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Automated Irrigation System Using IoT Cloud Computing

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Abstract*:* In India 85% freshwater is used in agriculture worldwide. This percentage continues to be leading in water consumption. The population evolution and increased food demand is one of primary factor of water maximum utilization. Therefore, primarily agriculture be contingent on monsoon, that is not a adequate source of water. So, irrigation is lively in the agriculture zone. The development of monitoring and observing the garden can now be transformed from manual and static to smart and dynamic, which centres on higher convertibility, water using productivity, and less human supervision effort. This is possible thanks to the ongoing development of artificial intelligence, IOT, and robotics. This essay focuses on a Mega 2560-based Internet of Things (IOT) computing, smart garden surveying, and watering system. The suggested system makes use of a cloud server, sensors, and a microcontroller to deliver real-time online content over a WiFi network. The observed data was continuously sent to the IOT cloud of Thing Speak. The system's cloud-based data is looked at and analysed.. The smart irrigation system is instructed to irrigate the garden when the target threshold for soil moisture is reached. The Arduino Mega 2560 microcontroller is used to construct the control unit. The main purpose of IOT is to remind the garden owner where to place the sprinklers. The sensors on the IOT cloud frequently update the data. In addition to this, the sensors send readings to a cloud channel where they are converted into graphs and sent for analysis.

Keywords: *IOT, Smart Garden, Arduino Mega, ThingSpeak, Cloud Computing*

1. Introduction

Trickle Irrigation, it's an artificial practice, provided to water the roots of the plants. It is known as micro-irrigation. An automated irrigation construction, is planned to simplify to provide efficient irrigation, water and labor shortage circumstances overcome. For high consistency, robustness and restricted properties, resistive sensors are selected. Here, it can be taken into account for smart buildings, smart cities, smart healthcare, and smart households. Additionally, it emphasises applications for smart grids, smart energy, and smart waste management systems.

It focuses on an IoT cloud-based and Arduino Mega-based smart garden irrigation system. When precise information regarding the soil's moisture is identified, the overall amount of water needed by the plant can be adjusted. It avoids the plant that is receiving too much or too little water. A soil moisture sensor measures the percentage of the soil's moisture content based on changes in resistance between the sensor's two conducting plates. Arduino receives real-time readings from sensors. These values are subsequently transmitted via serial connection to the cloud server. The Arduino Mega cannot access the internet by itself because it is a microcontroller.

For such durability, the TCP/IP protocol stack is integrated with the ESP8266-01 Wi-Fi module, a self-contained SOC that can connect to a Wi-Fi network. The Arduino Mega board can connect to a router and access the internet network thanks to this Wi-Fi module. The Arduino has been coded to allow communication with the cloud platform. the protocol for ThingSpeak via IP. The ESP8266-01 Wi-Fi module may implement TCP connections by receiving AT commands serially from the Arduino Mega 2560. Data sent by Arduino is collected, saved, and analysed via the IoT cloud service ThingSpeak.

The Arduino gathers the cloud notification (ThingSpeak). The threshold value for either the range of light intensity or moisture content. One or the other of a water pump and a light connected to the microcontroller through a relay shield is motorised.

The abilities that are found which is increased by relating to the scheme of IoT cloud:

1. As the irrigation system is active, the user is monitoring performance. Therefore, the value of moisture level can be periodically stored on ThingSpeak from anywhere at any time.
2. Since the moisture level threshold value is stored, this is very adaptable.
3. The individual can change these values remotely at

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any moment of time.

4. The Arduino board can read the threshold values. It may be automatically modified and managed from the cloud. the algorithm to adapt to the new environment.

2. System architecture

Figure 1 depicts the architecture of the system. It has two subsystems: the control subsystem and the Internet of Things subsystem.

