# SMART IRRIGATION SYSTEM USING IOT

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**ABSTRACT: The objective of the proposed system is to control the Water flow based on the moisture content in the soil. Our system will adjust time interval of the watering the crops in the field according to the moisture level in the soil and the surrounding temperature. The system uses DHT-11 and moisture sensor to monitor the temperature, humidity and moisture level in the soil at a selected location and automatically cancels water flow process when the soil is moist enough. When the soil dries down, the sensor lets the controller run its irrigation cycle. The Sensor data collected from the sensors are updated constantly to the web server (MYSQL) through PHP and also to the cloud server (Thingspeak). The data uploaded to the server can be accessed through the mobile application and also be used for various analytics. Daily, Weekly and Monthly reports of water usage and other statistical information can also be generated through the application. The system can also be controlled using the mobile application. Whenever the moisture level goes beyond the critical level an alert message is sent to the farmer's mobile application so that using his mobile application he can switch on the motor for watering the plants.**

***Keywords*** **– Moisture content, Temperature, Humidity, Automated Water flow, Mobile application, Analysis**

## 1. INTRODUCTION

Agriculture mainly focuses on the cultivation of crops for the people to have their food. India is agriculture based country and hence agriculture plays an important role in our Indian economy. Most of the people in India depend either directly or indirectly on agriculture. Nowadays as the population rate goes on increasing there is a demand for even the natural resources that we use. The major natural resource that is under demand nowadays is water. Agriculture majorly uses water. About 70% of groundwater is taken from rivers are used for irrigation purpose. Farmers do irrigate their field daily. Sometimes due to climatic conditions, the soil remains moist but still, the farmers irrigate their field the next day resulting in wastage of water.

Nowadays the world is moving towards technology and hence the technology must be applied in the field of agriculture too. To avoid wastage of water and to get best the yield of crops with minimal water usage we use the Internet of Things (IoT) to automate the irrigation process. Internet of Things is the trending technology which is used for controlling the device remotely. Challenges in agriculture due to unpredictable climatic conditions and drastic population growth led the concept of IoT to be used in agriculture. The product must be cost efficient for the farmers so that it can be implemented in their field daily without any hurdle. In this paper, we explain how the irrigation process can be automated. This paper thus provides a low cost and an effective product that can be used by the farmers.

## 2. SYSTEM ARCHITECTURE

The temperature, moisture and humidity are the parameters that are monitored by the sensors. The sensed data is stored in the Arduino. Using the WI-FI module, the sensor data is sent to the MYSQL database and also to the cloud (THINGSPEAK). The data collected are analyzed using Python and a report is generated. The farmer can view the report as well as the sensor data and the status of the motor through the mobile application.

