International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 02 | Feb 2020 www.irjet.net p-ISSN: 2395-0072

Automated Irrigation System Using IoT

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Abstract - *Agriculture is the basic spring of food supply for all nations in the world. The system consists of a sensor network for humidity, temperature, soil moisture, and rain sensors. Soil moisture, temperature, rain sensor, are placed in the origin zone of the crops. The microcontroller of the controller unit is set threshold values of the temperature and moisture content. The controller unit is used to collect all the details. In addition to that soil moisture sensor placed in this field, if it is excess water the buzzer gets automatically the turn on. Real-time monitoring data can be shown on the LCD. This paper is mainly focused on improving the agricultural fields yield by providing a monitoring system with effective and efficient usage of water resources. Thus further development in this project will lead to greater efficiency in the field of agriculture.*

Key Words: **Agriculture, internet of things (IoT), soil moisture, water, irrigation.**

1. INTRODUCTION

Agriculture is the backbone of all traditional countries [3]. In this world of growing global warming and decreasing water (H2O) level, discovery fertile soil with sufficient wetness content is a challenging task. Agriculturalists and other farmers in future necessity to define the value of soil moisture earlier spreading seeds or spending in crop manures. Also, another aspect of farming can be the different moisture requirement, temperature and humidity of the surroundings by different crops. Some crops require less amount of soil moisture and some require more. The temperature and humidity of the environments also matter to different crop patterns. Various methods of measuring soil moisture other than Arduino. The DHT11 sensor contains a component that senses humidity and a component called a thermistor which detects the temperature. There is also an IC (integrated circuit) on the back of the sensor. There can be three possible cases with the moisture content in the soil of a plant if the soil of a plant is too moist, the roots get wasted and also the plant does not get sufficient oxygen (O) from the soil. As a result, the plant dies. When the soil is too dry, the nutrient needs of a plant won't be fulfilled. The soil has just enough water to support the effective growth of a plant. Humidity or more precisely relative humidity can be defined as the amount of water vapor present in the air to the total amount of water vapor the air can hold. Humidity affects the opening of stomata pores on the leaves for transpiration or moisture exchange with the atmosphere. Stomata can also be stated as the breathing pores for the plant. When the relative humidity of the air is too high, the process of transpiration or evaporation of moisture becomes very difficult, as the plant cannot make water evaporate. In relatively warm temperatures and low relative humidity, plants feel easy to transpire. This reduces the need for fertilizing the plant. Also, high humidity in the air promotes the growth of mold and bacteria on the surface of the plants. This results in plant death and crop failure. Fungus and pests which feed on the plant roots also start accelerating in growth due to high humidity levels. The temperature required by plants to grow optimally also varies from plant to plant but obviously too high or too low temperatures kill plants.

2. METHODOLOGY

In this work, the automatic irrigation system based on a low power microcontroller was technologically advanced and deployed. To overcome the disadvantages of the existing system like a high price, problematic in maintenance and wired assembling, we introduce a new system that will have a wireless connection between server and nodes. We introduce a new design of embedded web servers making use of the Arduino controller. The automated irrigation system consists of a distributed sensor network built using a soil moisture sensor, temperature sensor, humidity sensor, and water level sensor. The water level sensor senses the extra water in the field. Earlier, farmer faced the problem of sending SMS and making calls, overcoming which we are designing a desired application which does the works depends upon sensor values.

3. HARDWARE COMPONENTS

3.1 *Arduino UNO*

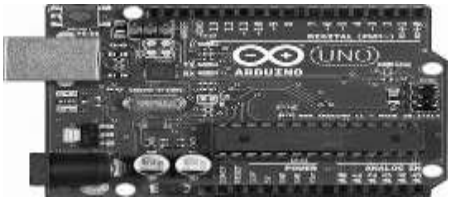

Fig -1: *Arduino UNO*

The Arduino Uno is a microcontroller board founded on the ATmega328P (Arduino UNO) microcontroller. The ATmega328 on the board comes pre-programmed with a boot loader that allows uploading new code to it without the use of an exterior hardware programmer [7].

3.2 Soil Moisture Sensor

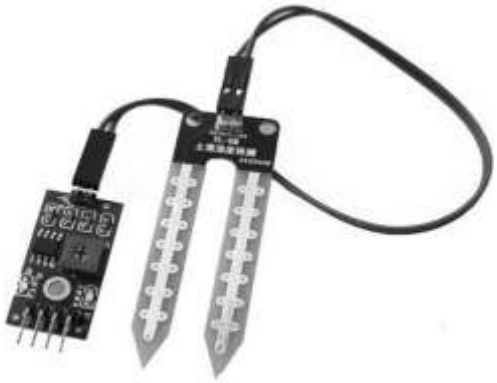

Fig -2: Soil Moisture Sensor.

