A Project Report on

# SMART IRRIGATION SYSTEM USING INTERNET OF THINGS

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in

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by


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# OBJECTIVE

Agriculture plays an important role in the life of a Gross Domestic Product of every country, especially India. It is the backbone of the economy of our country. Many problems have been found in this field. The most serious problem is the shortage of water resources which has been growing for the present as well as for future generations. It is necessary to adopt some smart techniques to solve the problem. This is where efficient use of the Internet of Things for traditional agriculture comes in. Advancement in agriculture is necessary in India to develop and help the farmers with the newer technology coming up. It shows the use of NodeMCU(ESP8266) based monitored and controlled smart irrigation systems. The main objective of this project is to build a Cost-effective, Simple & Automated system using Sensors, Internet, motors and AWS Cloud.

# MOTIVATION

Agriculture is the unquestionably the largest livelihood provider in India.It is observed that 70% of India's population depends on agriculture for employment. Currently, there are very less farmers who use the technology advancement for improving their crop yield and save some money and labour work. IoT is helping the farmers to fight with most of the agriculture problems. With a rising population, there is a need for increased agricultural production.

In order to support greater production in farms, the requirement of the amount of freshwater used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water during agriculture inadvertently results in wastage of water.

Internet of Things(IOT) is a technology which enables us to adopt the strategies to monitor the usage of water resources in the agriculture field.Generally, the main purpose of smart irrigation is to reduce manpower,reduce the unnecessary use of water resources and lead to efficient power consumption. This proposed IOT solution also enables them to remotely monitor & control the irrigation process. Since the irrigation process is automated, chances of human errors also reduces.

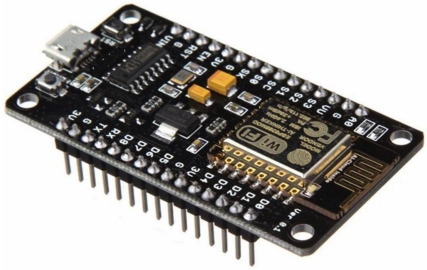
Using Cloud services also simplifies the project as no infrastructure is needed to store the values and all the internal operations are done using the AWS services keeping in mind the security of data exchanged over the network.

# EXPERIMENTAL SETUP

## Hardware used :

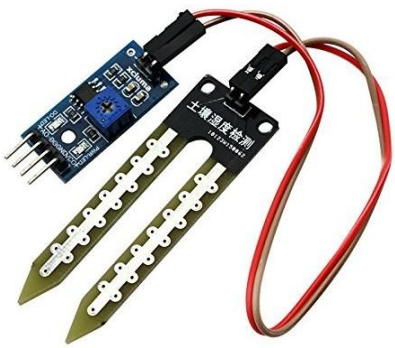
1. NodeMCU(ESP8266) -

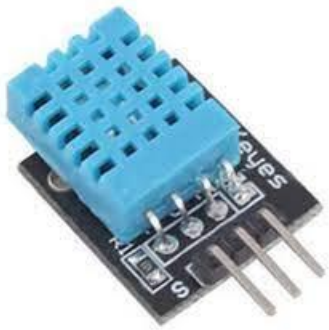
   It is a low-cost, open-source software and hardware development board built around System-on-chip microcontroller with built-in WiFi module. It contains 17 GPIO pins, 4 Power & 4 GND pins and 1 ADC pin.



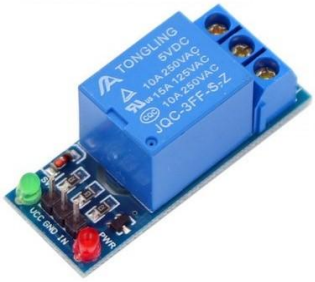
2. Soil-Moisture Sensor -

   It is a low-cost and simple gadget, which is used to observe soil moisture value. It has two probes which are used to sense the water level of the plants. The current is passed from these two probes them it estimates the resistance value of the moisture level.It is a low-power device operated in 3.3V-5V range.





3. Temperature & Humidity sensor(DHT11) -
   The DHT11 sensor is a basic, ultra low-cost, digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure surrounding air.
4. Relay Module -
   It is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could handle. There is no connection between the low voltage circuit operated by the microcontroller and the high power circuit.




