Smart Agriculture Irrigation System Using IOT (Internet of Things) Technology

Aman Meena (2K18/EE/020)
Electrical Engineering Department
Delhi Technological University

Abstract

In India, agriculture is the primary source of income. It has a significant impact on the country's economy. However, agriculture is being hampered these days as a result of people migrating from rural to urban areas. Monitoring environmental factors is not a complete strategy for increasing agricultural productivity. There are a number of elements that have a significant impact on productivity. As a result, automation in agriculture must be applied to address these issues. A farmer can save time, money, and energy by using an autonomous watering system. Traditional farmland irrigation methods necessitate human intervention. Human intervention can be reduced with irrigation equipment that is automated. Continuous sensing and monitoring of crops using Internet of Things (IOT) and making farmers aware of crop growth and harvest time on a regular basis, resulting in high agricultural productivity and ensuring the distribution of products to end users at the right location and time. To address this issue, we will employ a smart agriculture technology based on the Internet of Things (IoT). This project comprises sensors for collecting and processing field data, such as temperature, humidity, soil moisture, LDR, and rain detector. To remotely manage and monitor data from the sensors, these sensors are integrated with well-established web technology in the form of a wireless sensor network.

1. Introduction

Smart farming, which is based on IoT technology, allows growers and farmers to decrease waste and increase production in a variety of ways, from the amount of fertiliser used to the number of trips made by farm vehicles, as well as the effective use of resources like water and power. IoT smart farming solutions are a system that uses sensors to monitor the crop field and automate the irrigation system (light, humidity, temperature, soil moisture, crop health, and so on). Farmers can keep an eye on their fields from anywhere. They can also choose between manual and automated solutions for taking appropriate data-driven actions. For example, if the soil moisture level decreases, the farmer can deploy sensors to start the irrigation. Smart farming is highly efficient when compared with the conventional approach.

IoT have the potential to transform agriculture in many aspects. IoT devices in the agriculture industry will reach 75 million in 2020**,** growing 20% annually. At the same time, the global smart agriculture market size is expected to triple by 2025, reaching $15.3 billion (compared to being slightly over $5 billion back in 2016).

2. Literature Survey

Experts analysed the data to see if there was a link between environmental work and normal work yield. They are focused on agricultural monitoring; initial spatial data such as temperature and rainfall are gathered and analysed to reduce crop losses and boost crop yield. An irrigation automation system with an IOT-based crop-field monitoring system describes how to monitor a crop field. Sensors are used to create a system, and the irrigation system is automated depending on a server's decision based on sensed data. The sensed data is transferred to a web server database via wireless transmission. If the irrigation is automated, this implies that if the moisture and temperature fields fall below the possible range, the irrigation will be turned off. With the help of a programme that provides a web interface, the user can monitor and operate the system remotely.

Profs. K.A. Patil and N.R. Kale suggest a smart irrigation concept based on ICT (Information Communication Technology). The comprehensive real-time and historical environment is expected to aid in resource management and use. GPS-based remote

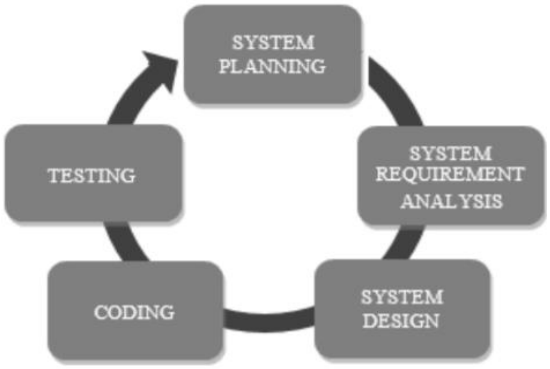
controlled monitoring, moisture and temperature sensing, intruders scaring, security, leaf wetness, and proper irrigation facilities are all aspects of the IOT-based Smart Agriculture Monitoring System.

Mohammad shareef Mekala, Dr.P.Viswanathan demonstrated some typical application of Agriculture IOT Sensor Monitoring Network Technologies using Cloud computing as the backbone.

