

# IoT Based Soil Monitoring and Water Pumping

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**Abstract:** In developing country like India agriculture plays an important role in economy. The main purpose of this project is to provide IoT based system for soil monitoring and water pumping to reduce the manual monitoring of the field and get the information via mobile application i.e Blynk IoT . The system is proposed to help the new Farmers who are not used to farming to increase the agricultural production. The soil is tested using various sensors such as moisture sensor, temperature sensor, and humidity sensor. Based on the result, the farmers can cultivate the appropriate plants that suits the soil. The obtained sensor values are sent to the field manager through the Wi-Fi development board and the crop suggestion is made through the Blynk app. Automatic irrigation system is carried out when the soil temperature is high or moisture is low. The readings are sent on Blynk application so that one individual can analyze the previous levels of temperature and moisture.

**Keywords:** IoT, Soil, Moisture and Temperature sensors, Relay, Wi-Fi module ESP8266.

## I. INTRODUCTION

As we know that Technology is advancing day-to-day but it's also important to focus on agriculture. Many researches are done in the field of agriculture and they also signify the use of wireless sensor like Temperature sensor, Humidity Sensor, Moisture Sensor. In irrigation sometimes more water is being irrigated due to human mistake which may lead to spoiling of crop. Monitoring soil moisture and taking necessary actions will optimize use of water. The benefits of optimizing irrigation scheduling with soil moisture sensors includes increasing crop yields, saving water, protecting local water resources from runoff, saving on energy costs, saving on fertilizer costs and increasing the farmer profitability.

### A. Existing System

Nowadays, Almost all farmers are using traditional ways for watering their farms. So, There's always a possibility that error can occur if farmer forgot to switch off then by overwatering of plants the crops/plants can get spoiled that will lead to loss of whole farm.

### B. Disadvantages

- 1) As Human cannot remember all things so there's always an possibility that Farmer can forget to switch off the water sprinklers.
- 2) There's always a person has to be their to see that whether Watering is needed or not.

### C. Proposed system & It's Advantages

This paper describes a real-time soil monitoring for the agriculture farmlands and home gardens to provide optimal and integrated data collections from crop fields and gardens. Real-time monitoring provides reliability, timely information of crop and soil status plays an important role in the decision making in the crop production improvement. Agriculture depends on many parameters of plants to give better yields such as soil parameters, climatic parameters so on. Here the system which is designed to collect the data set for major parameters such as temperature, humidity, soil moisture of the fields and plants. The system consists of DHT11 Sensor, soil hygrometer, MQ-135 sensor and DC motor.

### Advantages:

- 1) Good accuracy in medium to fine soils due to their fine-sized particle similar to its inner granular matrix.
- 2) Ability to read soil volumetric water content directly.
- 3) Direct water potential reading for irrigation scheduling.
- 4) Continuous measurements at same location.

## II. Literature Review

We have gone through many previous works done in this field by different researchers. Use of technology in the field of agriculture plays important role in increasing the production as well as in reducing the manpower efforts and accidental mistakes.

A Review paper IoT Based Plant Monitoring System[2] shows, In India about 35% of land was under reliably irrigated. And the 2/3rd part of land is depending on monsoon for the water. Irrigation reduces dependency on monsoon, improves food security and improves productivity of agriculture and it offers more opportunities for jobs in rural areas.

Farmers are facing problems related to watering system that how much water has to be supplied to plant so that plant makes adequate growth and at what time? Sometimes overwatering causes the damage to crops, plants and as well as wastage of water. Hence for avoid such damage we need to maintain approximate water level in soil which can be achieved our system.

A Review paper Internet of Things and Node MCU explains that prototype is the first, step in building an Internet of Things(IoT) product. An IoT system consists of user interface, hardware devices including sensors, actuators and processors, backend software and connectivity. IoT development board is used for prototyping. IoT (WiFi) development board contain low-power processors which support various programming environments and may collect data from the sensor by using the firmware and transfer raw or processed data to an local or cloud-based server. we have selected NodeMCU as it's an open source and LUA programming language based firmware developed for ESP8266 wifi chip.