Soil moisture sensor measures the water level in the soil. It uses the property of the electrical opposition of the soil. The connection between the measured things and soil moisture is regulated and it may vary depending on environmental factors such as temperature, soil type, or electric conductivity. Here, it is used to sense the moisture in the field and transmission it to the microcontroller in order to take controlling action of switching water pump ON/OFF [1]. By using the data from the sensor network, watering is automated. It saves 53% of water than a sprinkler system and more than 80% of water when compared to the traditional water fed system [5].

3.3 DTH11 Sensor

Fig -3:DTH11 Sensor

The system was studied and developed to build the wireless sensor network to assess the temperature, humidity [4]. The DHT11 is a low-cost numerical temperature and humidity sensor. It gives out the digital value of the microcontroller and hence we can give its output directly. It has a capacitive sensor for measuring humidity and temperature. The only real shortcoming of this sensor is that one can only get new data from it only after every 2 seconds [1]. This DHT11 Temperature and Humidity Sensor features a standardized digital signal output with the temperature and humidity sensor capability.

3.4 LCD

Fig -4: LCD Display

LCD (Liquid Crystal Display) is a type of level panel display which uses liquid crystals in its main form of operation. LCDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones and computer monitors.

3.5 Buzzer

Fig -5: Buzzer

Buzzer is an electrical device. When the soil moisture goes beyond the level it makes sound similar to a bell or buzzing noise and is used for signalling.

3.6 DC pump

Fig -6: DC Pump

The developed system consists of different *IoT* devices like *a water* pump. This information will be sent to the cloud and the user can analyze the amount of water. These sensor values are sending to the water pump via the relay to turn on/off the pump.

3.7 Relay

Fig -7: Relay

A relay is an electrically activated switch. That works on the principle of an electromagnetic attraction. Relays are used where it is required to control a circuit by a free low-power signal, or where many circuits must be controlled by one signal. In current electric power systems, these functions are done by digital instruments.

3.8 Wi-Fi Module

Fig-2: Wi-Fi module

The ESP8266 (WI-FI Module) is a low-cost Wi-Fi module with full TCP/IP stack and MCU (microcontroller unit) ability. This small module allows microcontrollers to connect to a Wi-Fi network and make a simple TCP/IP connection [2]. The ESP8266 Wi-Fi module is integrated with a TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 module is a very cost-effective board with a huge, and ever-growing, community. Data from all these junctions is collected and transferred to a cloud. Here, we are using the cloud factor as a storage database. The Data sent to the cloud is stored in the cloud database [6].

4. SOFTWARE REQUIREMENTS

4.1 Arduino IDE

The Arduino IDE **(**Integrated Development Environment) is a cross-platform that is written in functions from C and C++. The **Arduino IDE** supplies a software collection from the Wiring project, which provides some common input and output procedures.

5. SYSTEM DESIGN

5.1 BLOCK DIAGRAM

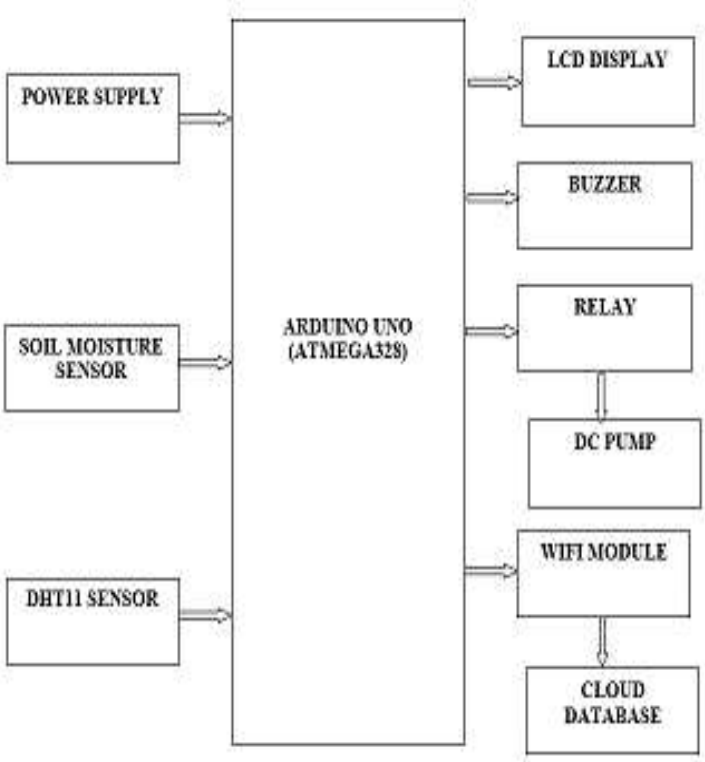

Fig-9: Represents the arrangements of components.

