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Automatic Plant Irrigation System Using IoT

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ABSTRACT :

The Internet of Things, or IOT, is a shared network of objects that may communicate with one another as long as they have an internet connection. By 2050, the agriculture sector—which provides food for 9.6 billion people—will rely heavily on IOT. By using fertilizer efficiently and reducing waste, smart agriculture raises crop yields. In this study, a method to automate the irrigation system and monitor the crop field using a sensor (soil moisture) is built. If the field's moisture content drops below the brink, the irrigation is turned on automatically. This methodology is more effective than the traditional one and will be more helpful in places where water is scarce.

Keywords :- IOT Technology , NodeMcu , Soil Moisture Sensor, DHT-11 Sensor, Relay Blynk App

Introduction :-

Throughout India, agriculture is vital to the country. The scope of agriculture has decreased as a result of the abrupt change in climate and decreased rainfall throughout India. The goal of cultivation should be optimum output with little water waste. The conventional method irrigates the ground with more water than is necessary for the crop. Modern irrigation systems, such sprinkler and drip irrigation, can reduce the amount of water wasted. However, this intelligent irrigation system may prevent over-watering by using physical labor, meaning it provides perfect irrigation of the area. A sophisticated irrigation device's design and implementation were widely decided in various scenarios, with the electric device exhibiting the most dependable price performance.

In actuality, the ingenious irrigation gadget offers more advantages than the traditional irrigation methods. It helps farmers irrigate and feed their crops with the right amount of water and fertilizers by using useful technologies. A reasonable irrigation system is easy to install on a relatively small piece of land, therefore the amount of work required is also minimal. Soil sensors are required for this system, based on the size of the agricultural land. By using the readings from different soil sensors, it is possible to irrigate the field uniformly and prevent issues like water waste and uneven irrigation. Remote operational systems monitor and control equally irrigated land. The Android mobile device can be used to accomplish the different modes of operation.

It has a bidirectional communication link and a microcontroller. IoT is crucial to the system's and farmers' communication. They are able to access the user interface through the usage of Android mobile applications. The development of the hardware and software for the farmer's irrigation system is this paper's greatest contribution. The goal of this paper's proposed solution is to completely automate irrigation in place of manual labor. Additional sensors are needed for this system based on the size of the farmer's land. With the help of this system, farmers can now monitor the health of their crops year-round by logging into the mobile app and checking the irrigation system's status with their unique user ID.

Because it uses so little power, the system can connect to a micro UPS in the event of a power outage. Alternatively, once the power is restored, the system will immediately connect to Wi-Fi and begin running. The microcontroller receives the values from the sensors. This data will be transmitted by the microcontroller to the cloud, which is linked to the mobile application. The values are compared to the reference values to generate an error signal, which is then communicated to the webpage and mobile app.

By using this, farmers can remotely monitor the irrigation system's condition and accurately determine how much water and fertilizer the crops actually need. By doing this, farmers can produce a large amount of crop material with little investment in water and fertilizer.

3 COMPONENTS REQUIRED :-

1. **Soil Moisture Sensor :-**

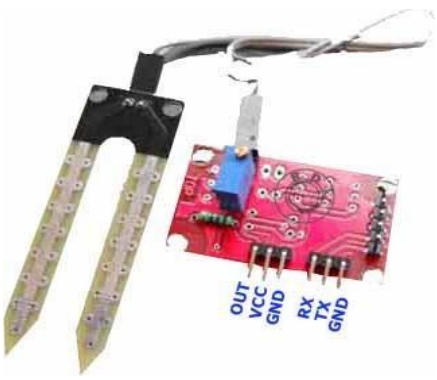

Fig 1. Soil Moisture Sensor

This sensor can be used to measure soil moisture content; if there is a water deficit in the soil, the output of the module is high; otherwise, it is low. This sensor allows one to water a flower plant or any other plant that needs to be watered automatically. The module has three output modes: serial output with precise readings, more accurate analog output, and straightforward digital output.

