

IOT BASED SMART IRRIGATION SYSTEM USING SOIL MOISTURE SENSOR AND ESP8266NODEMCU

¹Ms.S.Shobana, ²B. Sanjana Pandey, ³Padmashri.R, ⁴U.Triveni

M.G.R. Educational and Research Institute, University, Chennai, India

E-Mail:sanjanapandey3115@gmail.com

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, humidity etc. 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 the plants/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 system was powered by solar panel and it has a duplex communication link based on a cellular network.

Keywords: Soil moisture sensors, IoT , Arduino, Android, Microcontroller, duplex communication.

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 agricultural is necessary for the economic development condition of a country. The system designed to irrigate at a time of regular intervals for predefined period 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 like soil 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 is to apply the system for improvement of health of the soil and hence the plant via multiple sensor. Appropriate soil water level is a necessary pre-requisite for optimum plant growth. Also, water being an essential element for life

sustainable, there is vast necessity to avoid its undue usage. Irrigation is a dominant consumer 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 this thesis is to design a simple, easy to install methodology to 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. LITERATURE REVIEW

1. Soil moisture, 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 declines, the normal function and growth of plants are disrupted and crop yields are reduced. As climate 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 initialization.

Plants need four things to survive: light, water, soil and air. However, to raise healthy plants, 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 and humidity. A pump is used to pump the water to fertilize and water the plants. This research work enhances to help the small-scale areas cultivators will be increased the yield of crops then will increase government economy. Automating farm or nursery irrigation permits farmers to use the correct quality of water at the correct time. Additionally, farmer's mistreatment automation instrumentation is able to scale back runoff from over watering saturated soils, avoid irrigating at the incorrect time in a day. They lack in an exceeding featured mobile 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.

The process of water leaving the leaves through evaporation via the stomata on the underside of the leaves.

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.

Soil temperature appears to be more critical than air temperature when irrigating during mid-summer. Irrigation water gets warm, but it's okay when the water is cold. There are two reasons for this, colder water holds more dissolved oxygen and colder temperature keeps demand for oxygen relatively low.

2. Soil Volumetric Water Content [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 measures weight rather than volume. Graphing the VWC for a soil sample is a simple. The gravimetric soil water content is expressed per unit mass of oven-dried soil.

3. Temperature, Moisture, pH value of soil, 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) to 14 (alkaline), with 7 being neutral and is measured on a negative logarithmic scale. The lower pH, higher the acidity. Most plants are favored by a pH between 5.5 and 8.

4. Moisture, Temperature, pH content (T, M, P) [4]

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

Moisture is a presence of a liquid, especially water, often in trace amounts. Small amount of water may be found in the air and in foods.

5. A Low Cost Smart Irrigation System Using MQTT Protocol [5]

In India agriculture plays a very important role. 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 suggests the farmer about the type of crop to be grown. Soil moisture sensor will be monitored continuous if the dampness content is less than the threshold value of the motar will start watering the plant.

6. IOT Based Smart Power Management System Using WSN [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. The demand of WSN are increasing rapidly in the hoses for energy controlling service.

7. Smart Water Dripping System for Agriculture/ 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. EXISTING SYSTEM

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 farm in there land. There came a new technology to calculate soil moisture level, humidity and temperature belonging to the land condition. A sprinkler and a water pump is used and for displaying the calculated value microcontroller or led is used. This is very effective but in rural and urban areas there is no internet connection to connect with the led display, sometimes there may be power fluctuations also occurs. For overcoming the method new technology is used in this irrigation system.

Disadvantages:

- It is consume more work.
- It consumes more Manpower
- It needs internet connectivity
- Data is stored in the Arduino
- Accurate data is not known
- Water consumption is high

4. PROPOSED SYSTEM

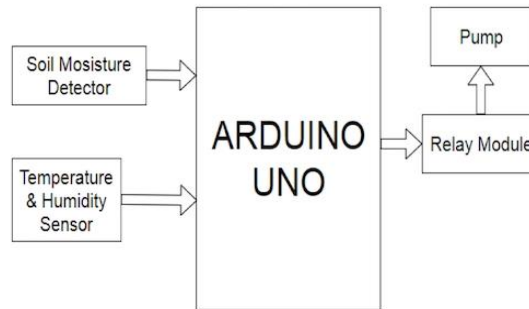
In our Proposed system of smart irrigation system using soil moisture sensor ESP8266 NODE MCU is a combination of hardware and software components. The hardware part consists of different sensor like soil moisture sensor, photocell sensor etc. An Arduino board and other components using Internet of Things(IOT) . 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:

- Less power consumption
- Direct water to the land
- No water is wasted
- Efficient for farmers technically

5. IMPLEMENTATION WORK

System Architecture:



The implementation of irrigation system the 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 soil moisture 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.

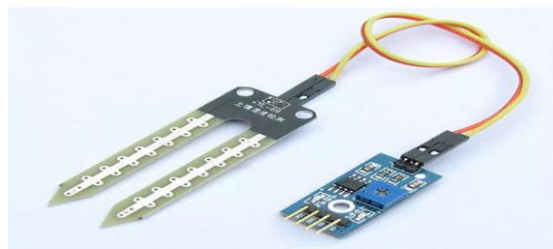
Modules:

The method of irrigation system are as follows:

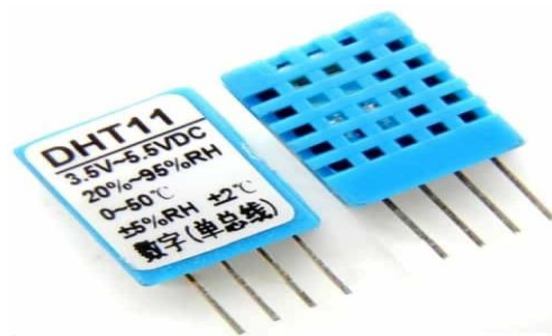
Sensors: In this irrigation system two types of sensors are used.

