IOT BASED SMART IRRIGATION SYSTEM

Ms. Keerthana [1], Ms. Pooja [2], Ms. Raksha [3], Mr. Vijaykumar T R[4], Mrs. Smitha[5]

[1,2,3,4]Students, Dept. of CSE, Yenepoya Institute of Technology, Moodbidri, India-574225
[5] Assistant Professor, Dept. of CSE, Yenepoya Institute of Technology, Moodbidri, India-574225

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Abstract: A smart irrigation system in agriculture is made up of a variety of hardware and software applications that use different technologies. Machine learning technology plays a significant part in this. It is a data analytic technique which is to master many types of methods and models information directly from data. The survey measures the impact of applied techniques and it helps the farmers to adapt suitable system according to their requirements. This project presents an open-source technology based smart system to predict the irrigation needs of a field using ground sensing parameter like soil moisture, soil temperature, and environmental conditions along with the weather forecast data from the Internet. The complete system of sensor node data is wirelessly collected over the cloud utilising web-services and a web-based interface, which has been created and deployed on a prototype scale. information insight based on the analysis of sensors data and weather forecast data.

1. INTRODUCTION:

Agriculture is the backbone of all developed countries. It uses 85% of available fresh water resources worldwide and this percentage continues to be dominant in water consumption because of population growth and increased food demand. As a result, efficient water management is a major challenge in many arid and semi-arid farming systems. To optimize water consumption for agricultural crops, an automated irrigation system is required. The goal of an automated irrigation system is to avoid overwatering and under watering. Over irrigation happens as a result of inefficient waste water distribution or management, resulting in water pollution. In places with high evaporation, irrigation increases soil salinity, resulting in a deposit of harmful salts on the soil surface. To solve these issues and save manpower, a smart irrigation system was implemented.

2. LITERATURE REVIEW

Archana and Priya (2016).

The humidity and soil moisture sensors are installed in the plant's root zone, according to a paper proposed. The microcontroller is utilised to control the supply of water to the field based on the measured readings. The farmer is not informed about the status of the field by this system [1].

Sonali D.Gainwar and Dinesh V. Rojatkar (2015).
The proposed a study in which soil factors such as pH, humidity, wetness, and temperature are measured in order to maximise soil yield. This system is completely automated, and it regulates the motor pump's operation based on the amount of moisture in the soil. The farmer is unaware of the current agricultural situation [2].

V. R. Balaji and M. Sudha (2016) proposed a study in which the system uses photovoltaic cells to generate energy from sunshine. This system doesn't depend on electricity. The soil moisture sensor was used, and the PIC microcontroller was used to turn on and off the motor pump based on the measured readings. Weather forecasting is not included in this system [3].

R. Subalakshmi (2016) proposed a paper to make irrigation system simpler, the complexities involved in irrigation is tackled with automation system using microcontroller and GSM. The GSM is based on the measurements sensed from soil moisture, temperature, and humidity sensors sends message to the farmer when parameters surpass the program's predefined threshold value. The nutrient content in the soil is not determined by this system [4].

Karan Kansara (2015) suggested an automated irrigation system in which humidity and temperature sensors monitor soil conditions and a microprocessor controls water flow based on those variables. Farmer will be intimated through GSM. The nutrient content of the soil is not monitored by this technique. [5].

Uttar Pradesh's Bobby Singla, Satish Mishra, Abhishek Singh, and Shashank Yadav (2019) Agriculture is an essential part of every country's Gross Domestic Product (GDP). It is the economic backbone of every country. In this field, numerous issues have been discovered. The most significant issue is the scarcity of water supplies for both current and future generations. To maintain the water, it is vital to employ certain innovative ways. The most prominent aspect. Wi-Fi Relay Module and Arduino UNO R3 are used to send all of the data to the farmer's mobile application.[6]

3. PROPOSED SYSTEM

Water scarcity is causing a lot of challenges in the agriculture area these days. Smart irrigation systems have been employed to assist farmers in overcoming their challenges. The transmitter module in this system, as illustrated in Fig. 1, consists of a soil moisture sensor and a temperature-humidity sensor that are both interfaced to the microcontroller. The Esp8266, which acts as a Wi-Fi module, connects the microcontroller to the internet [2]. ThingSpeak, an open source IoT (Internet of Things) programme, is used to construct a channel. ThingSpeak gives an API key that is used to send sensor data to the cloud and save it in the defined channel and specified fields [3]. The sensor values are collected by the microcontroller and sent to the ThingSpeak cloud through the internet using the HTTP protocol [4].

