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## DESIGN AND DEVELOPMENT OF AGRICULTURE FIELD MONITORING SYSTEM USING IOT

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### **Abstract:**

Over the past few years, IoT has become one of the most important technologies of the 21st century. The Internet of Things (IoT) describes the network of physical objects-“things”- that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools. IoT (Internet of Things), smart systems are also used in Agriculture domain. Indian farmers are mostly dependent on agriculture for satisfying their needs of food and economy. Maximum farmers are habitual to take crops continuously with traditional ways without checking the current suitability which may result into poor quality yields and hence reduces overall crop yields which leads to financial losses. Also the maximum extent of irrigation in India is to be dependent on the monsoons, which is also a reliable source of water. Depending on the soil type, plants are to be provided with water through a proper irrigation system.

This paper proposes an IoT based system used to measurement of different soil parameters like soil moisture, humidity and temperature with the help of sensors. The prototype is designed and developed for intelligent irrigation system controller which will allow irrigation to take place from remote places where manual inspection is not needed and reduces wastage of water, fertilizers and increases the crop yield. By tracking these parameters, the irrigation gadget can be computerized if soil moisture is low [5].

**Keywords:** Soil moisture sensor, soil moisture, IoT, Agriculture Parameter, automatic Irrigation System, Arduino, Wi-Fi.

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## **Introduction:**

In Developing Country like India, agriculture is almost prominent sector where majority of economy dependent upon agriculture field [6]. Continuous increasing population raises food demand and water which requires the improvement in food production technology. There is requirement of continuous monitoring of field and crop for better crop production. Though day by day we travel towards modernization, but the farmers are still dependent on rain water for farming, which is insufficient water source. Soil is a valuable resource that supports plant life, and water is an essential component of the plant life cycle. Soil provides medium and give essential support to plant growth. Soil parameters play important and crucial role in increase crop yield. Continuous field monitoring involves measurement of different soil parameters such as soil moisture, temperature and humidity, pH of soil, NPK etc. Remote soil monitoring becomes very essential to choose appropriate crop and fertilizes resulting into improve crop production and thus reduce fertilizer cost. Soil moisture sensors measure the volumetric water content in soil [4]. Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently.

By studying various parameters of soil crop selection for particular field will be possible, which results into better yield production. To provide water to plant and crops field irrigation is done with the help of humans. This continuous monitoring by humans is not possible for all the time. Hence automatic irrigation system is a suitable one which helps to irrigate the crops without the help of human intervention. This system will have continuous monitoring that helps better production of food and also decides fertilizes according to crop which leads to save fertilizer cost and hence overall cost required to field crop production.

## **Proposed System:**

The following figure (6) shows the block diagram of the proposed system. This system is constructed using soil moisture sensor and DHT11 sensor used to measure soil moisture and temperature as well as humidity respectively. Moisture value, temperature and humidity value are displayed on LCD display. A reference value for the moisture of the crops will be set. If the moisture level falls below the reference value, called as threshold value the crops will be irrigated i.e. motor pump will be ON. If the moisture level crosses the threshold value, the water pump will be stopped. The high temperature and Humidity around the crops, promotes the growth of unwanted substances like fungi and bacteria and also lead to rotting

of the crops. Hence our temperature and Humidity sensor will warn the farmer when to use insecticides and Pesticides [2].

This system includes hardware and software part and monitored online on the thingspeak platform and also on the Mobile phone .The hardware part of system consists of various sensors such as Soil Moisture Sensor, temperature, relay, motor pump, and ESP8266and also arduino uno board [2]. The software unit consist of Thing speak platform which stores the data collected from sensors which is later accessed by the farmers using android app [2].

### System Components:

There are various hardware components using which system is design and developed, which includes sensor unit and IoT system board.



Fig.1 – Soil moisture Sensor Fig.2 – DHT 11 Sensor Fig.3 – ESP8266 Fig.4 – Relay Fig.5 – Arduino uno board

#### 1. Soil Moisture Sensor -

Soil moisture sensor has a comparator (LM393) which helps in converting analog data to digital data easy for the processing purpose.The Soil moisture sensor consists of two electrodes which are put in soil and current is passes through this electrodes, will determine the moisture content of soil. More the water content in soil, easier it will be to pass the current between the electrodes.