5. Water Pump
6. BreadBoard
7. Jumper Wires
8. 5V Power Supply

## Software Used :

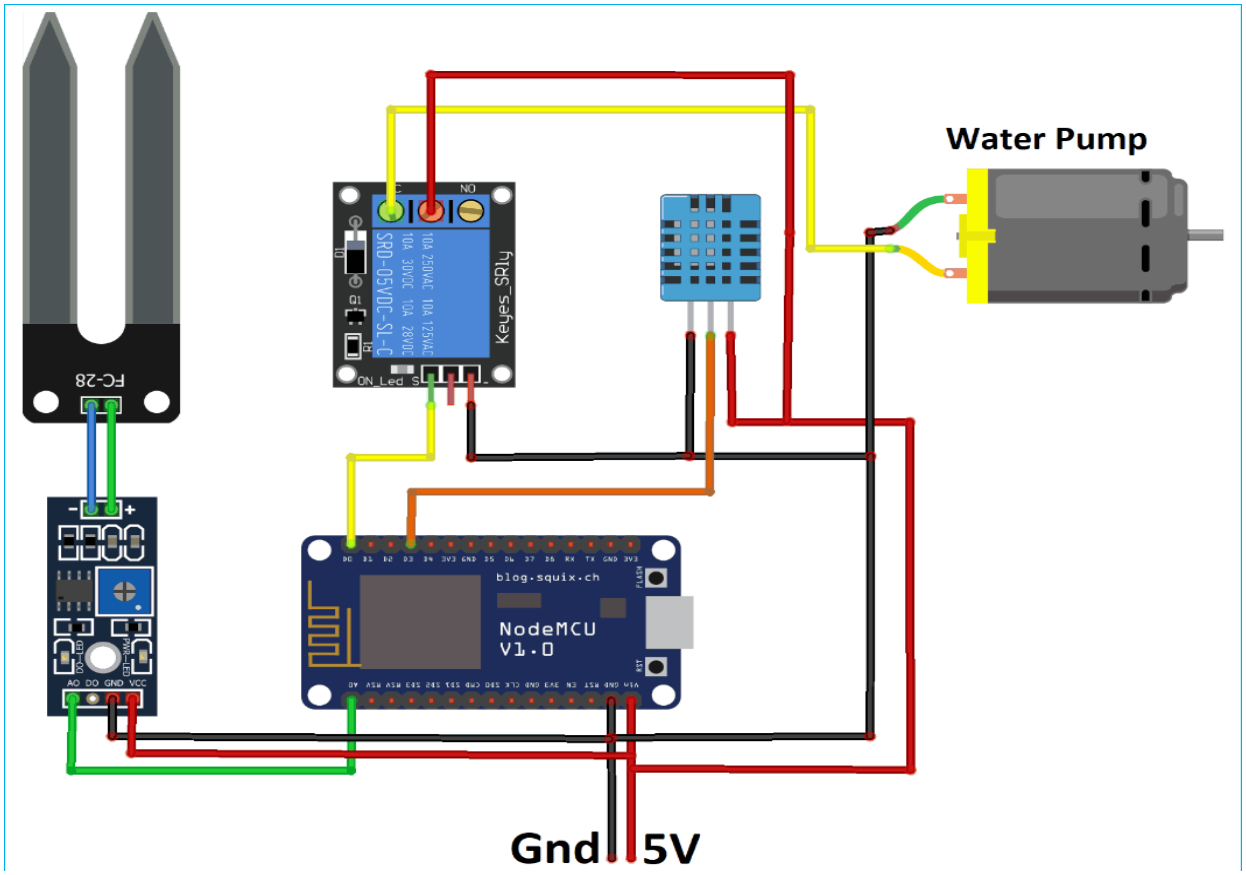
1. Arduino IDE -
   It is an integrated development environment used for uploading code to the NodeMCU. It contains a text-editor for writing code in C++ programming language, a message area to display errors,console toolbar , serial monitor for printing necessary information regarding the project. It connects the hardware to the internet by uploading program and communicate with them.

2. AWS IOT Core -
   It is a Cloud platform which provides various IOT services which can be integrated with the hardware devices and sensors to receive, store and

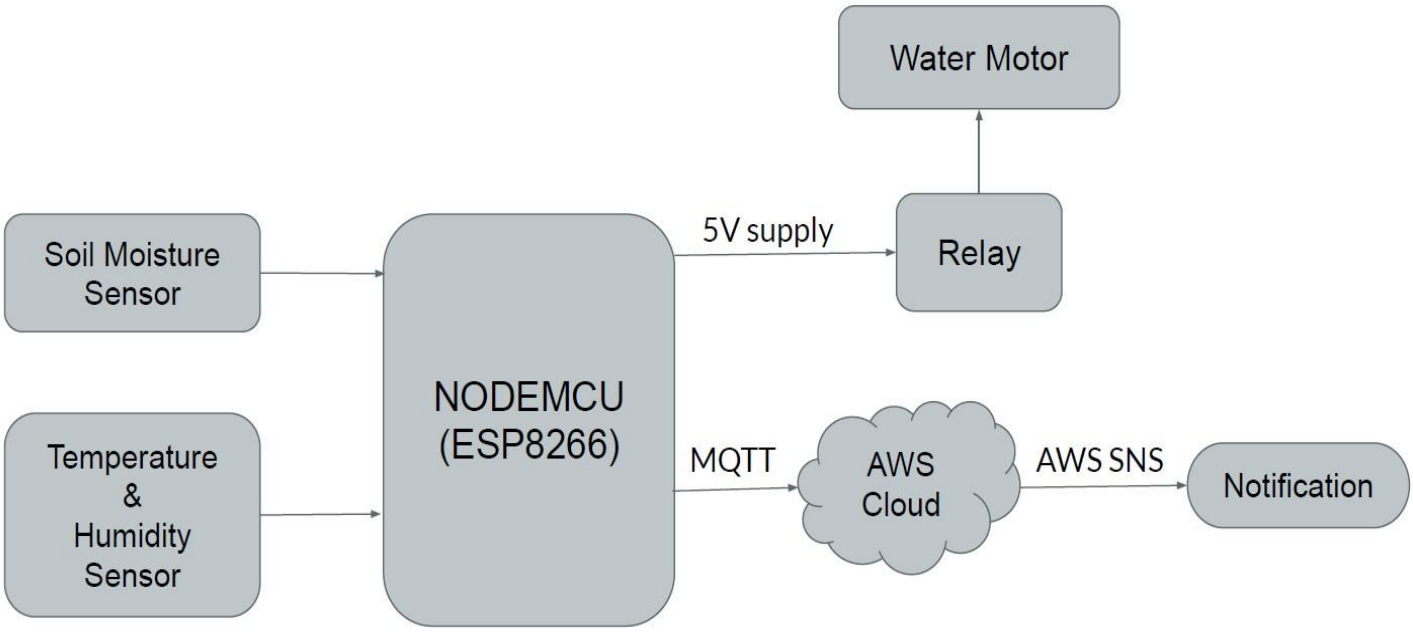
analyse the data. The communication between the IOT devices and AWS Cloud is done using MQTT protocol. This exchange of information is secured by Transport Layer Security (TLS) and Secure Socket Layer (SSL) cryptographic protocols.