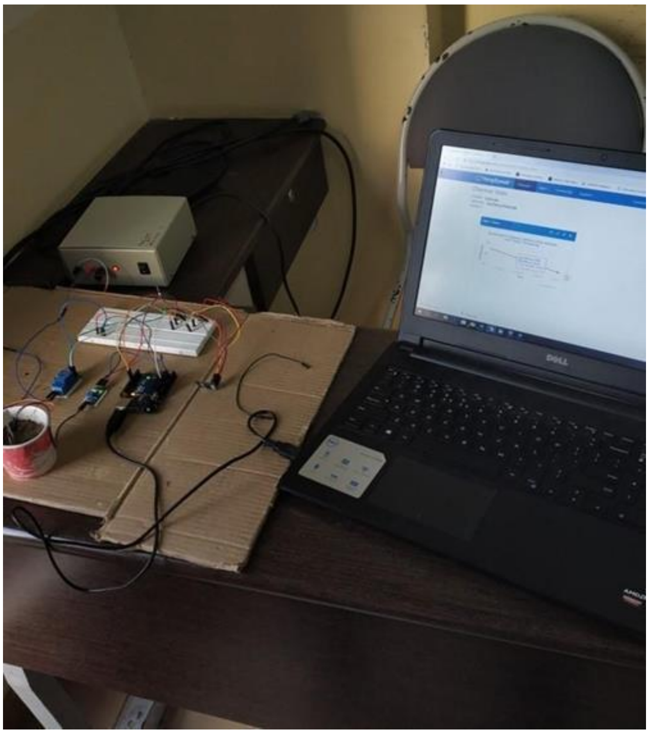
A. The Control Sub-System

The subsystem consists of:

1. Arduino Mega 2560microcontroller.
2. ESP8266-01, links the internet to an Arduino board.
3. Measures the soil's moisture content is a soil moisture sensor.
4. Relay for water pumps that connects to an Arduino Mega board

B. IoTSubsystem

The Arduino Mega 2560 is connected to the IoT cloud in order to increase system proficiency. The cloud is the analytics and IoT platform from MathWorks that enables users to collect, store, analyse, and conduct operations on data from sensors or hardware devices. Thingspeak provides rapid representations of information sent by particular devices and analyses live data in the cloud. In ThingSpeak, the MATLAB analysis is subsequently put into practise. It enables users to perform online analyses of the sensor data produced. Then, users develop cloud channels. There are fact fields on the channel. Write or read data to or from the channel by the user. Additionally, it uses MATLAB code to process and visualise the data before joining it with the React app and other relevant notifications. Three channels are built in ThingSpeak for the proposed system: one for analogue readings, one for soil moisture percentages, and one for ESP8266 control pumps. One field is established for every channel. Soil moisture sensor analogue readings are converted to moisture percentages in the Analog Reading channel using MATLAB analysis, which is then stored in the Soil Moisture Percentage channel. Then MATLAB analysis is used in the second channel, and if the moisture % is below the threshold value, a numeric value of 1 is transmitted to the ESP8266 control pump channel.



3. Design and Implementation of Arduino Circuit

The Arduino Mega circuit is set up as shown in Figure 2.

It is made up of a soil moisture sensor, a pump relay, an ESP8266-01 Wi-Fi module, and an external 12V DC power source.

4. Future Scope

So further in advance, this project can be used in the larger field as in four (4) area parts. In each part,a sub-network is constructed of Nine (9) ESP8266s which will work on solar power. In the center of the field, it a box can be placed that contains another ESP8266 module, 1 Arduino Mega, a GPRS 3G Arduino compatible module and Solar Panel. In each sub-network, arranges the ESPs are in a tradition formation to use 3 as repeaters (the middleman) and the other 6 as sensor readings (the workers).

Each and Every middleman ESP8266 will be programmed to listen and receive the readings from the workers, and then send it further to next middleman up until the ESP8266 of the central box. The central box will be configured to be the Main Cluster data manager, in charge with receiving and processing data from the closest middle man.