#### 2. Temperature and humidity Sensor -

DHT11 is a low-cost digital sensor for sensing temperature and humidity. DHT11 sensor consists of a capacitive humidity sensing element and a NTC thermistor for sensing temperature.

##### Specifications of DHT11 sensor –

- i. Humidity measuring range: 20%~90%RH(0~50 degree (temperature compensation).
- ii. Temperature measuring range: 0~+50degree.
- iii. Humidity measurement accuracy:  $\pm 5.0\%$  RH.
- iv. Temperature measurement accuracy:  $\pm 2.0$ degree.

### 3. ESP8266 –

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

### 4. Relay –

A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

### 5. Arduino uno Board

The Arduino-Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. The power to the Arduino can be provided by connecting USB with the laptop, computer or either by using the battery.

#### Methodology:

This prototype monitors the amount of soil moisture content in the soil using soil moisture sensor connected to the arduino.

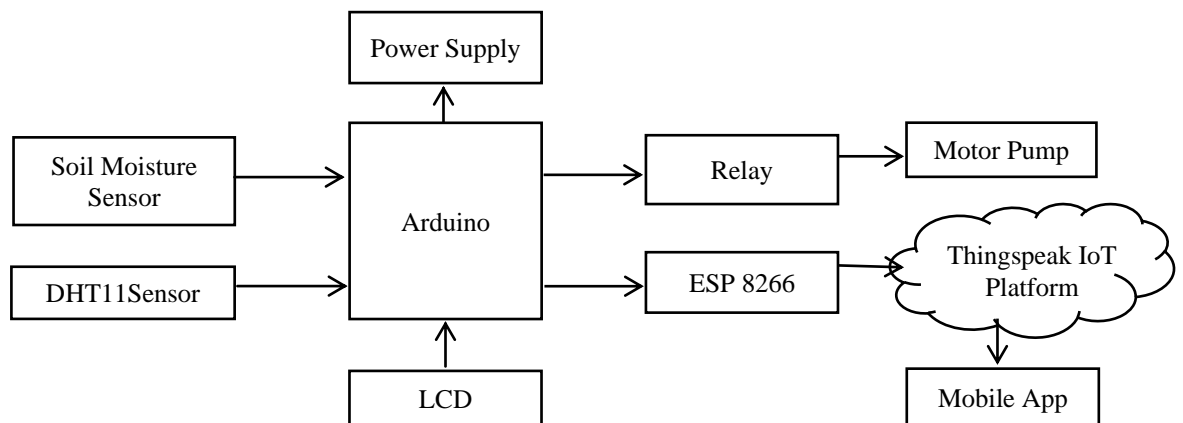


Fig.6 - Block Diagram of proposed System

A reference value of soil moisture is set and can be varied with crops i.e. some crops required more water or some crops less water. In case the soil moisture deviates from the specified reference, the watering system is turned ON. The reference value of soil moisture called as threshold value will be checked every time by the arduino and according to that motor pump will be turned ON or OFF using relay. The arduino is also connected to the thing speak platform through ESP8266 which receives information from sensors wirelessly. The thing

speaks platform stores the data which can belater shared to an android App which lets the framers monitor the sensor data remotely and accordingly they can decide preliminary precautions related to crop and pesticides [2].

### **Conclusion:**

In India where most of the food production depends upon agriculture and the about 60 % peoples are dependent on agriculture for their livelihood, and to fulfill their basic needs. So there is necessity of to adopt smart and efficient techniques for farming[2]. System provides attractive user interface with the most efficient way of controlling the irrigation system which is cost efficient.It gives the idea to monitor the soil moisture content and temperature in a farming area and the user can control watering system using Android device provided with Wi-Fi facility[1].The lots of water can be saved by adapting to thisautomated irrigation system, where irrigation is done when water is needed. This will also let farmers save the quality of crops by over or less irrigating the crops. The temperature and Humidity sensors warn the farmers to use pesticides and infectants whenever their value is too high[2].The farmers can also analyse the Soil moisture conditions on mobile phones using android App. Thus, designed prototype is a potential solution to the problems faced by farmers.

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