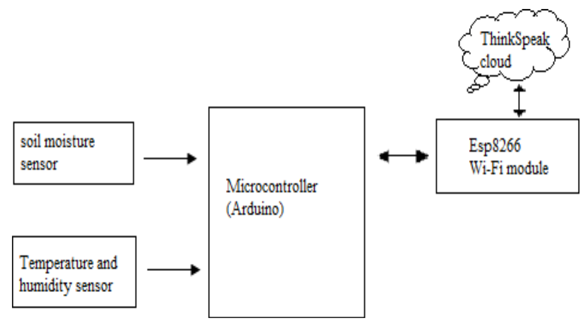

Fig.1. Transmitter module

1. ARDUINO UNO

Arduino is a free and open-source electronics prototyping platform with adaptable hardware and software. The Arduino Uno, as illustrated in Fig.2, can sense the environment by accepting information from a variety of sensors and can influence it by controlling motors and other actuators. An Arduino board is made up of an Atmel 8-bit AVR microcontroller and other components that make programming and integrating it into other circuits easier. An Arduino microcontroller is also preprogrammed with a boot loader that simplifies uploading of programs to the onchip ash memory, compared with other devices that typically need an external programmer.

The Arduino Uno is an ATmega328-based microcontroller board. It has 14 digital input/output pins (six of which can be used as PWM outputs), six analogue inputs, a 16 MHz ceramic resonator, a USB port, and a power jack. and a 16 MHz ceramic resonator, an ICSP header, and a reset button. It includes everything you'll need to get started with the microcontroller, including a USB cable to connect it to a computer

Fig.2. Arduino Uno

2. SENSORS

A. Soil moisture sensor

The moisture content of the soil is measured using a soil moisture sensor. The digital output will be low level (0V) if the soil moisture value detected by the sensor is above the threshold level, and high level (5V) if it is below the threshold level. The digital pin is used to immediately read the current soil moisture measurement in order to determine if it is over or below the threshold. A potentiometer can be used to control the threshold voltage.

B. Rain sensor

A rain sensor is a type of switching device that detects the presence of rain. It operates like a switch, and the theory behind it is that whenever it rains, the switch is generally closed.

C. Temperature sensor (LM35)

The LM35 is a temperature sensor with a proportional analogue output voltage to the temperature. It provides output voltage in Centigrade (Celsius). It does not necessitate the use of any additional calibrating electronics. The sensitivity of LM35 is 10mV/degree Celsius. As the temperature

and an AC-to-DC adapter or battery power it.

rises, so does the output voltage.

3.

ESP8266 Wi-Fi Module

The ESP8266 NodeMCU is a microcontroller with an integrated Wi-Fi module. It is a device having 30 pins, 17 of which are GPIO pins that are connected to various sensors to receive data from the sensors and transmit output data to the associated devices. Whenever the NodeMCU receives input data from various sensors, it crosschecks the data received and the data stored in it. It delivers a pulse to the Relay Module, which functions as a switch to turn on or off the pump, depending on the data received. The operating frequency of the NodeMCU ranges from 80 to 160 MHZ, and the operating voltage ranges from 3 to 3.6V. The range of the Wi-Fi module presents in the ESP8266 ranges from 46 to 92 Meters.

Fig.3. ESP8266 Wi-Fi module

4. MOTOR DRIVER (L293D)

A motor is a device that turns electrical energy into mechanical energy, which necessitates a lot of power. Because the microprocessor is incapable of supplying such high power, the motor driver board serves as a link between the microcontroller and the motor.

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Fig.4. Motor Driver

4. WORKING PROCESS

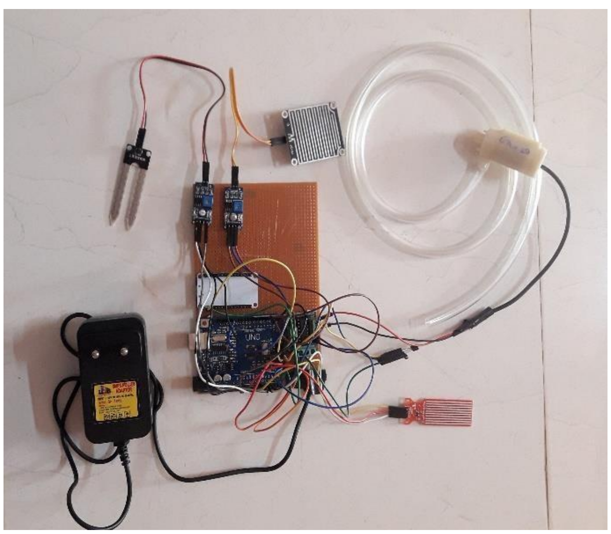

Fig.5. Hardware setup for Smart Irrigation

The smart irrigation system is a simple model based on IoT technology. It consists of a Cloud page which act as a user interface, an IoT device which helps in the real-time updation of information in the system. All the background works are handled by the IoT. The IoT device is connected to different sensors, which collects the status of various aspects on the plantation field and transfers the value to the IoT device.

The IoT Device used here is Arduino UNO and Wi-Fi ESP8266 module which helps to connect the system to the network. The information collected in the Arduino UNO from the temperature sensor, soil moisture sensor and humidity sensor are transmitted and saved in the Thingspeak via this network established using the Wi-Fi ESP8266 module. The soil moisture level sensor is placed in the soil. According to the sensor values we can detect whether the irrigation is happening or not. If the moisture level is found to be below the desired level, the moisture sensor sends the signal to the Arduino Uno which triggers the water pump to turn ON and supply the water to plant automatically. The values recorded by them are sent to the cloud. The status values are then updated in the Thingspeak. Farmers and gardeners who don't have enough time to water their crops/plants are the principal beneficiaries of this endeavour.