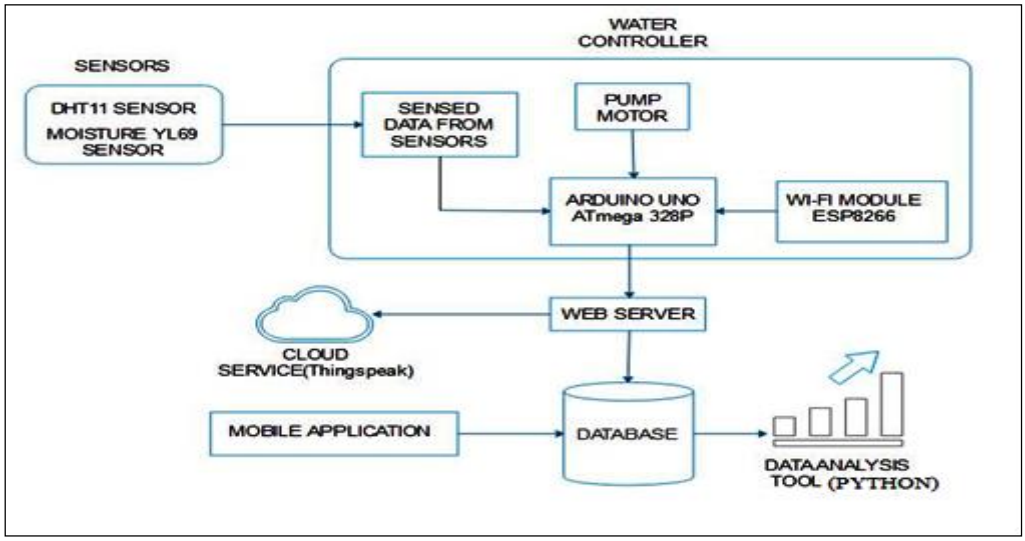



FIG 1: ARCHITECTURE DIAGRAM

## 3. WORKING PRINCIPLE

Automation of Irrigation system is done using Arduino UNO R3. It is programmed such that it gives the signals to the motor via the motor driver module. Soil sensor is connected to the A1 pin to the Arduino board which senses the moisture content present in the soil. Whenever the soil moisture content values goes down, the sensor senses the humidity change, giving signal to the microcontroller so that the pump (motor) can be activated. This concept can be used for automatic irrigation system. The circuit comprises an Arduino UNO board, a soil moisture sensor (YL69), a DHT-11 sensor, ESP-8266 WI-FI module, a 3-6V DC motor pump, a relay, a 9V battery. You can power the Arduino board using a 5V to 9V wall wart or plugin adaptor or solar panel.

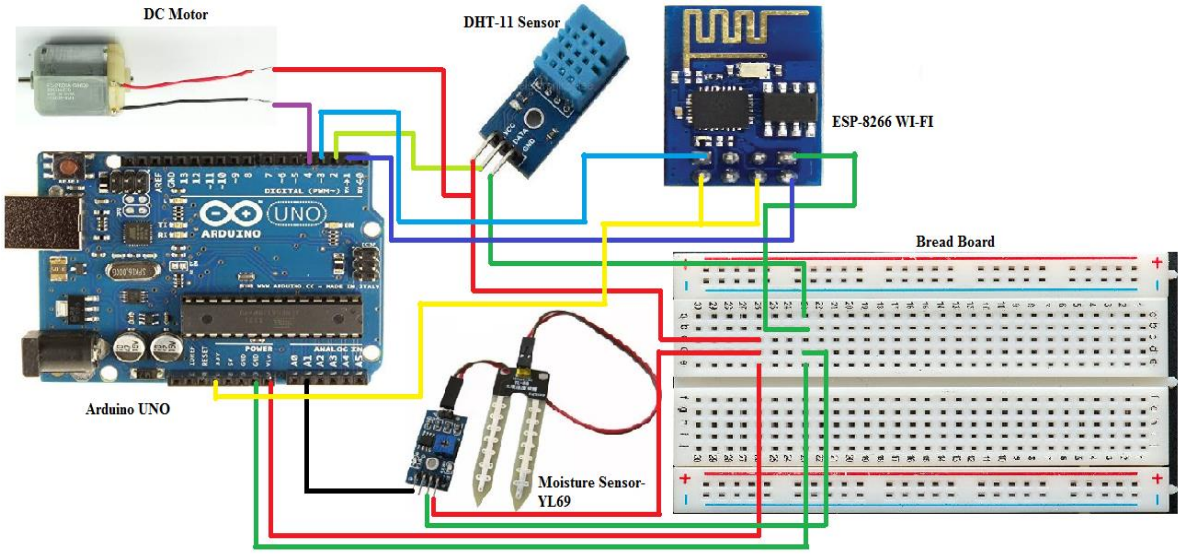



FIG 2: SENSORS CONNECTION WITH ARDUINO UNO

The motor is automatically controlled by taking moisture level as a constraint. Thus the power consumption and the water usage can be minimized. The sensor data such as moisture content, temperature, humidity are measured and it is sent to the database so that farmer can view the live recorded data from a remote location. The state of motor is also shown to the farmer. Thus the farmer can see the motor's state (i.e.) whether it is ON or OFF, temperature, humidity and also the time at which the values are recorded through the mobile application. The daily recorded data are now set for analysis. Weekly or monthly reports are generated to show the farmer that how much of water is being used based on the seasonal changes.

