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# IOT Based Smart Irrigation System using Soil Moisture Sensor and Esp8266nodemcu

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***Abstract:*** The key objective of the paper is to monitor the soil moisture content during its dry and wet conditions with the aid of a moisture sensor ,an automated water inlet setup which can also monitor and record temperature, humidityetc. It controls the irrigation of Plants automatically where the need for human intervention can be reduced

As water supply is becoming scarce in today's world there is an urgency of adopting smart ways of irrigation The project describes how irrigation can be handled smartly using IOT. This project aims to save time and avoiding problems like constant vigilance. It also helps in conserving water automatically providing water to theplants/fields depending on the water requirements this system can also prove to be helpful in agricultural parks and lawns. The objective system is to detect the moisture content of the soil and depending upon its sprinkling of water. This entire information will be sent to the user's mobile phone. The smart irrigation system was developed to optimize water use of crops.

The system has a distributed wireless network of soil-moisture temperature sensors placed in the root zone of the plants. Also, a gateway unit handles sensor information, triggers, actuators, and transmits data to the web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quality the system was proved. The systemwas powered by solar panel and it has a duplex communication link based on a cellular network.

*Keywords:* Soilmoisturesensors, IoT, Arduino,Android,Microcontroller,duplexcommunication.

## 1. INTRODUCTION

Agriculture is considered as the basis of life for us as it is the main source of food and other raw materials. It plays vital role in the growth of country's economy. Growth in agriculturalis necessary for theeconomic development condition ofa country. The system designed to irrigate at a time of regular intervals for predefinedperiod of time. n this technique, moisture sensor are placed at the root zone of the plant and near the gateway unit handles the sensor information and transmit data to the controller which in turn control the water pump.The system is used in many processes factors likesoil moisture, salinity, humidity, temperature, intensity etc.

This needs to repeat the task and have to work in abnormal weather conditions. Soil has to overcome the flaws in the irrigation system, the land based on the soil humidity and at the same time the status of irrigation is updated. The main objective isto applythe systemfor improvementof health ofthesoiland hence theplant via multiple sensor. Appropriate soilwaterlevelisanecessarypre-requisiteforoptimumplantgrowth.Also,waterbeinganessentialelementforlife sustainable, there is vast necessity to avoid Its undue usage. Irrigation is a dominant consume of water. This calls for the need to regulate water supply for irrigation purpose. Fields should neither be over-irrigated nor under- irrigated. The objective of thisthesis is to designa simple, easy to install methodologyto monitor and indicate the level of soil moisture that is continuously controlled in order to achieve maximum amount of water in the land environment.

## 2. LITERATUREREVIEW

### 1. *Soilmoisture,Temperature,Humidity,Gas[1]*

Soil moisture is the water stored in the soil and is affected by precipitation, temperature, soil characteristics and more. As moisture availability decline, the normal function and growth of plants are disrupts and crop yields are reduced. Asclimate changes, moisture availability is becoming more variable. Since moisture is critical and water weather prediction and numerous sensitivity studies investigating the impacts of soil moisture initialisation.

Plants need four things to survive : light, water, soil and air. However ,to raise healthyplants, the most important element is the effect of water Respiration in plants

The Arduino Uno can be programmed to analyze some signals from sensors such as moisture, temperature andhumidity.A pump is used to pump the water to fertilize and water the plants. This research work enhance to help thesmall-scale areas cultivators will be increased the yield of crops then will increase government eeconomy.Automating farm or nursery irrigation permits farmers to use the correct quality of water at the correct time.Additionally farmer's mistreatmentautomationinstrumentationisable to scalebackrunoff fromover watering saturated soils,avoid irrigating at the incorrect time in a day. They lack in an exceeding featuredmobile application developed for users with acceptable user interface. It solely permits the user to observe and maintain the wetness level remotely in no matter of time.