5.2 Flow Diagram

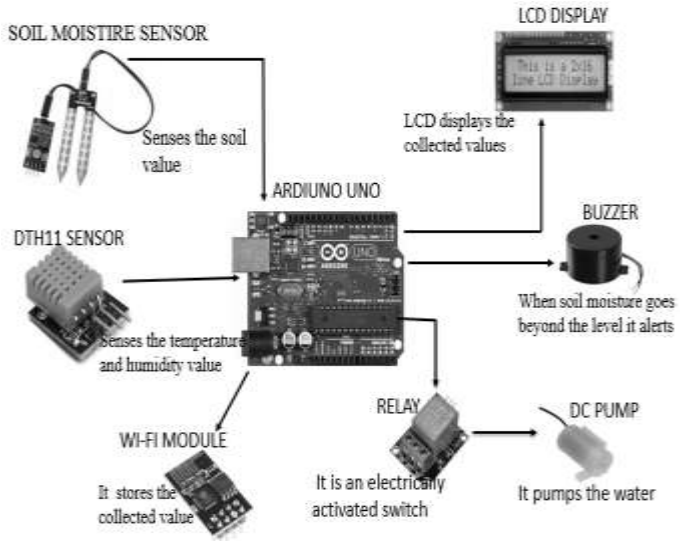

Fig -10: Flow diagram.

5.3 Schematic diagram

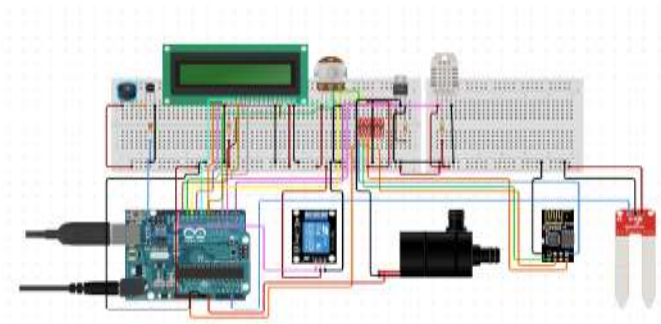

Fig -10: Schematic diagram.

6. Working procedure

1. First of all, we will have to take the data from two sensors- soil moisture sensor, Temperature sensor and (DHT11) humidity sensor.
2. These sensors provide information to the Arduino UNO.
3. Arduino takes necessary decisions/action and also notifies about the sensor values and its necessary actions to the farmer through LCD.
4. The moisture sensors are placed at different parts of the field and if the moisture levels are less than the prescribed level then the moisture sensor sends a request to the Arduino board.
5. As soon as the Arduino gets a request from the moisture sensors, the moisture levels are displayed in the LCD and the alarm will be "ON "if the readings are above the threshold level.
6. On the other side, concentrate on the ground part, we should also take care of the leaves.
7. The leaves will be regularly dried whenever there is a heavy temperature.
8. To overcome this temperature sensor is used, which regularly sense the temperature and if the temperature is higher than the prescribed temperature (48□C), the information displayed on LCD, and buzzer also automatically goes to ON condition.
9. The relay gets turned ON so that the irrigation process is automatically initiated.
10. These details are viewed in a cloud database with the help of the Wi-Fi module.

7. RESULT AND DISCUSSION

The soil moisture sensor senses the volumetric water content in the soil and if the soil is in the dry condition the motor will be on so that the plant gets required water.DTH11 sensor senses the temperature and humidity level in the soil. The collected data from soil moisture and DTH11 sensor values will be displayed on the LCD. When the soil moisture level is reduced the buzzer gets ON to alert the farmer. The sensors are connected to Arduino UNO and power supply is given. The Arduino UNO reads the values from Sensors and posts the information to the cloud server. If the values are less than the already set threshold values, then the motor stays in ON condition till the factor that is less than the threshold value reaches the threshold value. When the threshold value is reached, the relay automatically switches OFF the motor.

8. CONCLUSION

For future enlargements, it can be improved by developing this system for huge acres of land. Also, the system can be combined to check the quality of the soil and the development of the crop in each soil. The sensors and microcontrollers are well interfaced and wireless communication is done between various nodes. All observations and experimental tests show that this project is a complete solution to field activities and irrigation problems. Implementation of an organization in the field can definitely support to improve the harvest of the crops and overall production.

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