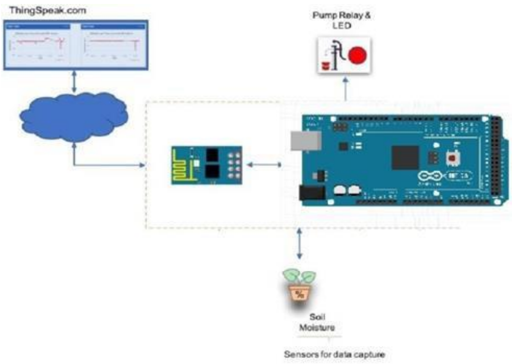


Fig.1 Smart watering System Architecture

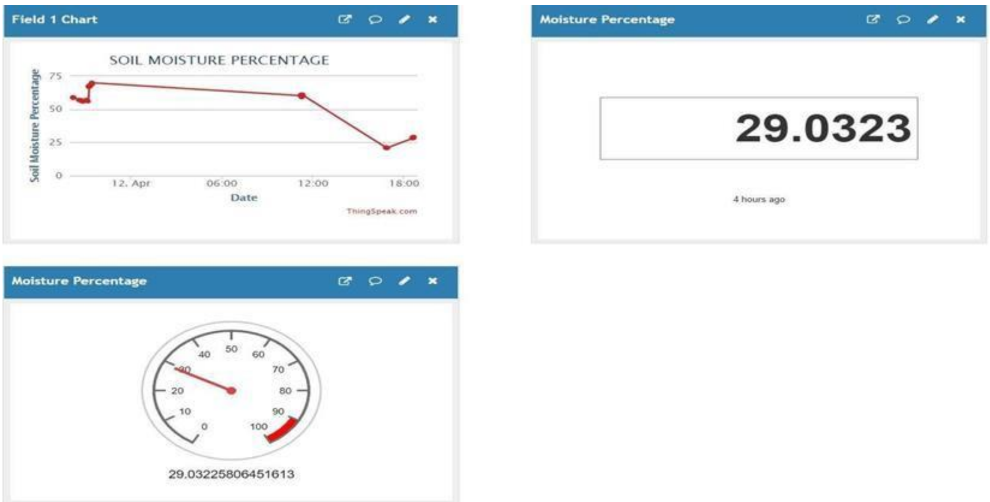


Fig. 2. Implemented Arduino

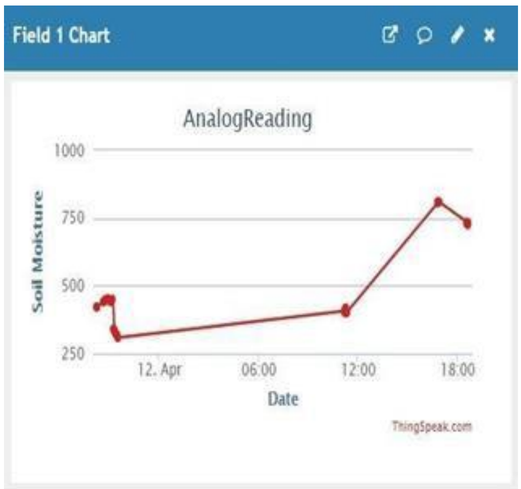