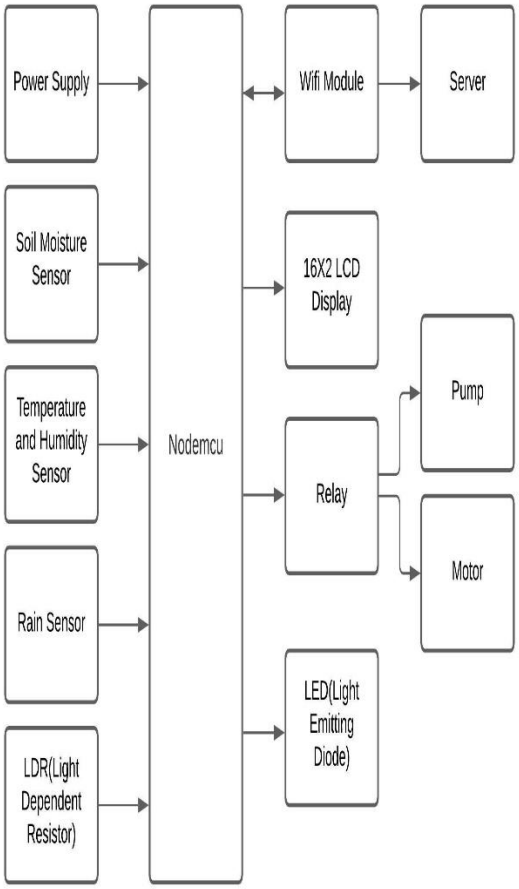
Prathibha S.R., Anupama Hongal Jyothi M.P. Created monitoring temperature and Humidity in agriculture field through sensor using CC3200 Single chip. Camera is interfaced with CC3200 to capture images and send that pictures through MMS to farmers mobile using Wi-Fi**.**

3. Project Methodology

A case-study approach was adopted to conduct this exploratory project. The methodology used in this project is the System Development Life Cycle Model (SDLC). The phases involved in the SDLC are; system planning, system requirements analysis, system design, coding and testing of the system.

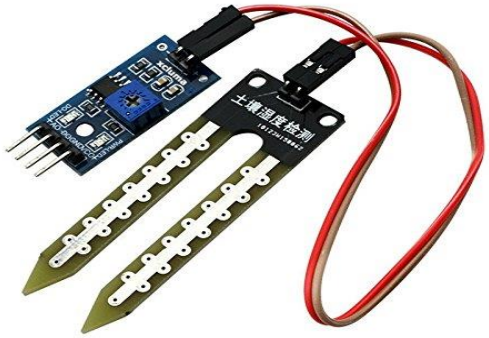


4. Block Diagram



5. Hardware Used

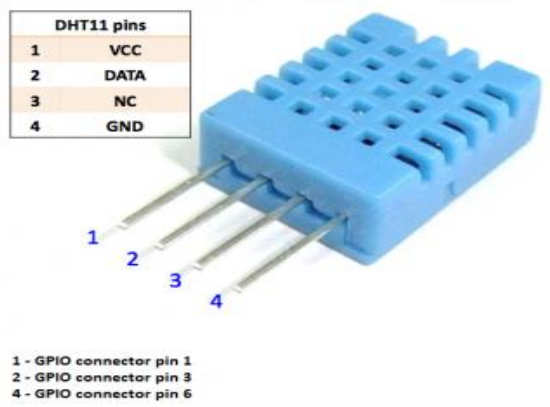
Soil Moisture Sensor



The volumetric water content in soil is measured by soil moisture sensors. Because direct gravimetric measurement of free soil moisture necessitates the removal, drying, and weighing of a sample, soil moisture sensors indirectly measure the volumetric water content by using another property of the soil as a proxy for the moisture content, such as electrical

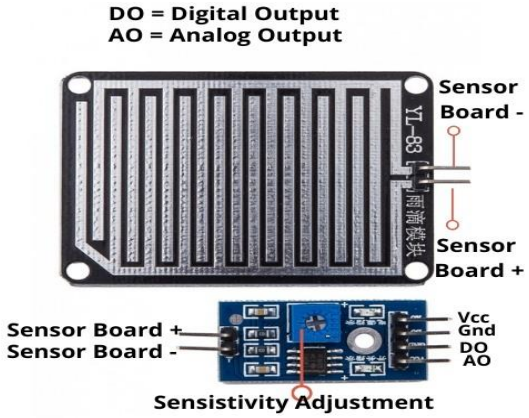
resistance, dielectric constant, or neutron interaction.
The relationship between the measured property and soil moisture must be calibrated, and it can change depending on environmental conditions including soil type, temperature, and electric conductivity. The soil moisture affects reflected microwave radiation, which is employed for distant sensing in hydrology and agriculture. Farmers and gardeners can use portable probing tools.