3. AWS SNS -
   Amazon Simple Notification Service (Amazon SNS) is an AWS Cloud managed service that provides message delivery from publishers to subscribers. Publishers communicate with subscribers by sending messages to a *topic*, which is a logical access point and communication channel. Clients can subscribe to the SNS topic and receive published messages using HTTP, email, mobile push notifications, and mobile text messages (SMS).

## CIRCUIT DIAGRAM :



## BLOCK DIAGRAM :




## RESULT

After the code is uploaded to the NODEMCU(ESP8266) board and power is supplied, the system reads the analog value of moisture content in soil using the soil-moisture sensor and temperature & humidity via the DHT11 sensor at regular intervals. This sensor data is sent/retrieved to the AWS Cloud using the Publish/Subscribe architecture of MQTT(Message Queue Telemetry Transport) Protocol. Published data is then checked each time with the threshold condition of soil-moisture and crop temperature. If the moisture content in soil is less than the threshold value or the crop temperature is more than required temperature then the water pump is turned ON via the relay module to water the plants/crops. Simultaneously the rules of AWS IOT are checked in order to send the notification to the user via SMS,email or mobile push notifications. Once the soil-moisture & crop-temperature is restored, the water pump is turned OFF and again the user is notified and the cycle continues.

Threshold values & Optimum Crop Temperature data is given below-

| S.No. | Crop | Moisture Level( in % ) | Water Requirement ( in mm ) | Optimum Temperature ( in C ) |
|---|---|---|---|---|
| 1 | Rice | 20% | 900-2500 | 25 |
| 2 | Wheat | 12% | 450-850 | 22 |
| 3 | Maize | 18-24% | 500-800 | 25 |
| 4 | Soyabean | 13% | 450-700 | 14 |
| 5 | Sunflower | 9.50% | 350-500 | 16 |
| 6 | Corn | 15.50% | 500-750 | 35 |
| 7 | Tomato | 10% | 600-800 | 30 |
| 8 | Potato | 12.50% | 500-700 | 16 |
| 9 | Onion | 11% | 350-550 | 24 |
| 10 | Bean | 16% | 300-500 | 24 |

# FUTURE WORK

In future, the project can be improved by making a Web App using AWS in order to display the Soil-moisture content, Temperature and Humidity and various other parameters involved. Also AWS service can be used to store the published data in a database(like DynamoDB) and use it to visualize the graph through the Web App. The precision of the project can further be improved by incorporating the Machine learning algorithms where we can predict the environmental conditions accurately to determine when it is the correct time to water the crops according to the weather conditions like rain, loo winds etc. Most important thing is placing the Smart Irrigation System in farmland and helping farmers with this technology and reducing the burden off them. Also this would save water and electricity usage. This system can also be used in vertical gardens across the world.

# REFERENCES


- Ravi Kishore Kodali and Borade Samar Sarjerao, “A Low Cost Smart Irrigation System Using MQTT Protocol”, IEEE Region 10 Symposium (TENSYMP), Cochin, India, 2017
- Prakhar Srivastava, Mohit Bajaj and Ankur Singh Rana, “Overview of ESP8266 Wi-Fi module based Smart Irrigation System using IOT ”, IEEE Xplore - https://doi.org/10.1109/AEEICB.2018.8480949
- P. Singh and S. Saikia, “Arduino-based smart irrigation using water flow sensor, soil moisture sensor, temperature sensor and ESP8266 WiFi module”, 2016 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Agra, India, 2016
- V. V. h. Ram, H. Vishal, S. Dhanalakshmi and P. M. Vidya, “Regulation of water in agriculture field using Internet Of Things”, 2015 IEEE Technological Innovation in ICT for Agriculture and Rural Development (TIAR), Chennai, 2015, pp. 112-115.