## 4. MODULE DESCRIPTION

### MODULE- 4.1: MOVING SENSOR DATA TO WEB SERVER

This module comprises of various sensors placed in the farm field, collecting those sensor data such as temperature, humidity, moisture content and sending those data to the server. The components used here are:

- DHT-11 Sensor (Digital Temperature and Humidity sensor)
- Moisture Sensor – YL69
- Wi-Fi module

These sensor data are collected and sent to the server (MY SQL database) through PHP. The sensor data are also sent to the cloud server (Thingspeak).

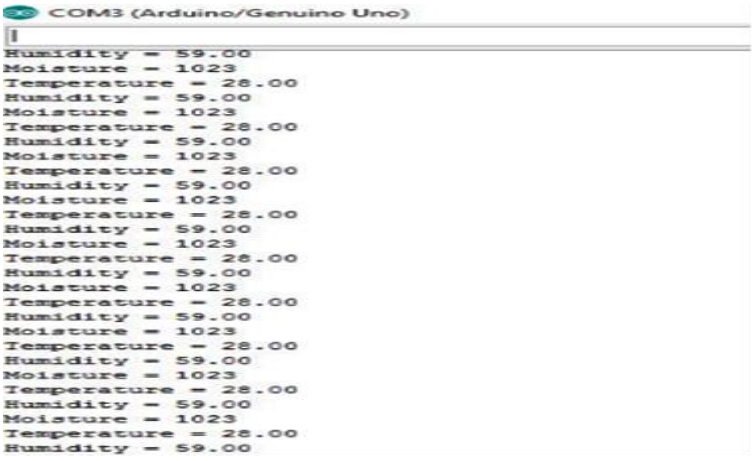



FIG 3: THE SENSOR DATA ARE DISPLAYED IN THE SERIAL MONITOR OF ARDUINO.

| Date | Temp | Hum | Mois |
|---|---|---|---|
| 2018-01-23 14:13:26 | 0.00 | 0.00 | 1022 |
| 2018-01-23 14:14:00 | 25.00 | 60.00 | 1023 |
| 2018-01-23 14:14:34 | 24.00 | 61.00 | 1023 |
| 2018-01-23 14:15:09 | 24.00 | 62.00 | 1023 |
| 2018-01-23 14:16:17 | 24.00 | 62.00 | 1023 |
| 2018-01-23 14:16:51 | 24.00 | 62.00 | 1023 |
| 2018-01-23 14:38:32 | 0.00 | 0.00 | 1021 |

FIG 4: THE REAL TIME DATA THAT ARE STORED IN THE WEB SERVER

**MODULE – 4.2: AUTOMATE THE WATER FLOW**

This module ensures that the water flow is automated. The moisture sensor checks the moisture level in the soil, whenever the moisture content goes beyond the desired level the water pumps from the motor automatically. The sensor outputs changes accordingly to the water content in the soil. When the soil is:

- Wet: the output voltage decreases
- Dry: the output voltage increases

Whenever there is a failure in automation of water flow an alert is sent to the farmer.

FIG 5: AUTOMATION OF WATER FLOW

**MODULE – 4.3: MOBILE APP FOR VISUALIZING THE DATA**

Using the mobile application the sensed data such as moisture content which is taken from moisture sensor (YL69), temperature and humidity data taken from the DHT-11 sensor can be retrieved from the web server (MY SQL database) and can be visualized. The temperature, humidity and moisture content values are displayed along with the date and time when the data were recorded through the mobile application to the user. The user also can view the graphical representation of data from Thingspeak. Live data is uploaded to the server every 10 min.