Temperature and Humidity Sensor (DHT11)



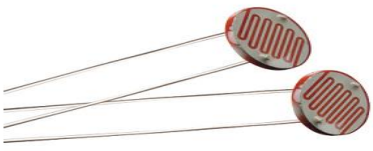
The DHT11 digital temperature and humidity sensor is a composite sensor with a calibrated digital temperature and humidity signal output. The temperature and humidity sensor technology, as well as dedicated digital module collection technology, are used to assure the product's high dependability and long-term stability. The sensor is coupled to a high-performance 8-bit microcontroller and comprises a resistive wet component sense and an NTC temperature measurement device.
VCC, GND, and DATA are the only three pins that can be used. The communication process starts when the DATA line sends start signals to DHT11, which DHT11 receives and responds with an answer signal. After receiving the response signal, the host begins receiving 40-bit humidity data (8-bit humidity integer + 8-bit humidity decimal + 8-bit temperature integer + 8-bit temperature decimal + 8-bit checksum).

Rain Sensor



Nowadays, conserving water as well as its proper usage is essential in everyone's life. Here is a sensor namely rain sensor which is used to detect the rain and generate an alarm. So, we can conserve water to use it later for different purposes. There are several methods available for conserving water like harvesting, etc. Using this method we can increase the level of underground water. These sensors are mainly used in the field like automation, irrigation, automobiles, communication, etc.
The rain sensor's operation is straightforward. The sensing pad consists of a series of uncovered copper lines that function together as a variable resistor or potentiometer. The resistance of the sensor pad will alter in response to the amount of water dropping on its surface. As a result, the resistance is inversely proportional to the amount of water present.
When there is more water on the sensor pad, the conductivity improves and the resistance decreases. Similarly, when there is less water on the surface pad, the conductivity is poor and the resistance is high. As a result, the resistance has a significant impact on the sensor's output.

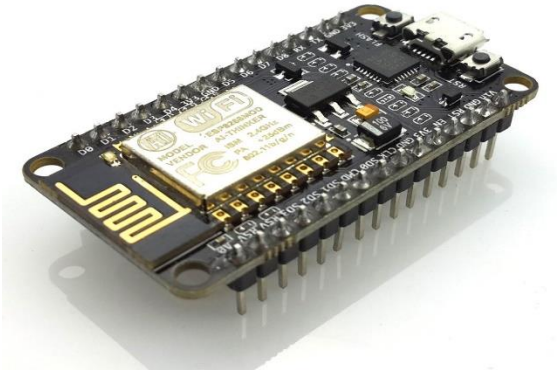
Light Dependent Resistor (LDR)



Photoresistors, also known as light dependent resistors (LDRs), are light-sensitive devices that are commonly used to detect the presence or absence of light, as well as to measure the intensity of light. Their resistance is quite high in the dark, sometimes up to 1 M, but when

exposed to light, the resistance reduces rapidly, perhaps down to a few ohms, depending on the light intensity. LDRs are nonlinear devices with a sensitivity that varies with the wavelength of the light applied. They are employed in a variety of applications, but other devices such as photodiodes and phototransistors are often used to fulfil the light sensing function. Some countries have banned LDRs made of lead or cadmium over environmental safety concerns.

Nodemcu



NodeMCU is an open source Lua based firmware for the ESP8266 WiFi SOC from Espressif and uses an on-module flash-based SPIFFS file system. NodeMCU is implemented in C and is layered on the Espressif NON-OS SDK.
The firmware was initially developed as is a companion project to the popular ESP8266-based NodeMCU development modules, but the project is now community-supported, and the firmware can now be run on any ESP module.

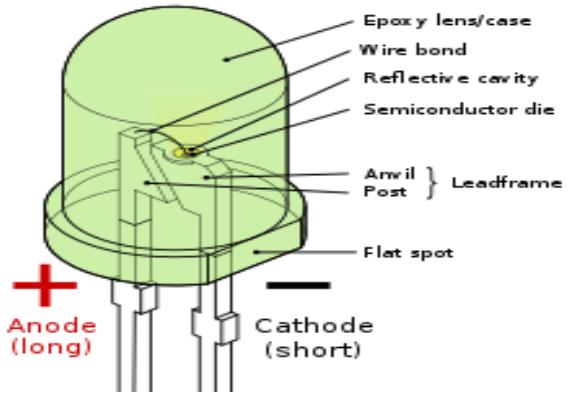
Relay

If you are from the electronics field, this word must be prevalent and if you are not, let us tell you all about it! Relays are switches that are used to close and open circuits both electronically and electromechanically. It regulates the opening and shutting of an electrical circuit's circuit connections. The relay is not energised with the open contact when the relay contact is open (NO). If it is closed (NC), however, the relay is not energised due to the closed contact. When energy (electricity or charge) is supplied, however, the states are more susceptible to change.

