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Smart Irrigation System

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Abstract— *With the increase in need of water for irrigation, there is also a case where we use more water for irrigation than it's needed for crops. That results in the wastage of water and causes the problem in the growth of crops. To overcome this problem, this paper puts together a study of a system based on Irrigation using IOT (Internet of things). This system targets on sensing the soil moisture and temperature using the sensors and provide the data to the Thing speak server after which the farmer can decide whether to ON or OFF the pump.*

Keywords*— *Thingspeak, IoT, Sensors, Node MCU.

I. INTRODUCTION

Agriculture in India plays a major role in the economy of the India. The study reveals the agriculture accounts for 26% of Gross domestic product and provides the employment to 65% of Indian population. There has been always a problem of irrigating the crops in the right ways. To do this, there are technologies used like drip irrigation, sprinkling system and many more. With the advancement with technology, we tried to bring the system "Smart Irrigation System" that is based on IOT (Internet of Things).[1] In this system, the moisture of soil and temperature is being measured by the sensors FC-28 and DHT-11 respectively. To get what's happening in the field we get the data through the Thing speak server in the form of graph and pie-chart. After that the farmer can turn ON or OFF the system according to it. In this system, we also use the ESP8266 controller and a relay module that will help the data to send it to the Think speak server.

II. LITERATURE REVIEW

The steps include the combination of existing practices, the comprehension of requirements and development of a framework for the system. Earlier, the system consist only the soil sensor as the key sensor in the system that measures the moisture and sends the data to an android application. On the android application the values of the moisture are seen. It aims to build an efficient irrigation system to allow the pump to turn ON and OFF when the content of earth dampness detected. In these systems wireless sensors, soil moisture valve and Short Message Services (SMS) are the centre part of system. In these systems the farmer has to operate the pump manually and when the moisture of the soil increases then they have to switch off the pump. Sometimes that becomes hectic.

III. PROPOSED SYSTEM

The system proposed by us is based on IOT(Internet Of Things) and having the sensors (FC-28 – Soil Moisture sensor and DHT-11 – Temperature sensor) that detects the moisture of the soil and the temperature. It's core is Node Mcu -ESP8266 module that not only helps to irrigate the water automatically on the basis of moisture level but also send the data to Thing speak server to keep track of the land condition.[2] The system consist a water pump which is used to irrigate the land depending upon the land environmental condition such as moisture, temperature and humidity. It also consists of a relay module.