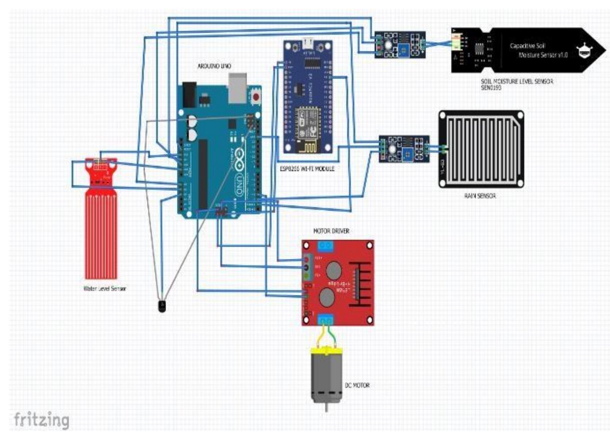

Fig.6. Circuit diagram of Smart irrigation

5. RESULT

The system is tested in real life conditions on a farm field for 30 days. The system works properly and sensed the soil moisture, rain and the control unit act accordingly to sensed data and control the water pump. All these sensors value are sent to ThingSpeak cloud. So that we can fetch it using the ThingSpeak tool free application on the mobile phone.

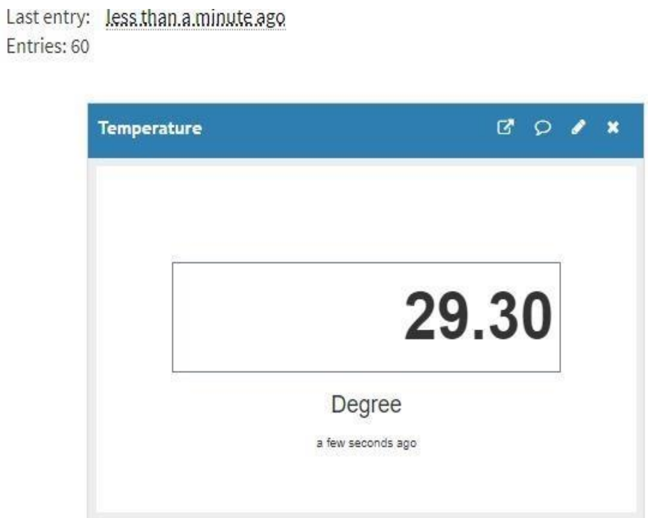

Fig.7. Sensor output of temperature

As shown in the Fig.7. Temperature sensor measures the amount of heat energy or that is generated by soil and the weather then it produces as digital output.

Fig.8. Sensor output of Soil Moisture

Soil moisture sensor measures the water content in the soil and can be used to estimate the amount of stored water in the soil horizon as shown in Fig.8.

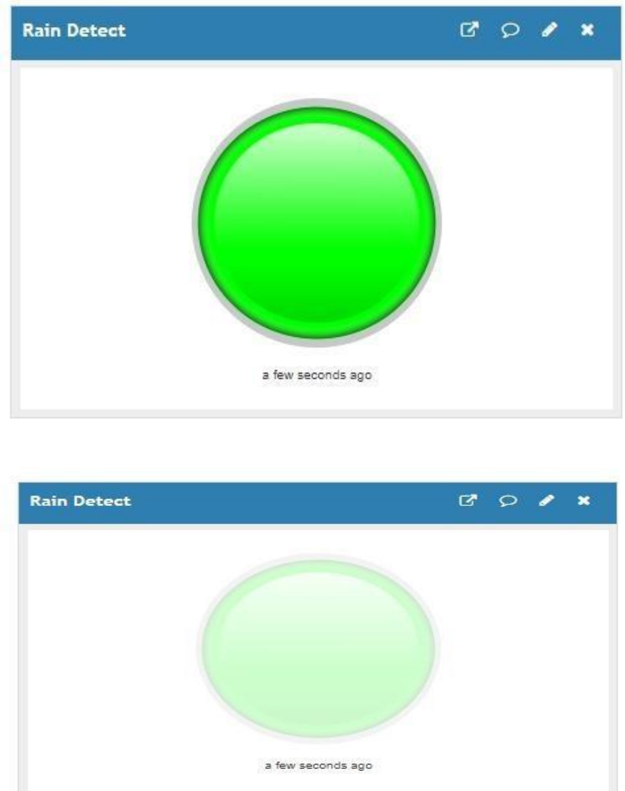

Fig.9. Sensor output of Rain detector

The rain sensor continuously checks for the rain. When rain begins to fall, the sensor detects it and sends a signal to the control unit, which then turns off the water pump or motor based on the sensor data.

Fig.10. Sensor output of water level indicator

Sensor measures the water level inside the tank and the moisture content of the soil.

6. CONCLUSION

The moisture content of the soil is an important factor to consider when designing a smart irrigation system. A variety of climatic factors influence soil moisture, including air temperature, air humidity, UV, soil temperature, and so on. Weather forecasting accuracy has improved dramatically as a result of technological advancements, and weather projected data may now be utilised to predict changes in soil moisture.

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