DC Motor(with Fan)

A DC motor is an electric motor that runs on DC (direct current) (unlike an induction motor that operates via an alternating current). DC electrical energy is converted into mechanical energy by a DC motor.
When a current-carrying conductor is put in a magnetic field, it is subjected to torque and tends to move.
In other words, a mechanical force is created when a magnetic field and an electric field interact. That is how a DC motor, often known as a direct current motor, works. This is referred to as "motoring activity."
Fleming's left hand rule states that if the index finger, middle finger, and thumb of your left hand are extended mutually perpendicular to each other and the index finger represents the direction of the magnetic field, the middle finger represents the direction of the current, and the thumb represents the direction in which force is experienced by the shaft of the DC motor, then the thumb represents the direction in which force is experienced by the shaft of the DC motor.

Light Emitting Diode (LED)



A light-emitting diode (LED) is a semiconductor device that generates light when an electric current is conducted through it in its most basic form. When the current-carrying particles (known as electrons and holes) collide within the semiconductor material, light is created.

LEDs are solid-state devices because light is created within the solid semiconductor material. The name "solid-state lighting," which includes organic LEDs (OLEDs), distinguishes this type of lighting from others that employ heated filaments (incandescent and tungsten halogen lamps) or gas discharge (fluorescent lamps).

Pump

A pump is a mechanical device that propels fluids (liquids or gases), or sometimes slurries, by converting electrical energy into hydraulic energy. Pumps are divided into three categories based on the technique of fluid movement: direct lift, displacement, and gravity pumps.

Pumps use energy to produce mechanical work (usually reciprocating or rotational), and they consume it to move the fluid. Pumps can be powered by a variety of sources, including human work, electricity, engines, or wind power. They can come in a variety of sizes, ranging from microscopic pumps for medical applications to massive industrial pumps.