2. ESP8266 NodeMCU :-

The ESP8266 NodeMCU is a well-liked option for embedded and Internet of Things systems because it is a flexible microcontroller board with affordable prices and strong capabilities. Its integrated WiFi module allows it to be designed to seamlessly connect to wireless networks. For IoT applications, connectivity is essential since it allows devices to exchange data and communicate with one another online. Its interoperability with the Arduino IDE, which makes programming easier by enabling developers to use the well-known Arduino programming language and libraries, is one of its best features. It also includes a USB-TTL converter, which makes it easy to use for debugging and programming. The NodeMCU provides flexibility in attaching different types of sensors, displays, and other peripherals because to its assortment of GPIO pins. Its flexibility is necessary to customize Internet of Things solutions. Designed initially for NodeMCU firmware, this board comes with extra features and support for more advanced capabilities.

The NodeMCU has a lot of flash memory for its compact form size, which is enough to store enough data and code. For projects with limited area, its compact size is ideal. The NodeMCU is also incredibly inexpensive, which makes it a viable option for developers and enthusiasts wishing to integrate IoT projects without going over budget.

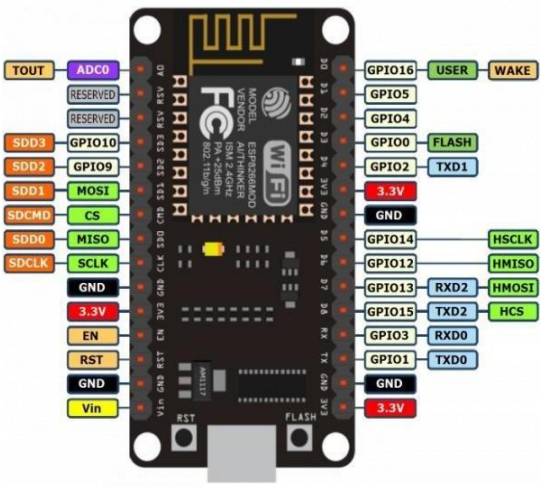

Fig 2. ESP8266 NodeMCU

3. DHT11 Sensor:-

The combined temperature and humidity sensor, the dht11 sensor, usually outputs data in either digital or analog format. It includes details like the humidity level in the surrounding air and the temperature around the plant, indicating whether it needs more sunlight. By measuring the electrical resistance between the two electrodes, water vapor can be found.

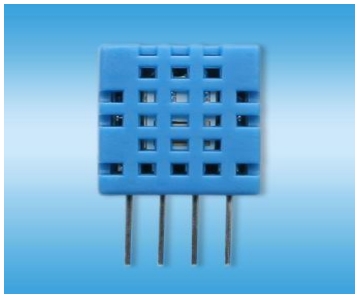

Fig3. DHT11 Sensor

The electrode and substrate, which are in charge of holding onto moisture while in contact with the surface, make up the humidity sensing component. It is the substrate that releases ions. As soon as it absorbs water vapor, the conductivity between the electrodes increases. The dht11 sensor's calibration result is quite precise. There is a vast array of applications for the DHT11 sensor due to its compact size and low power consumption. Additionally, it is capable of sending signals up to 20 meters away. We used a four-pin single row pin box as the product.

4. Connecting Wires

Since they enable the establishment of electrical connections between different components, connecting wires are crucial parts of electronics and electrical applications. Usually composed of conductive materials like copper or aluminum, they are available in different gauges and lengths to meet different requirements. In order to guard against environmental elements like heat and moisture and to avoid electrical shorts, these cables are frequently insulated. It is simpler to connect components correctly because of their color-coding, which aids in identifying the purpose of each wire. There are many uses for connecting wires, ranging from straightforward circuit connections to intricate wiring in commercial and residential environments.