Theprocessofwaterleavingtheleavesthroughevaporationviathestomachontheundersideoftheleaves.

A humidity sensor senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the Highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor when looking for comfort. Humidity Sensors work by detecting changes that alter electrical currents or temperature in the air.

Soiltemperatureappearstobemorecriticalthanairtemperaturewhen irrigatingduring mid-summer.Irrigation watergets warm, but it's okay when the water is cold. There are two reason for this, colder water holds more dissolved oxygen and colder temperature keeps demand for oxygen relatively low.

### 2. *SoilVolumetricWaterContent[2]*

Volumetric water content is a numerical measure of soil moisture. It is simply the ratio of water volume to soil volume.Another equally valid measurement is GWC, gravimetric water content, which measure weight rather than volume. GraphingtheVWC for asoilsampleisa simple. The gravimetricsoil water contentis expressed per unit mass of oven-dried soil.

### 3. *Temperature,Moisture,phvalueofsoil,Humidity[3]*

Soil pH is used to indicate the acidity of soil, and is a measure of the concentration of hydrogen ions(H+) in the soil solution. pH is measured from 1(acidic)to14( alkaine,with 7 being neutral and is measured on a negative logarithmicscale. The lower pH , higher the acidity. Most plants are favoured by a pH between 5.5 and 8.

### 4. *Moisture,Temperature,phcontent(T,M,P)[4]*

The pH of irrigation water should usually be within the range of 5.5 to 6.5 enhance the solubility of most micronutrients and avoids a steady increase in the pH of the growing medium. This pH range also optimize the solubility of nutrients in concentrated fertilizer stock solution.

Moisture is a presence ofa liquid, especially water, oftenin trace amounts. Small amount is water maybe found inthe air and in foods.

### 5. *ALowCostSmartIrrigationSystemUsingMQTTProtocal[5]*

In India agriculture plays a very important rule. The objective is mainly to collect the data from the sensor and send the data whenever user wants to check the required soil moisture and water pump. pH sensor will be in activated state until it suggeststhefarmeraboutthe typeofcroptobegrown.Soilmoisturesensor willbemonitored continuousifthedampness content is less than the threshold value of the motar will start watering the plant.

6. *IOTBasedSmartPowerManagementSystemUsingWSN [6]*

In recent years internet technologies and WSN are expanding rapidly. Hence home environment has been a rapid introduction of network enabled digital technology which offers new and exciting opportunities to enhance the connectivity of devices within the home for purpose of home automation. WSN support power management using web services and middleware technologies. This system is designed by the integration of WSN with web service communication to acknowledge the power management and provide information services using IOT platform. Thedemand of WSN are increasing rapidly in the hoses for energy controlling service.

7. *SmartWaterDrippingSystemforAgriculture/farming[7]*

Water scarcity has been a big issue for agriculture. This proposed idea is beneficial to the farmers to irrigate the farms efficiently using an automated irrigation system based on soil temperature, moisture and pH. There is increased pressure on existing water requirements globally. The productivity of the irrigation system.

## 3. EXISTINGSYSTEM

In the existing method the farming is done manually by farmer, before moving to the topic farmers can't predict the weather conditions and do farmin there land. There came a new technology to calculate soil moisture level, humidityand temperature belongingto the land condition. Asprinkler and a water pump is used and for displayingthe calculated value microcontroller or led is used. Thisis veryeffective but in rural and urbanareas there is no internet connectionto connect with the led display, sometimesthere maybepower fluctuationsalso occurs. For overcoming the method newtechnology is used in this irrigation system.

