff copper probes are inserted in the soil to detect the soil moisture condition. The comparator used here monitors the sensors and when sensors sense the dry condition, the proposed system will switch on the motor pump, else it will switch off the motor pump. A transistor is used to drive the relay during the moist condition. A 5 Volt double pole – double through relay is used to control the water pump. LED indication is provided for visual representation of the load status [1].

A switching diode is linked across the relay to neutralize the reverse EMF. This proposed system runs with 5V regulated power supply. Power on the LED is connected for visibility of power status.

Soil Moisture Sensor:

Soil Moisture sensor will sense the moisture level in the sand as Fig 3. It is made of two probes. It permits the electric current to pass through the soil, which measures the moisture level of the soil according to its resistance. When there is sufficient water in the soil, the sensor conducts more electricity, which means it has less resistance. This indicates high moisture content in the soil. Dry soil reduces the conductivity of the electricity. When there is less water; the sensor conducts less electricity, which means it has more resistance. This indicates low moisture content in the soil. This sensor controls the motor pump and also monitors the moisture content of soil

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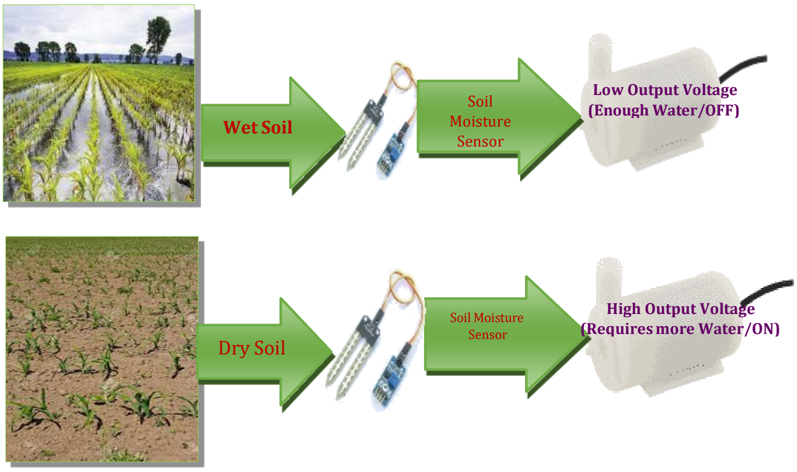


Fig. 2 Soil Moisture Sensor for wet & dry sand

ii) Soil Moisture Monitoring:

Soil moisture is the water held within the soil pores. Soil moisture is one of the main agent deciding harvest, as it affects the water uptake of the crops. So measuring the soil moisture level always plays an important role for successful farm management. The traditional method of evaluating soil moisture content as "look and feel" can be highly inadequate. The use of moisture sensors helps to evaluate soil moisture which leads to relevant irrigation decisions. The hardware consists of an 8051 microcontroller and a pre-wired soil moisture sensor module. The soil moisture sensor module, built around the LM25 comparator, gives an active-low (L) level output when the soil is dry. Thus, the digital output (wet soil/ dry soil) is routed to one of the I/O terminals of the 8051 microcontroller. According to this input, it gives an active-high (H) output through I/O terminal if the soil condition is dry, and an active-low (L) output, when soil condition is wet [7].

iii) Components of the Architecture Design

a) Step Down Transformer:

It is used to convert the high voltage into low voltage. It gives low voltage value for the electronic appliances. In this proposed system, it converts 280-volt power supply into 12-volt power supply as shown in Fig. 3

Fig.3 Step Down Transformer

b) Relay:

As Fig.4, the relay switch is used to acts as a switch on or off high power circuit from a low power circuit, which uses electro-magnetism.

c) Microcontroller 8051:

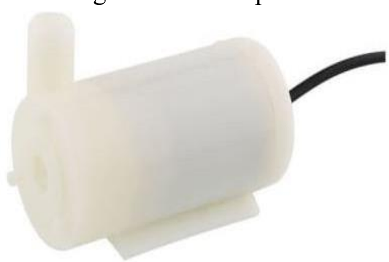
The 8051 is an 8-bit microcontroller, has components like CPU, 5 or 6 interrupts, 2 or 3 16-bit timer/counters, programmable full-duplex serial port, 32 I/O lines, RAM and ROM as shown in Fig 6. The 8051 handles the interrupts. Vectoring to fixed 8-byte areas is suitable and efficient.