Fig. 3. Analog Reading on Thing Speak IOT Cloud

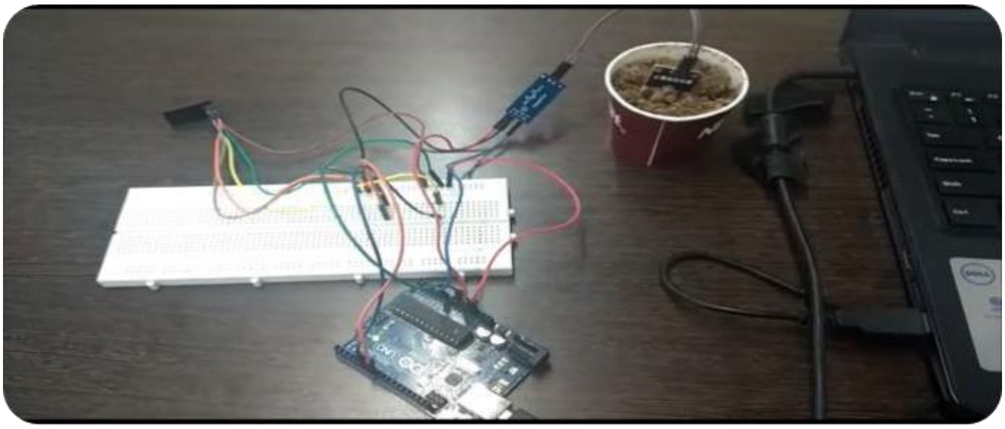


Fig. 4. Soil Moisture Percentage Channel

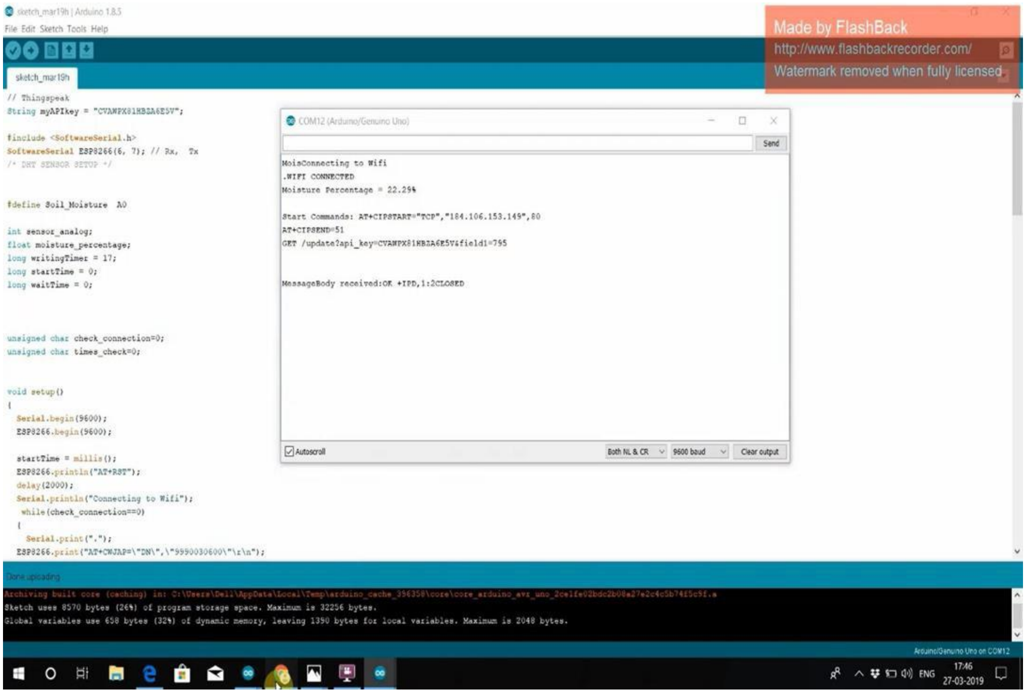
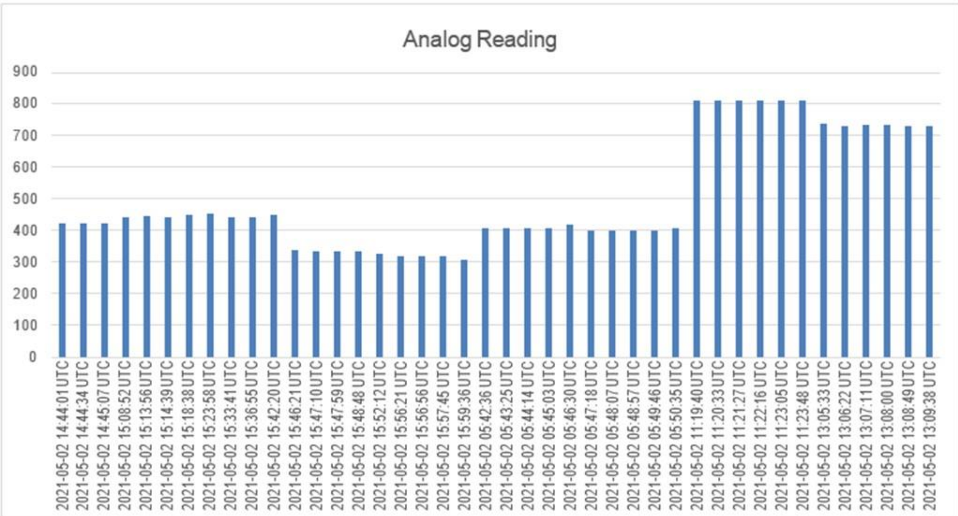