**Disadvantages:**

- Itisconsumemorework.
- ItconsumesmoreManpower
- Itneedsinternetconnectivity
- DataisstoredintheArduino
- Accuratedataisnotknown
- Waterconsumptionishigh

## 4. PROPOSEDSYSTEM

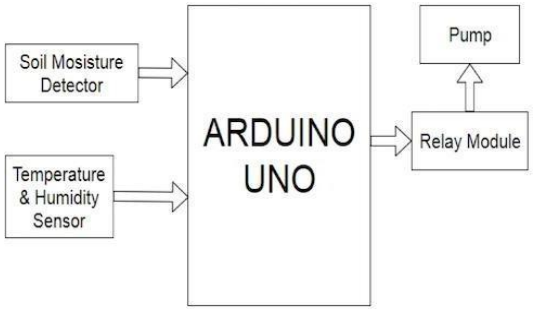
In our Proposed system of smart irrigation system using soil moisture sensor ESP8266 NODE MCU is a combination of hardware and software components. The hardware part consists of different sensor like soil moisture sensor, photocell sensor etc. An Arduino board and other components using Internet of Things(IOT) . The android based application consists of signals and a database in which readings are displayed from sensors and are inserted using the hardware. The improvement in irrigation system using a wireless network is a solution to achieve Water conservation as well as improvement in the irrigation process. This research tries to automate the process of irrigation on the farmland by monitoring the soil water level.

**Advantages:**

- Lesspowerconsumption
- Directwatertotheland
- Nowateriswasted
- Efficientforfarmerstechnically

## 5. IMPLEMENTATIONWORK

**SystemArchitecture:**



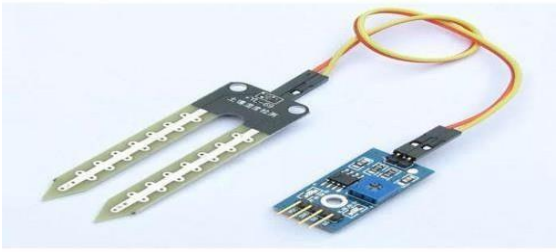

The implementation of irrigation systemthe soil moisture sensor and ESP266 NODEMCU is compulsory. Connect the hardware components to breadboard and jump wires are used to connect the positive and negative ends of the soilmoisture sensor. Wi-Fi is connected with the help of Thinkspeak server and run the program . The values of temperature, humidity, moisture are known in Arduino Uno Board.

**Modules:**

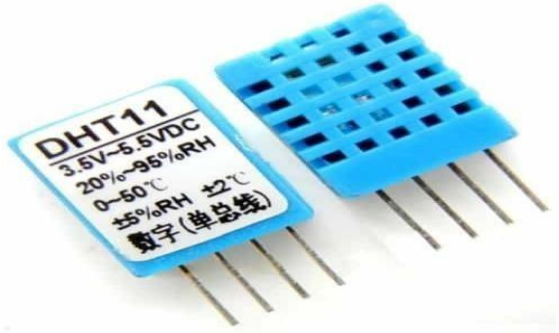
Themethodofirrigationsystemareasfollows: Sensors:Inthisirrigationsystemtwotypesofsensorsare used.

- Soilmoisturesensor
- DHT11Sensor

The soil moisture sensor is connected with breadboard and positive and negative wires are connected. Sample plant iskept inside the glass jar and moisture content is measured using Arduino Uno. The DHT11 sensor is used under low-cost digital temperature and humidity sensor. It measure the surrounding air and splits out a digital signal on the data pin.



Soilmoisturesensor




DHT11Sensor

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Think speak : Think speak provides instant visualization of data posted by your device to think speak. Here we can perform online analysis and processing of the data as it comes in. This is often used for prototyping and proof of concept IOT system that requires analytics.

Think speak enables the sensor to send data to the cloud where it is stored in either a private or a public channel. Create your own channel to calculate the moisture, temperature and humidity etc.