Fig.5 8051 Microcontroller

d) Motor Pump:

The Fig.6 is a Mechanical device, which it's use to pump out water for irrigation. In this proposed system it is automatically turned on / off depending upon the moisture content of the soil.

Fig.6 Motor Pump



iv) Algorithm

Step 1: Switch on the System
Step 2: Place the Moisture Sensor Probes into the soil
Step 3: Connect the motor pump to the battery
Step 4: If the moisture content of the soil is sufficient,then the motor will be turned off.
Step 5: Otherwise, the motor will be turned on.
Step 6: Motor on and off status will be displayed on theLCD Screen.

IV. EXPERIMENTAL RESULTS

The hardware used in this system is interfaced with all the sensors in the board. The hardware components include the 8051 microcontroller, a motor pump, relay, 9V battery and the soil moisture sensor. And power supply is given. As shown in Fig. 7, the system is tested by watering and the soil moisture sensor is inserted in the field section.

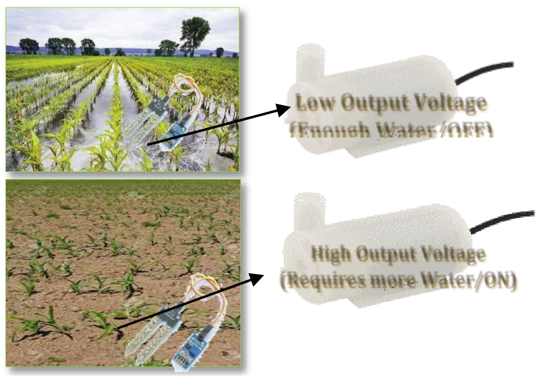


Fig. 7 Tested in the field

The sensor is used to sense the soil by using soil moisture sensor. Also, this system is automatically turned on, when the moisture content of the soil is low; the pump is turned on and off depending on the moisture content. The percentage of Soil moisture content varies from different soils at which irrigation should occur. The different types of soils are Sand, Loamy Sand, Sandy Loam, Loam, Silt Loam, Silty Clay Loam, Clay Loam, Sandy Clay Loam, Sandy Clay, Silty Clay, Clay. Implementation is carried out in Keil C compiler.

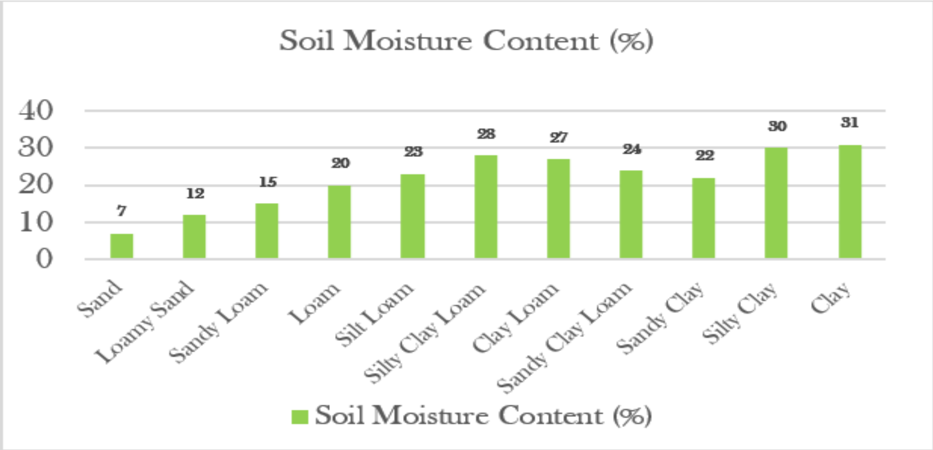


Fig.8 Tested in different soils

As a result, the soil moisture sensor cost is very low. With certain distance fixed in the whole field, it will monitor the water level. Tested in small area with different types of soils as shown in Fig.8

V. CONCLUSION

Thus, Internet of Things based agriculture field monitoring and control system is used to detect the moisture content present in the soil. When humans are out for vacation, they cannot always keep an eye on their field and monitor the moisture content. To overcome such problems, our system can be implemented. This does not require any human attention as this system can automatically manage the situation, as it is self-independent and an automated system. In future, this proposed system can be enhanced by using Wi-Fi Connection technology.

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