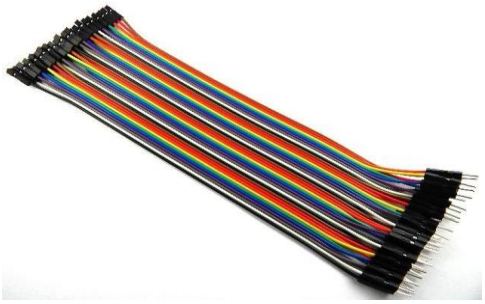

Fig4. Connecting Wires

5.Relay:-

Within a relay is a core that has a coil of copper wire wrapped around it. The normally closed (NC) terminal and the switch (armature) are in contact under typical circumstances. Applying power causes the coil to become like a magnet, drawing the armature to the normally open terminal (NO) and creating an electromagnetic field. Relays are little more than that at their most basic. Apart from that, there are numerous additional kinds of relays, including thermal and solid state relays, which all have different mechanisms of operation but accomplish the same thing. This part controls the flow and temperature of the tiny DC pump that waters the plants automatically.

6.Blynk App :-

Using IOS and Android apps, Blynk is a platform that lets you use the Internet to control devices like Arduino, Raspberry Pi, and others. You can construct a graphical user interface for your project by dragging and dropping widgets on this digital dashboard. You can make your own apps with a tool called Blynk. Either one project or several projects can use it. Any project can integrate virtual LEDs, buttons, value displays, and even a text terminal, in addition to allowing interaction with one or more devices.

BLOCK DIAGRAM AND WORKING

Upon turning on the system, the Nodemcu board establishes a connection with the Blynk app through the Blynk cloud and internet. The soil moisture levels are then shown on the LCD and the Blynk app interface. We can also turn the relay module on and off using the button that was generated in this Blynk app. In other words, a water pump that is linked to the relay module has the ability to be turned on and off.

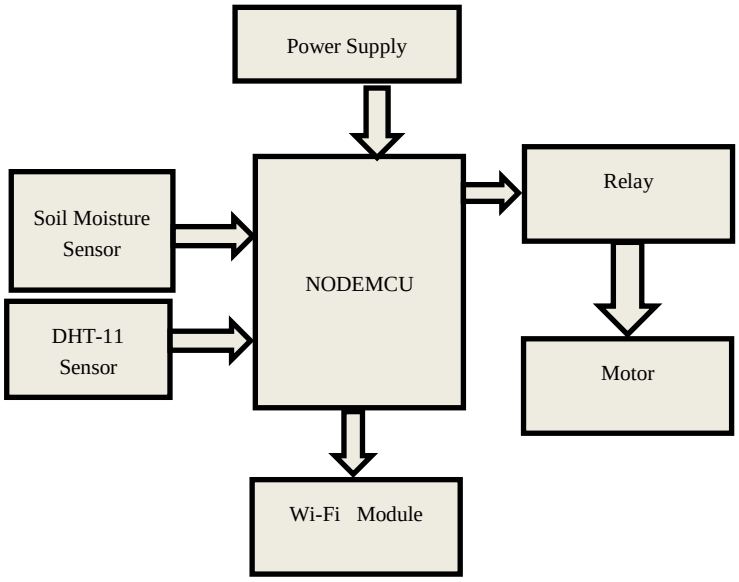

Fig 5. Block diagram

APPLICATIONS

1) Beneficial in parks and open spaces.
2) Extremely effective in rice and paddy crops.
3) Field irrigation.

BENEFITS INCLUDE

1) A rise in output
2) Use less water; 3) Be safe
4) No human resources needed

CONCLUSION

With less manure needed, this technique has increased crop growth rate while decreasing water waste. Farmers can receive notifications via IoT and Android applications regarding crop health, crop requirements for water and fertilizer, and crop condition overall. It is possible to communicate remotely between the user and the system. Farmers are able to alter their operating mode from anywhere at any time. A lone farmer may confirm that every field is linked to his login ID. The agricultural sector loses manpower as a result of this approach. With the help of the mobile app and website that are offered, farmers can effortlessly monitor and control the irrigation system.

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