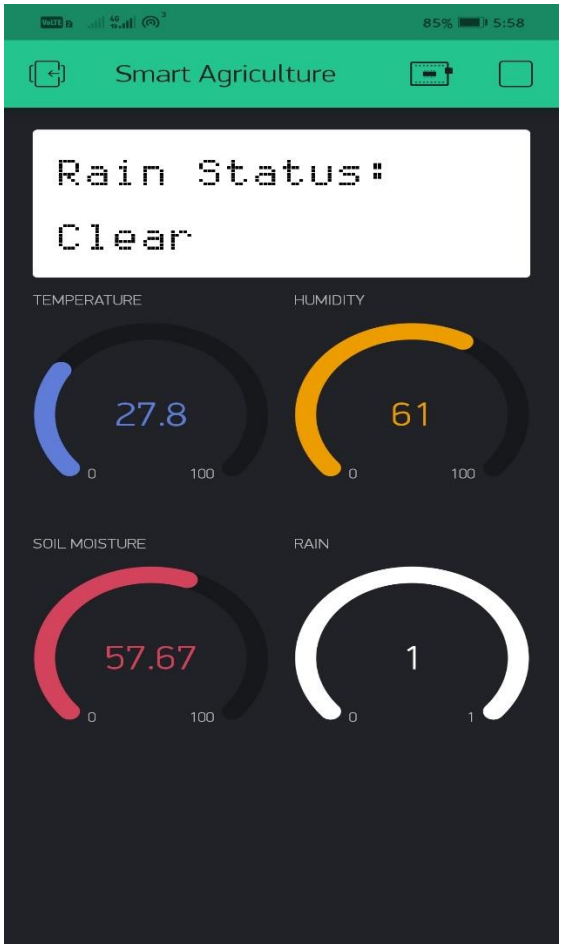
6. Implementation

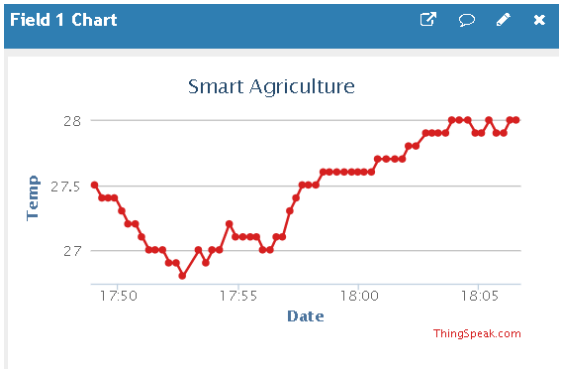
In smart agriculture, the Internet of Things (IoT) plays a critical role. Sensors in the Internet of Things can provide information on agricultural lands. We've proposed an automated IoT and smart agriculture solution. This IoT-based agriculture monitoring system employs wireless sensor networks to collect data from various sensors installed at various nodes and transmit it via wireless protocol. Temperature sensor, Moisture sensor, Rain sensor, LDR (Light Dependent Resistor), LED (Light Emitting Diode), Water pump, and DC motor are all part of this smart agricultural employing IOT system, which is driven by Nodemcu. The temperature, humidity, and moisture levels are checked when the IoT-based farm monitoring system is turned on. It provides data about the levels to the IoT cloud and a phone app. Sensors detect the level of moisture in the air, and if it falls below a certain threshold, the water pump is immediately activated. If the temperature rises above the set point, the fan will turn on. In addition, if it is raining and there is no sunshine, it will automatically switch to LED since the LDR detects that there is no light. This all is presented on the LCD display module. This all is also visible in IOT where it gives information about Humidity, Moisture and Temperature with date and time, based on per minute. Temperature can be controlled to a specific level depending on the type of crops grown. If we wish to firmly close the water on IOT, there is a button provided from which the water pump can be halted. This system is very useful in Farms, gardens, home etc. This system is completely automated and there is no need for any human intervention.

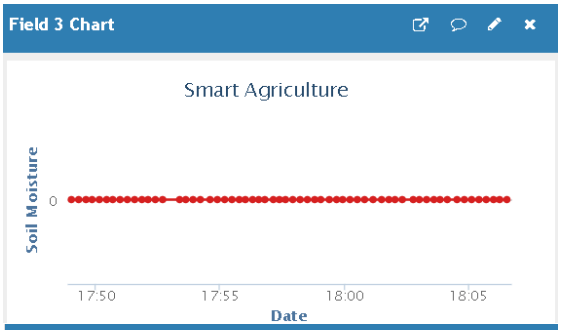
7. Results

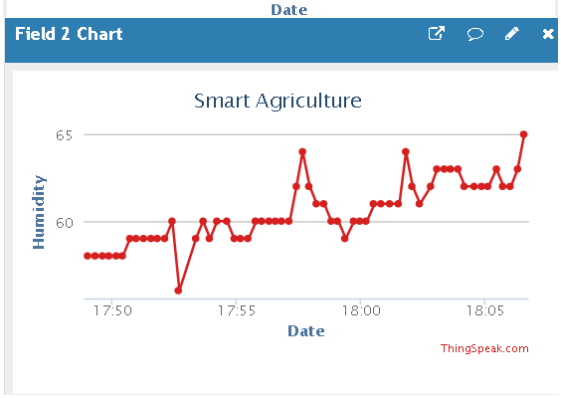
The server or we can say IOT cloud will start displaying the Soil Moisture, Rain Status, Air Humidity, and Air Temperature as soon as we turn on the device. It displays real-time data. When the soil moisture content drops below a certain level, the water pumps kick on and irrigate the field until it reaches the desired level of moisture. Also, if the temperature and humidity drop, the dc fan will kick on and begin chilling the crops on the field. Also, if the LDR

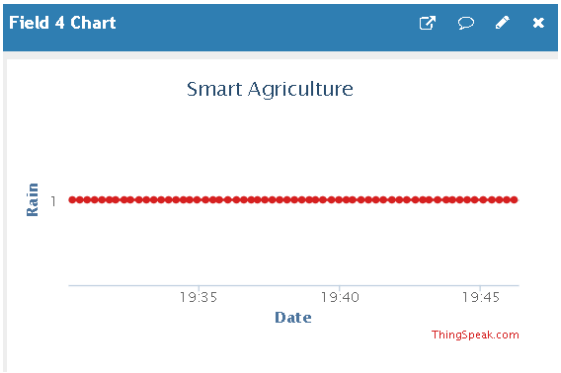
detects that there is no light, the LED will switch on automatically until sunlight is detected by the LDR. Using Thingspeak Server and Blynk App, we can monitor data from anywhere in the world.. To do that, go to the private view of the Thingspeak server and Blynk App. You can check the soil Moisture, Humidity, and Temperature as well as relay status.











8. Conclusion

This paper describes automated irrigation system using IOT. The combination of the internet of things and cloud computing creates a system that effectively controls the agriculture sector. This system will detect all environmental characteristics and transmit the information to the user via the cloud. These are the graphs or data which we obtain from Thinkspeak Server. The user will take control action in accordance with it, and this will be done with the help of an actuator. This asset enables the farmer to improve the cultivation in the manner required by the plant. It results in a larger crop output, a longer production period, better quality, and the use of fewer pesticides.

9. References

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