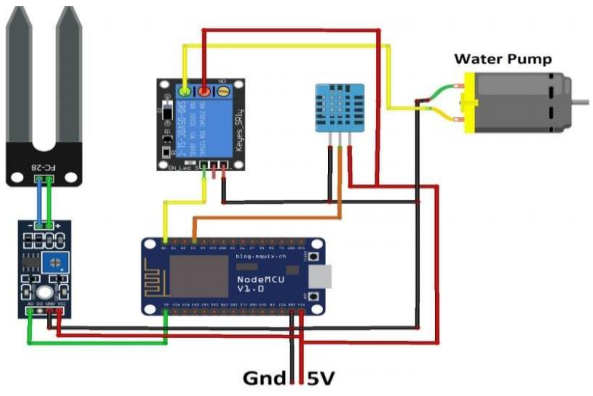

Fig.-1 Circuit connections

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3.1 SOFTWARE

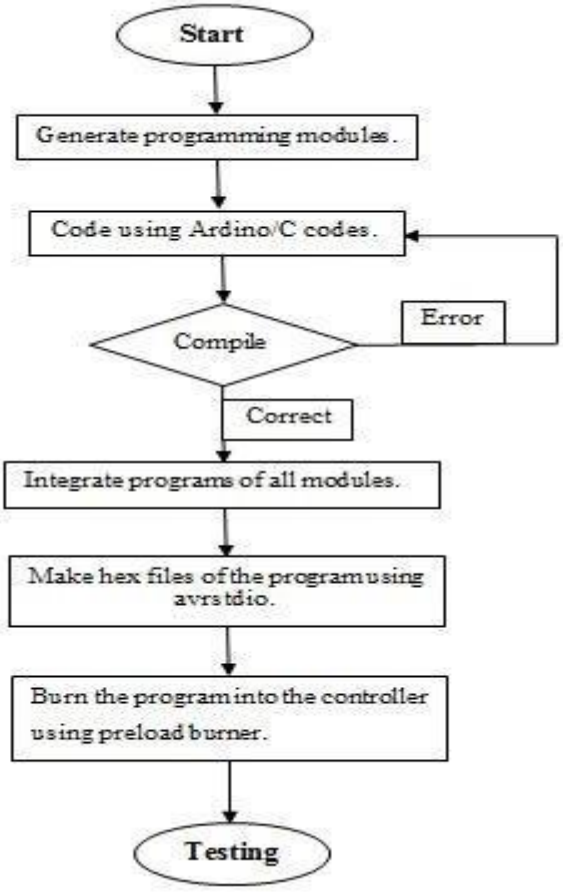


Fig.-2 Software Programming Flow Chart

3.2 HARDWARE

The Smart irrigation System has wide scope to automate the complete irrigation system. Here we are building a IoT based Irrigation System using ESP8266 NodeMCU Module and DHT11 Sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to ThingSpeak Server to keep track of the land condition. The System will consist a water pump which will be used to sprinkle water on the land depending upon the land environmental condition such as Moisture, Temperature and Humidity.[3]

Here we connecting all wires . Esp8266 Node mcu pin A0 connecting to the soil moisture sensor pin A0. Node mcu pin D3 connecting to the output of DHT11 sensor. Relay input pin connecting to the node mcu pin D0. And put all required GND and VCC connection. We provide power to node mcu from the external source with Vin pin of node mcu.The cloud website which is used is Thing Speak. This site, by just clicking the channel link. Details can be seen on.

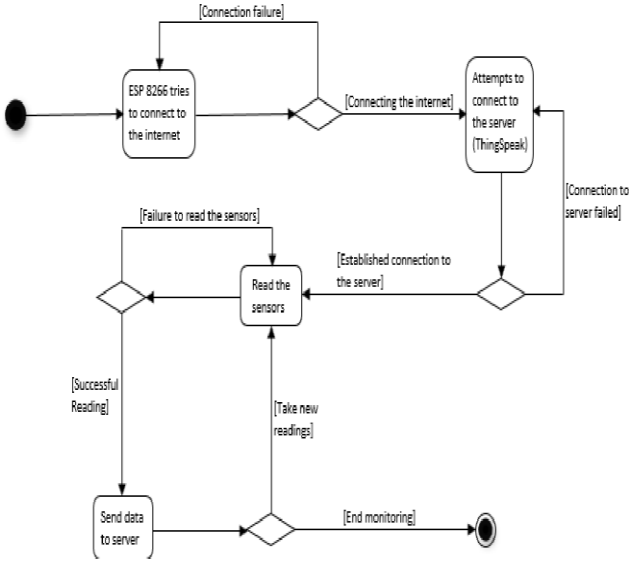
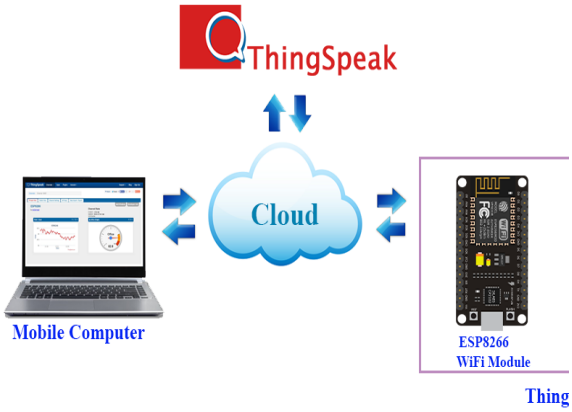