### A. Related Work

The process of monitoring the agricultural land , percentage moisture in the soil and other factors are has been proposed by many researchers. N.K.Choudhari and Mayuri Harde proposed an cost effective automated irrigation system which can effectively monitor and send the details regarding all the factors like (Temperature, Humidity, Moisture) that affect the growth of the plant. A.M.Ezhilazhahi and P.T.V. Bhuvaneshwari focused on organic farming and they have used the Remote monitoring system where by using the event detection algorithm the event will be generated depends upon the condition is satisfied. Judika Herianto Gultom et al focused on the factors that affect the chili plant , the information received from the sensor is processed and according to that appropriate measures are taken to have a better growth. Mustafa Alper Akkasa and Radosveta Sokullub proposed an system based on IOT for measuring the humidity level in Real time and the measured information will be send through the communication module, so that improvement can be achieved in the next set of farming

process and process will be interactive. K.Lakshmi and S.Gayathri by receiving the images of plant processing is performed and the result is used to identify the current growth of the plant and whether it is affected by any pesticides or by any other external problems, they have achieved a better result in terms of identifying the condition of the plant.

### B. Components

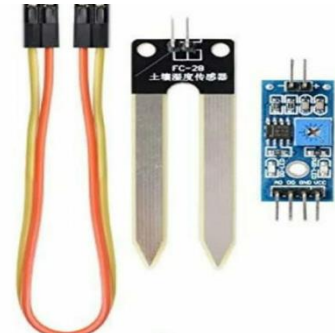
#### 1. Nodemcu ESP8266



NODEMCU ESP8266

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support was added for the ESP32 32-bit.

#### 2. Soil Moisture Sensor



Soil Moisture Sensor

Soil Moisture sensor consists to two module one is sensor module and other is Soil Hygrometer for sensing moisture present in soil. These meters have been proved to be very helpful for the gardeners, as they guide them when one should start or stop hydrating their plants and prevent overwatering plants.

#### 3. Relay Module



Relay Module

**Understanding 5V Single-Channel Relay Module** The single-channel relay module is much further than just a plain relay, it contains factors that make switching and connection easier and act as pointers to show if the module is powered and if the relay is active.