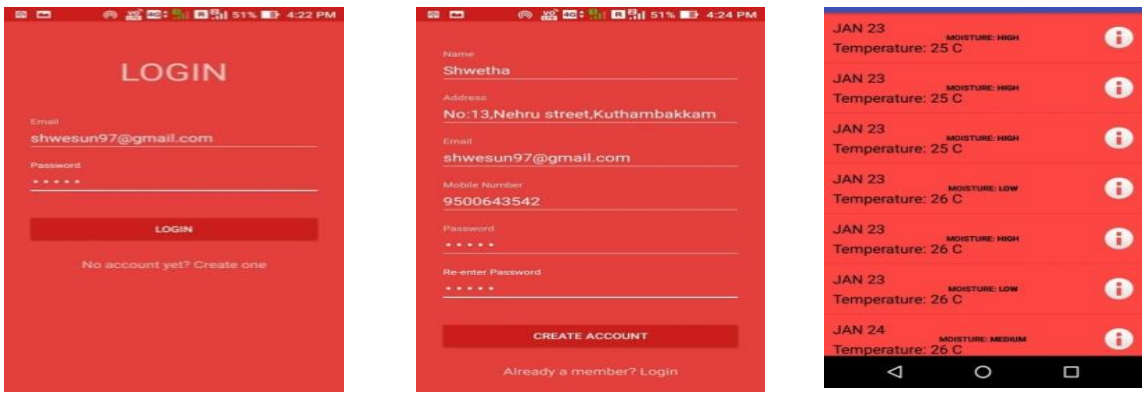



FIG 6: MOBILE APPLICATION FOR FARMER TO VIEW THE STATUS OF HIS FIELD

**MODULE – 4.4: ANALYSIS ON DAILY COLLECTED SENSOR DATA**

The analysis is done on the data that are collected daily using sensors. Python is an increasingly popular tool for data analysis. In recent years, a number of libraries have been included, allowing R users to take advantage of the performance of Python. Here we analyze the moisture content present in the soil and thus a report is generated.