- Soil moisture sensor
- DHT 11 Sensor

The soil moisture sensor is connected with breadboard and positive and negative wires are connected. Sample plant is kept 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.



Soil moisture sensor



DHT11 Sensor

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.



Fig 5.1 Home Page

- Open think speak server

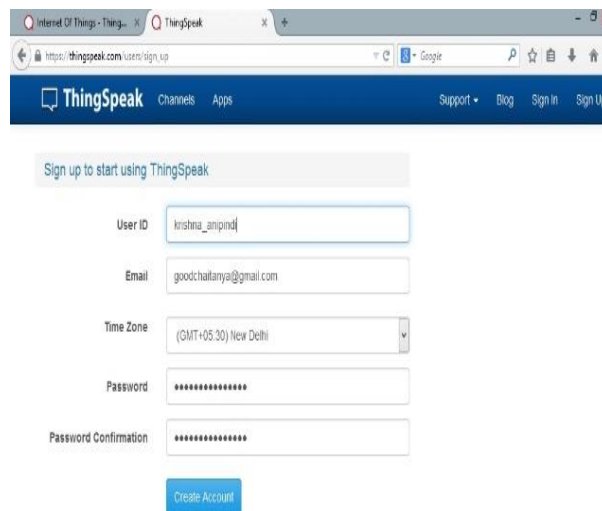


Fig 5.2 Channel page

- Create a channel using a mail id
- Create a password and confirm password.

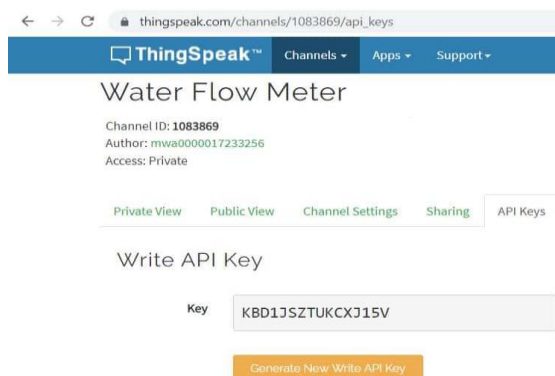


Fig 5.3 API keys

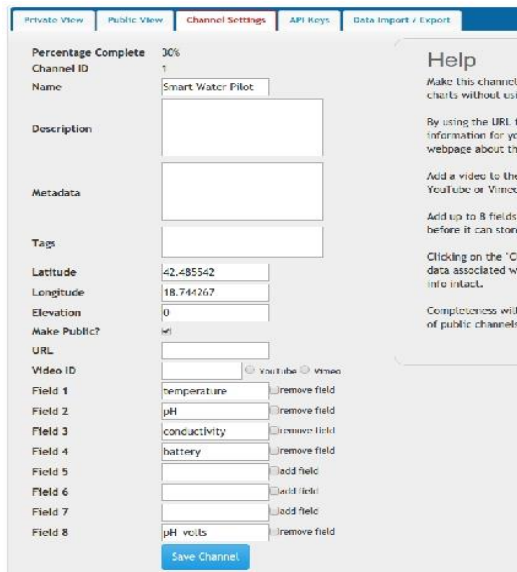


Fig 5.4 Adding fields

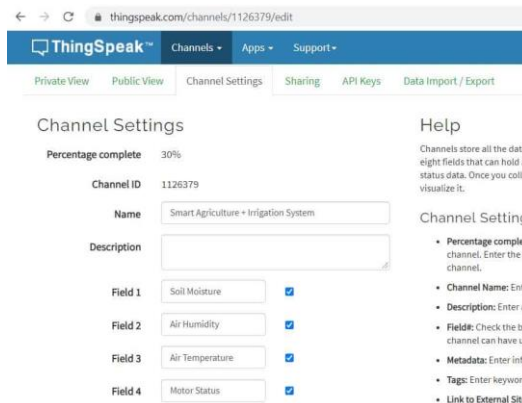


Fig 5.5 Temperature, humidity

This bar chart provide the temperature and humidity calculation

The measure of soil, temperature and humidity graph is shown above:

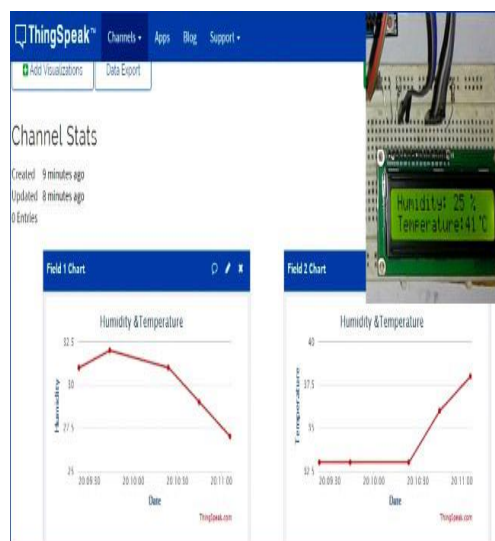


Fig 5.6 Bar graph

6. CONCLUSION AND THE FUTURE ENHANCEMENT

Currently, farmers control irrigation method by manually and irrigate their area at a systematic period of time. These mechanisms deplete high amount of water and the outcome is water less. While dry area's have less rainfall and irrigation is challenging. Therefore, ESP8266 Wi-Fi based communication system has been taken because of the ease of application, maintenance and price. The gadget is automated that will accurately monitor and control the water requirement and reliable. The communication through the website authorised the user to interact with sensor from anywhere in the world in 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 properly watered, 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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