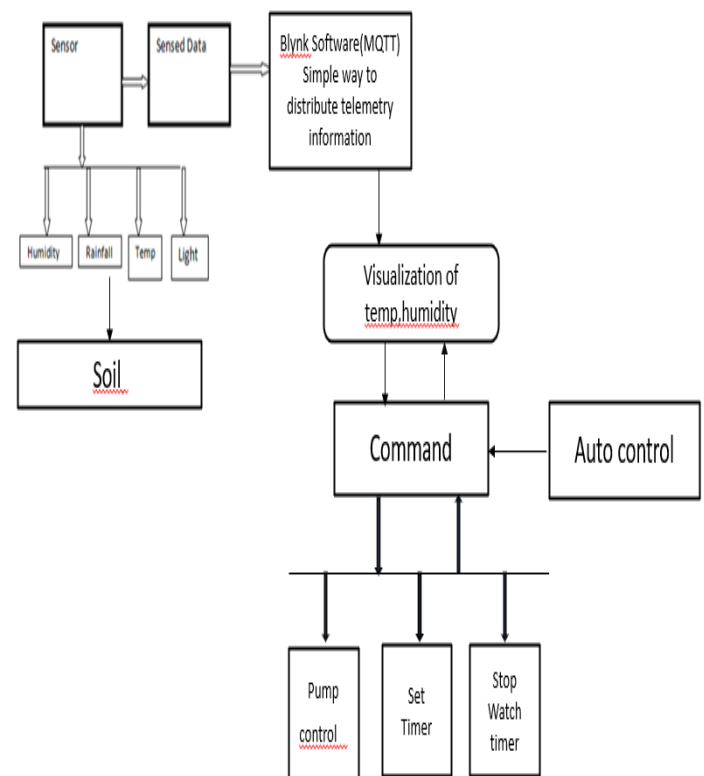
### III. Implementation

The global population is predicted to touch 10.2 billion by 2050 – this poses a big problem for the agriculture industry as number of people will increase but amount of soil won't. Despite combating challenges like extreme weather conditions, rising climate change, and farming's environmental impact, the demand for more food has never decreased. To meet these increasing needs, agriculture has to adopt to new technology. New smart farming applications based on IOT technologies will enable the agriculture industry to reduce accidental damage and enhance productivity. It is the application of IoT in agriculture which will help farmers to enhance productivity and quality. In IOT based smart farming, a system is built for monitoring the crop field with the help of various sensors like light, humidity, temperature, soil moisture, etc. The farmers can monitor the field conditions from anywhere through a mobile application. Soil moisture sensors measure the moisture content in soil. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners so that it won't be a tedious task to carry it. Soil moisture sensors aid good irrigation management. Good irrigation management gives us better crops, uses fewer inputs, and increases profitability and reduces manual intervention. Soil moisture sensors help farming individual to understand what is happening in the root zone of a crop. Water source is necessary and an important factor in agricultural and plantation and farm production is basic need of us. Monitoring water level of a water source, such as water tank or bore well etc., plays a key role in agricultural as water is the basic need of each and every plant and crop. It also plays a role in water management. Keeping track of water level in a water source can be used to preserve water and to study the water usage by plants. Thus monitoring water level is a topic of concern in agriculture. In this prototype experiment of the proposed system NODE MCU wifi board which will connect to wifi for internet purpose. In this prototype we have also used moisture sensor, DHT 11 sensor which help to gather information about temperature and humidity.

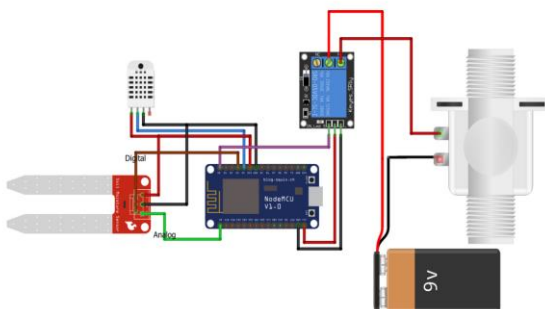
In above circuit diagram 9V Battery acts as energy source for all components like solenoid water valve, nodemcu ESP8266, Relay Module. One terminal of Battery is being connected to solenoid valve and other is connected to Relay Module. Soil Moisture sensing probe consists of two header pins which are internally connected to two copper tracks. Sensor module consists of 4 pins VCC,A0,D0,GND and 2 sensor input pins.

Relay Module consists of three output terminals which are NC,NO,COM and three input headers which are GND, 5V, IN. COM is connected is connected to one of the terminal of battery and NO is connected to another terminal of solenoid valve.