Fig.-3 Hardware Programming Flow Chart



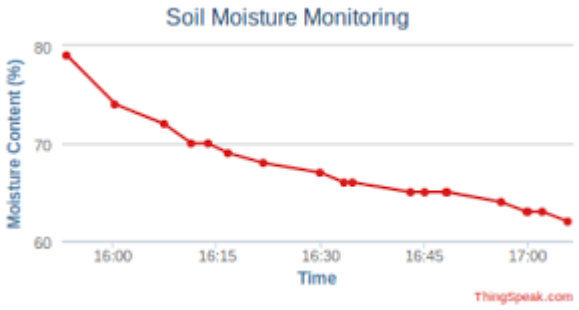


Fig.-4 Monitoring

IV. THINGSPEAK

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB code in ThingSpeak you can perform online analysis and processing of the data as it comes in. ThingSpeak is often

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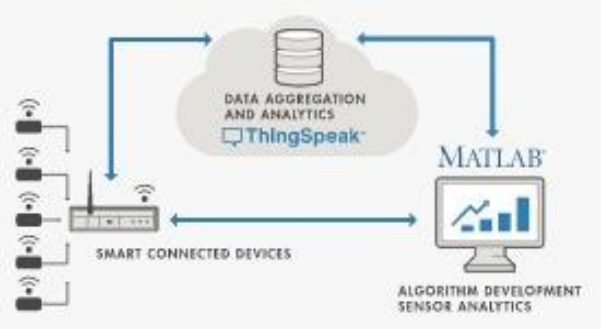
used for prototyping and proof of concept IoT systems that require analytics.

Internet of Things (IoT) describes an emerging trend where a large number of embedded devices (things) are connected to the Internet. These connected devices communicate with people and other things and often provide sensor data to cloud storage and cloud computing resources where the data is processed and analyzed to gain important insights.[4] Cheap cloud computing power and increased device connectivity is enabling this trend.

IoT solutions are built for many vertical applications such as environmental monitoring and control, health monitoring, vehicle fleet monitoring, industrial monitoring and control, and home automation.



On the left, we have the smart devices (the "things" in IoT) that live at the edge of the network. These devices collect data and include things like wearable devices, wireless temperatures sensors, heart rate monitors, and hydraulic pressure sensors, and machines on the factory floor.

In the middle, we have the cloud where data from many sources is aggregated and analyzed in real time, often by an IoT analytics platform designed for this purpose.

The right side of the diagram depicts the algorithm development associated with the IoT application. Here an engineer or data scientist tries to gain insight into the collected data by performing historical analysis on the data. In this case, the data is pulled from the IoT platform into a desktop software environment to enable the engineer or scientist to prototype algorithms that may eventually execute in the cloud or on the smart device itself.

An IoT system includes all these elements. ThingSpeak fits in the cloud part of the diagram and provides a platform to quickly collect and analyze data from internet connected sensors.

4.1 THINGSPEAK KEY FEATUIRES:

ThingSpeak allows you to aggregate, visualize and analyze live data streams in the cloud. Some of the key capabilities of ThingSpeak include the ability to:

- Easily configure devices to send data to ThingSpeak using popular IoT protocols.
- Visualize your sensor data in real-time.
- Aggregate data on-demand from third-party sources.
- Use the power of MATLAB to make sense of your IoT data.
- Run your IoT analytics automatically based on schedules or events.
- Prototype and build IoT systems without setting up servers or developing web software.

V. CHALLENGES

Farmers face two major challenges in irrigation scheduling:

i Overwatering

Many times, the irrigation cycle is started too early and runs for too long in the absence of a proper monitoring system. This not only wastes water and money but also causes damage to the crop.

ii Underwatering

On the other hand, sometimes the irrigation cycle is started too late or not run for enough duration. This reduces yields and leads to poor crop growth which affects price and profits.