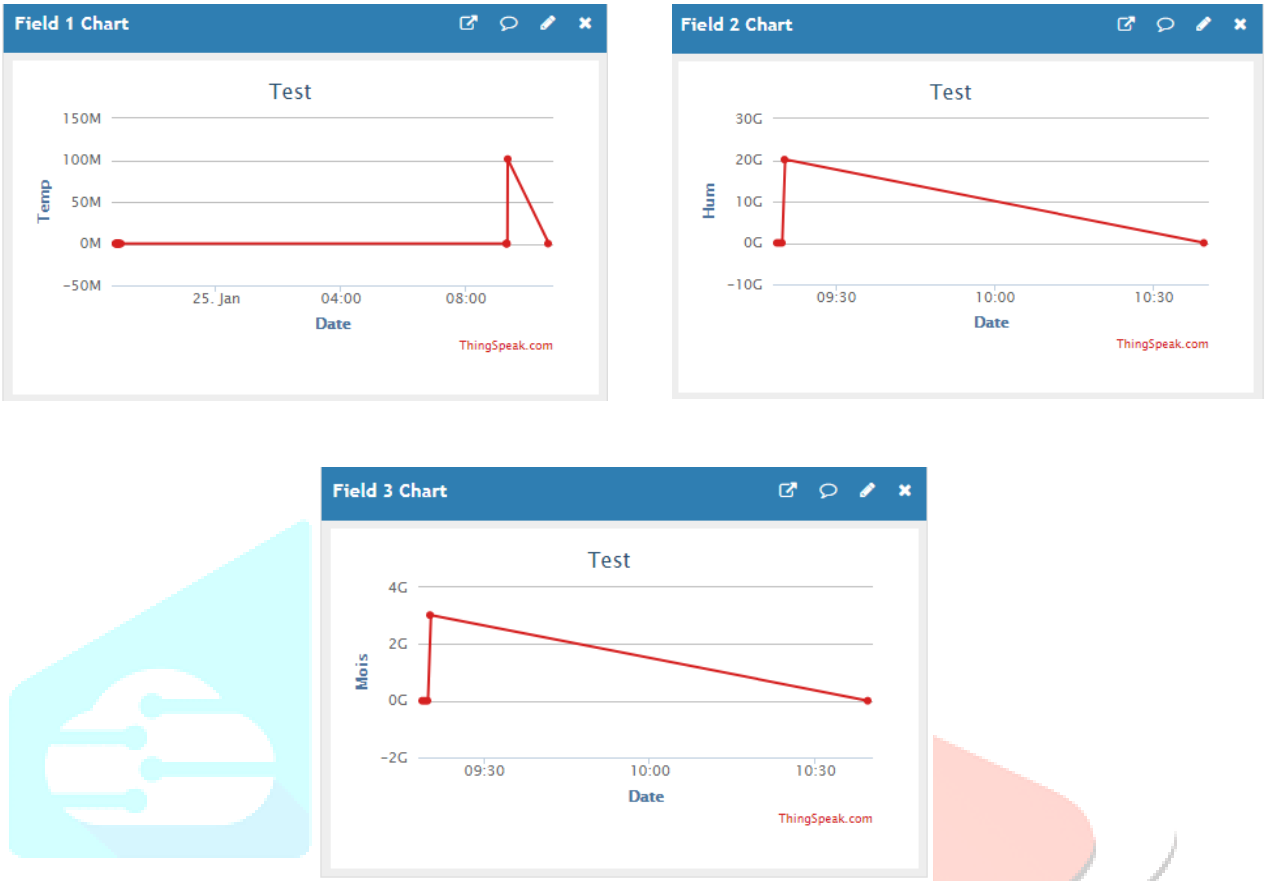
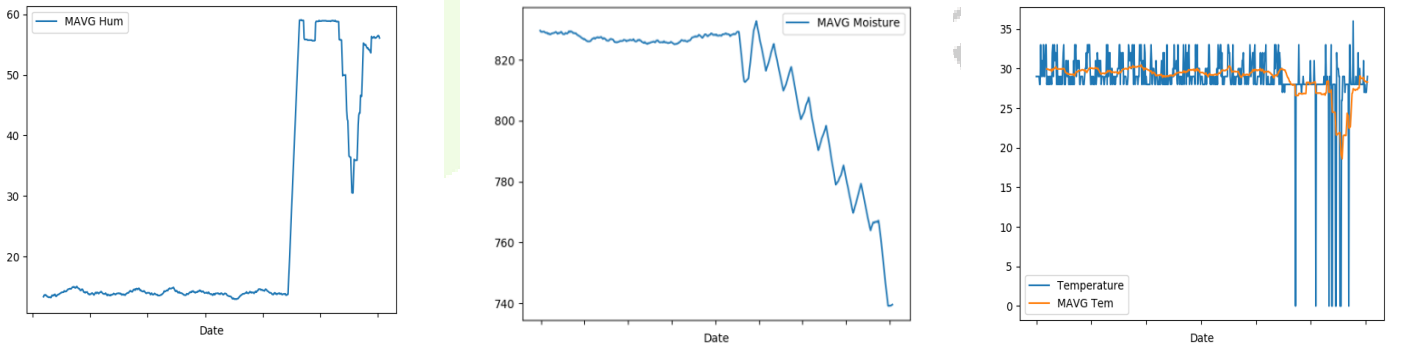



FIG 7: DEPICTS THE ANALYSIS USING THINGSPEAK




MOVING AVERAGE HUMIDITY ANALYSIS

MOVING AVERAGE MOISTURE ANALYSIS

MOVING AVERAGE TEMPERATURE ANALYSIS

FIG 8: ANALYSIS ON THE DAILY COLLECTED SENSOR DATA

## 5. ADVANTAGES OF PROPOSED SYSTEM

The proposed system uses the Wi-Fi module for the communication. So, even if the distance from the farm and the farm house is more, the information will be transmitted without any issue. As Arduino is used the system is cost effective for the farmers.

## 6. FUTURE EXPANSION & CONCLUSION

FUTURE EXPANSION:

This project can be further expanded such as the app can suggest what type of crop can be produced in the field based on the soil type and the water resource used for irrigation, source of availability of seeds, organic manures to be used for the best yield, methods for preserving the produce till marketing and so on.

CONCLUSION:

Once this idea gets implemented we can save the water wasted unnecessarily. The various moisture, temperature, rainfall and humidity value are monitored using the various sensors. The moisture value is compared with the threshold and the water pump is automated when the moisture value is lower than the threshold value. The information is sent to the user through the android application. Thus we can save our natural water bodies for future generation.

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