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System Architecture

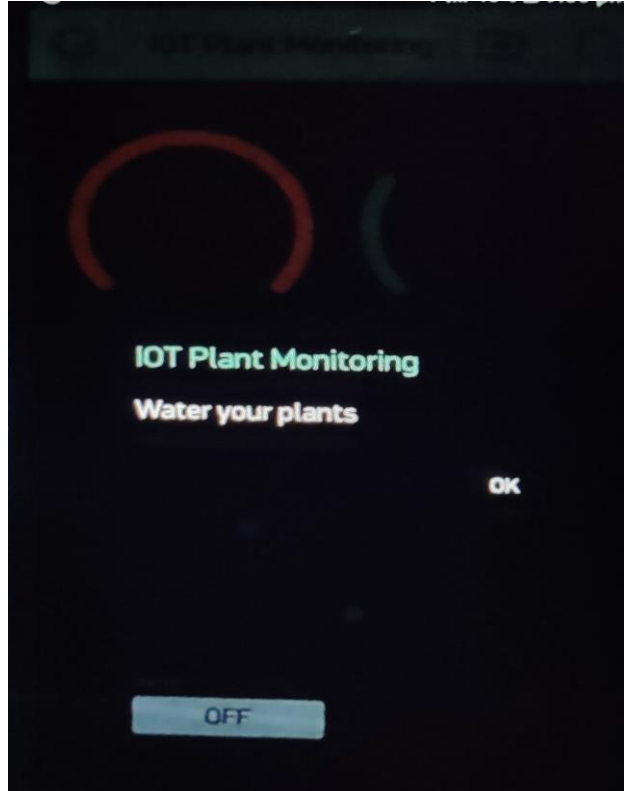


Circuit Diagram

## VI. Working

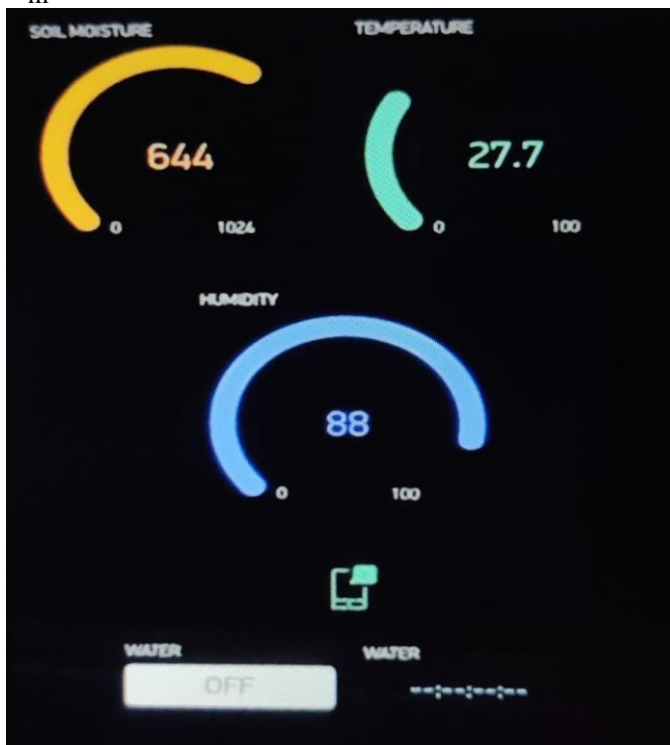
### A. Notification:

When sensor is placed in dry soil then an notification is shown as **Water Your Plants.**



### B. Reading:

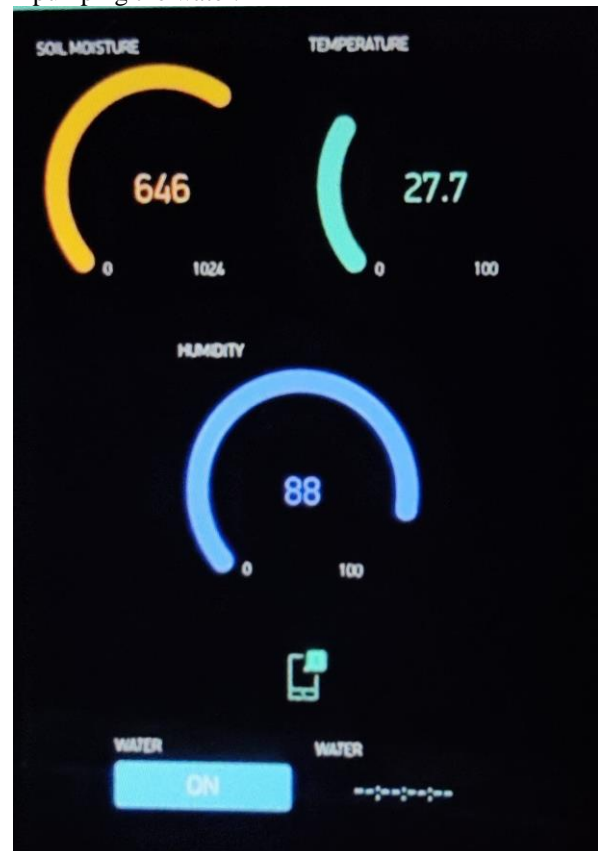
When soil sensor is placed in soil i.e place where m



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### C. Water pumping

Whenever water button is switched to on then it will start pumping the water.



## Conclusion

A system to monitor temperature, humidity, moisture levels in the soil was designed and the project provides an opportunity to study the existing systems, along with their features and drawbacks. Agriculture is one of the most water consuming activities. The proposed system can be used to switch the motor (on/off) depending on favourable condition of plants i.e., sensor values, thereby automating the process of irrigation. which is one of the most time efficient activities in farming, which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through Front End Structure. By this work, the wastage of water and the consumption of power by motor can be reduced so that they are conserved for the future use. Through this project it can be concluded that there can be considerable development in farming with the use of IOT and automation.

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