**Fig5.1HomePage**

- Openthinkspeak server

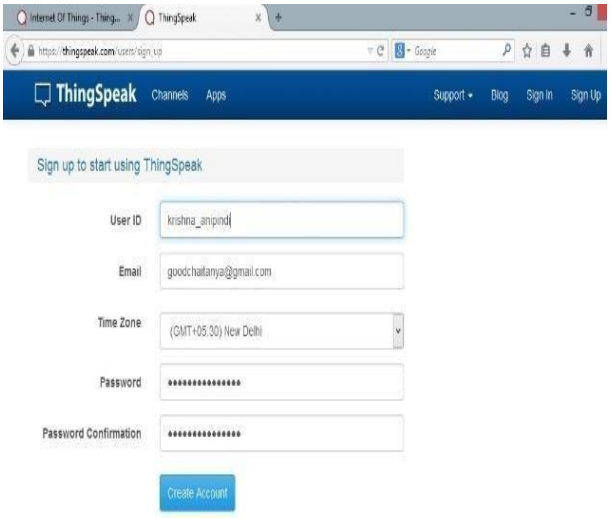


**Fig5.2Channel page**

- Createachannelusingamailid
- Createapasswordandconfirmpassword.

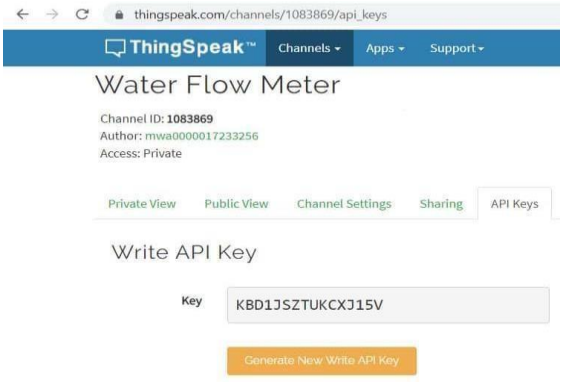


**Fig5.3APIkeys**

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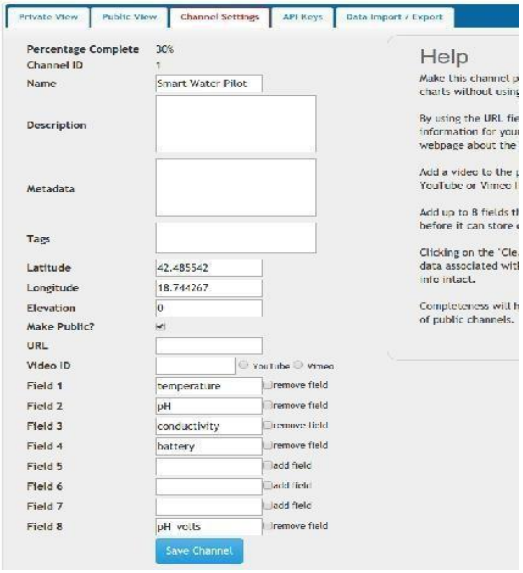



**Fig5.4Addingfields**

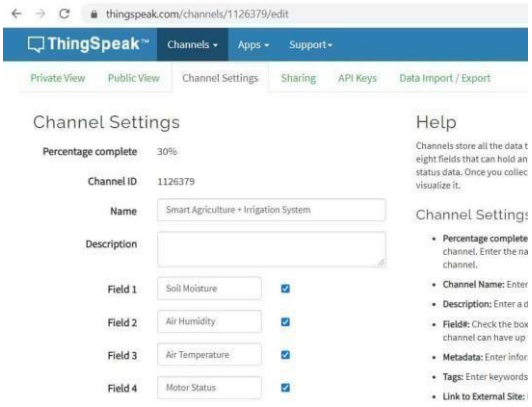



**Fig5.5Temperature,humidity**

Thisbarchartprovidethetemperatureandhumiditycalculation Themeasureofsoil,temperatureandhumiditygraphisshownabove:

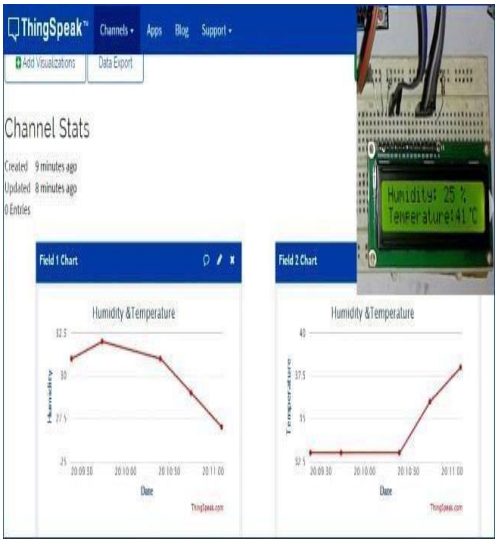
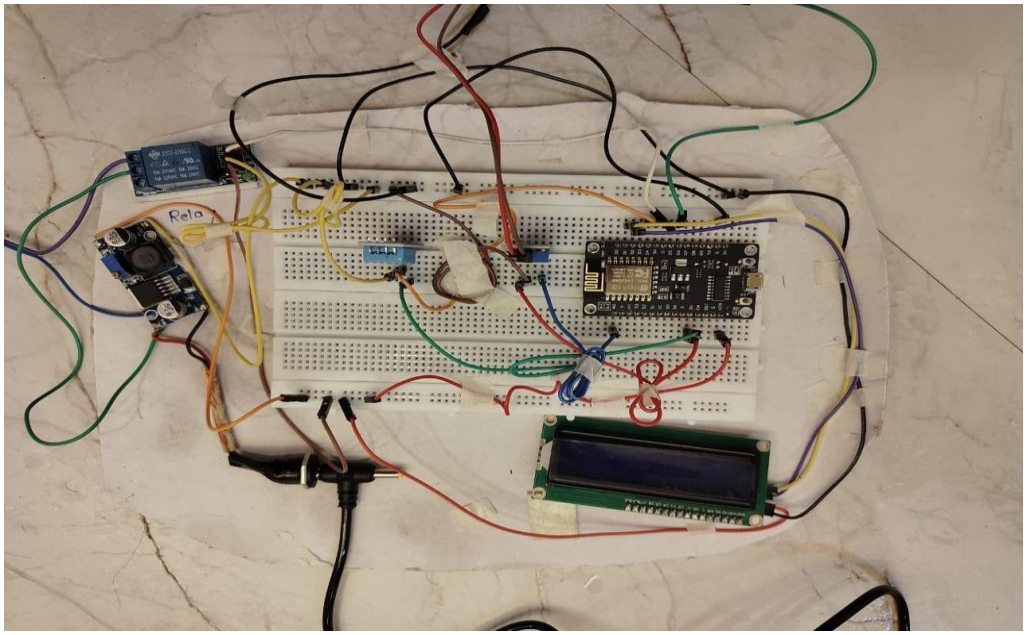



**Fig5.6Bargraph**




## 6. CONCLUSIONANDTHEFUTUREENHANCEMENT

Currently, farmers control irrigation metho by manually and irrigate their area at a systematic period of time. These mechanisms deplete highamount of water and the outcome is water less. While dryarea's have less rainfall and irrigation ischallenging.Therefore,ESP8266Wi-Fibasedcommunicationsystemhasbeentakenbecauseoftheeaseofapplication, maintenance and price. The gadget is automated that will accurately monitor and control the water requirement andreliable.Thecommunicationthroughth websiteauthorisedtheusertointeract withsensorfromanywhereinthe worldin nanosecond which is fruitful for the user to interact with sensor from anywhere in the Arduino that diminish power consumption by ascending the system life executes on large for relatively small investment. The system can also be designed for temperature sensor based cooling system. Even after then they need to wait until the field is properlywatered, which makes them to stop doing other activities. Here is an idea which helps not only farmers even for watering the gardens also, which senses the soil moisture and switch the pump automatically when the power is ON.

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