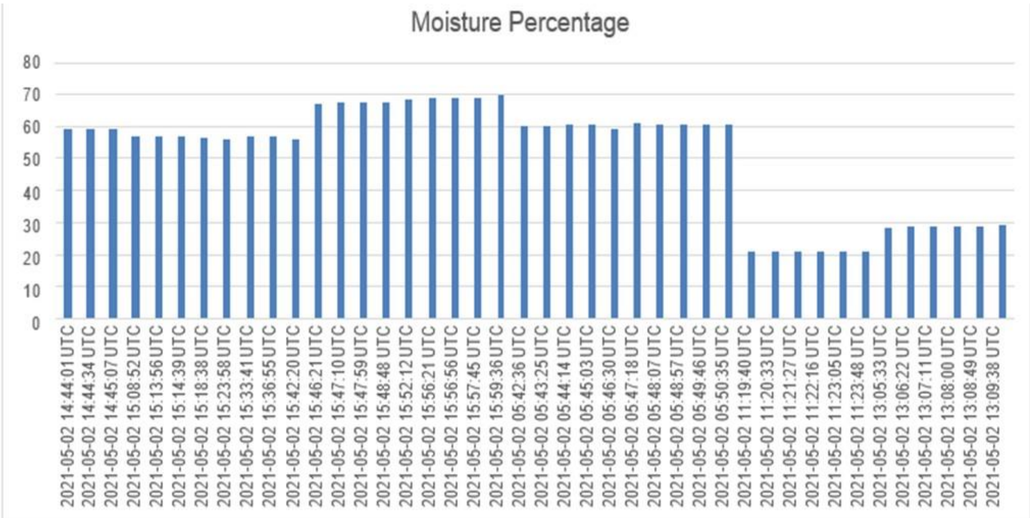
Fig. 4. Soil Moisture Percentage Channel

VI. CLOUD ANALYSICS OF DATA



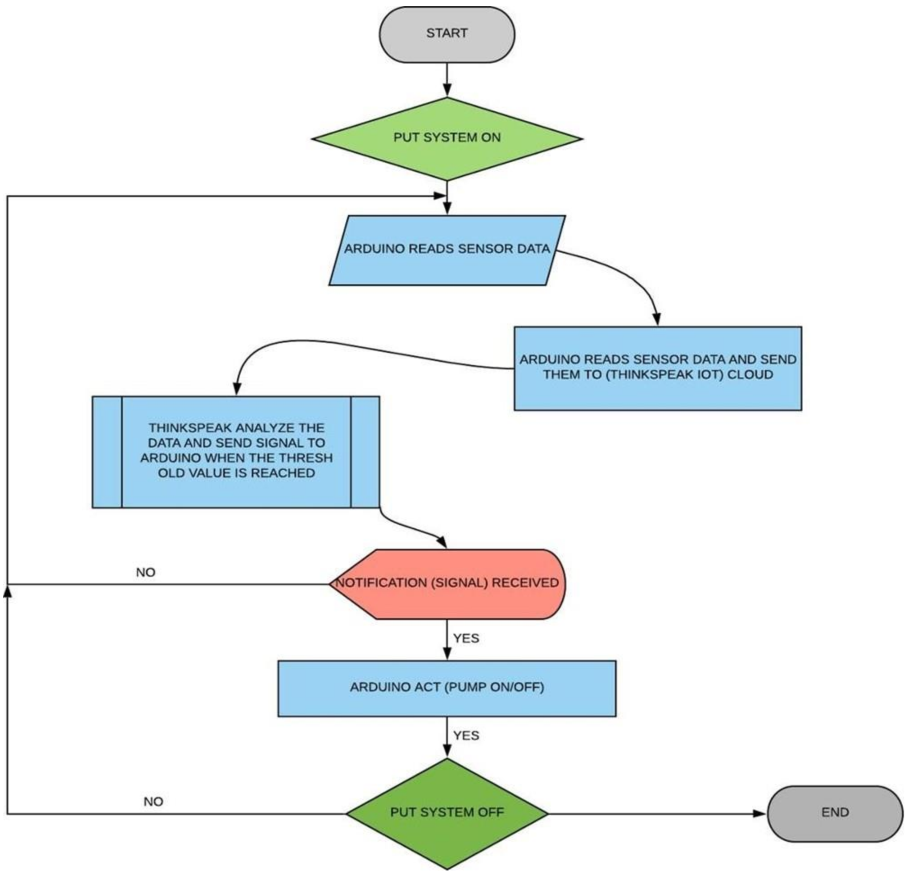
Formula Used= 100 – (Analog output * 100)

To convert analog reading to moisture percentage.



Using this data (moisture percentage), a value 0 or 1 is generated in the cloud using MATLAB Analysis and React App. Then, this value is fetched from the cloud via Arduino Mega 2560 and then it is processed in the micro controller to turn the pump on or off automatically.

5. Working principle (Flowchart)



6. Conclusion

This paper situates the forward an efficient and price convertible way of implementing Trickle (Drip) irrigation system. The usage of the cloud of the system varieties the application reachable from the remote places. Future effort includes adding more sensors and using the benefits of interconnecting ESP8266 and Solar Power to cover larger area.

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