An IoT-based smart soil monitoring system helps to address these problems and minimizes their financial and practical impact on crop production. Let's see how:

The traditional methods of soil irrigation lead to wastage of about 50% of the supplied water due to inefficiencies in irrigation, evaporation and overwatering. A smart soil irrigation system employs sensors to realize and inform watering routines in real-time to improve efficiency, thus saving water. A smart soil irrigation monitoring system not only helps you to save water, but it also uses sensors to realize and inform watering routines in real-time to improve efficiency.[5]

A smart irrigation system has two types of controls:

I Weather-based – The monitoring system uses local weather information derived from reliable weather sources, sensors and historical data to make watering schedule decisions. The system determines water schedules by analyzing data of different parameters like local temperature, humidity, insolation and wind.

II Soil-based – The sensors integrated into the ground capture soil moisture data. The monitoring system uses this data to make water scheduling decisions. You can

customize the system to act as per the moisture level required in the soil. For example, it can start irrigation when the soil/land is dry and stop irrigation when the moisture in soil/land reaches the required level.

VI. ADVANTAGES

- It can optimize water levels as per soil moisture and weather predictions with the help of moisture sensors.
- It can determine when a farm/land needs to be watered based on local weather data.
- It will help you to have better control on your landscape and irrigation needs.
- It will save a substantial amount of money on your water bills as it cuts water wastage significantly.

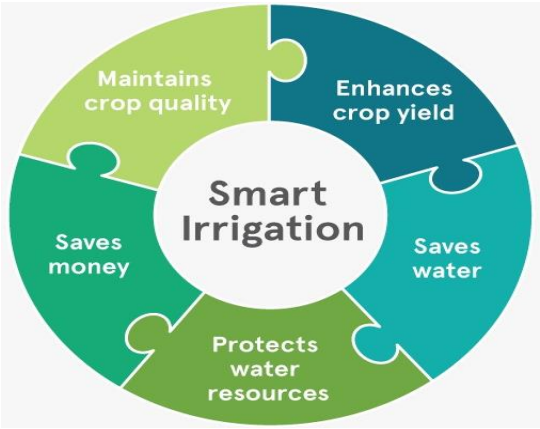


Fig.-5 Benefits of smart irrigation

VII. CONCLUSION

The smart irrigation system implemented is cost effective for optimizing water resources for agricultural production. The proposed system can be used to switch on/off the water pump depending on the soil moisture levels and temperature sensor and the data given by them on thingspeak thereby making the process simpler to use. Through this project it can be concluded that there can be considerable development in irrigation with those of IOT and automation. Thus this system is a solution to the problems faced in the existing scarcity of water and execive water used for crops.

It can be seen that the combination of hardware and software provides a irrigation controller that can be implemented at relatively low cost and which is extremely user friendly. From the point of view of working at remote place the developed microcontroller based irrigation system can work constantly for indefinite time period, even in certain abnormal circumstances. If the plants get water at the proper time then it helps to increase the production from 25 to 30 %. This system can be used to irrigate very large areas as it only needs to divide the whole land into number of sectors and single microcontroller can control the whole process. It saves human energy, time, cost, etc.[6]

VIII. FUTURE SCOPE

The proposed system consist of less hardware as compared to the previous model hence it is compact as compared to the previous system. It is more cost efficient, this claim is made on the fact that the proposed system does not need the heavy and expensive hardware for implementation. This type of automated irrigation system consumes 40-50% less water as compared to the traditional system Ideal growth condition is been provided when small amount of water is been applied over large amount of time. This smart irrigation system extends watering time for plants, and provides ideal growth condition. It saves time and timer delay as per the environmental condition can be added for automatic watering. This smart irrigation system can be adjusted and modified according to the changing environment. It is simple to operate it starts by designing the map of your garden and marking the location of planting.

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