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**International Journal of Research Publication and Reviews**

Journal homepage: www.ijrpr.com ISSN 2582-7421

# Smart Agriculture System Using IoT

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A B S T R A C T

Agriculture has been practiced in every country from ancient times. Agriculture is the art and science of growing and cultivating plants. Agriculture was a critical component in the country's development. As the globe moves toward trendy technologies for automation, it is becoming increasingly vital to use these technology to agriculture in order to boost agricultural yield and quality.
Because IoT sensors can provide information about agriculture fields and then act on it based on user input, smart agriculture is a new concept. The goal of this paper is to create a smart agriculture system that takes advantage of cutting-edge technologies like Arduino, IoT, and wireless sensor networks.
Smart Agriculture Technology in Farming is a concept that refers to farming operations that make use of modern information and communication technologies to improve crop yield and quality. Smart technology's goal is to provide an intelligent foundation system for agricultural management. A system is constructed for monitoring the agricultural field with the help of sensors (light, humidity, temperature, soil moisture, etc.) in this IoT-based smart farming... In terms of environmental concerns, IoT-based smart farming can deliver significant benefits, such as more efficient water usage and crop input and treatment optimization.

The main feature of the Smart Agriculture System is that we can use our phone to automatically irrigate a plot of land and spray fertilizers and pesticides wirelessly.

## 1. Introduction

Smart Agriculture System Technology is a concept that refers to farming operations that make use of modern information and communication technology in order to increase crop yield and quality.
As the name implies, the goal of this Internet of Things-based project is to create a smart agricultural system that can conduct and even monitor a variety of farming chores. For example, you can use your smartphone to arrange the system to automatically water a plot of land or to spray fertilizers/pesticides on crops.
This Internet-of-Things-based project can also monitor soil moisture. As a result of the improved system's ability to undertake basic agricultural activities, farmers and cultivators may focus on more labor-intensive agricultural tasks.
The majority of us own a little garden, farmland, or plantation. Our hectic schedule, on the other hand, prevents us from doing so. However, with the help of technology, we can easily accomplish this. As a result, we're planning to create a smart agriculture system based on the Internet of Things that can track soil moisture. We will be able to use this technology to autonomously water a plot of land and wirelessly spray fertilizers and pesticides while we are occupied with other tasks

## 2. Literature Review

1.Benyezza H., Bouhedda M., Djellout K., and Saidi A. Benyezza H., Bouhedda M., Djellout K., and Saidi A. (2018). Thing speak and Arduino-based Smart Irrigation System The International Conference on Applied Smart Systems is a gathering of experts in the field of smart systems (ICASS). http://dx.doi.org/10.1109/icass.2018.8651993.

A smart framework is presented to maximize the use of water and assist farmers in remotely monitoring their fields without having to visit them. To monitor soil moisture, the system includes two sensors: a water level sensor and a soil moisture sensor. The ESP8266 Wi-Fi module transmits the sensed values to the Thing Speak cloud. A talkback system is developed that gives directions on whether or not to water the plants. [1]

2.R. Rao and B. Sridhar (2018). Smart crop-field monitoring and irrigation automation system based on the Internet of Things. doi: 10.1109/ICISC.2018.8399118. 2nd International Conference on Inventive Systems and Control (ICISC).

The LM35 temperature sensor and the soil moisture sensor are used to monitor the water supplementation in the field. A system using an LM35 temperature sensor, a moisture sensor, an RPi 3 model B, an IC 3208 converter, a relay, and a buzzer has been presented. Soil moisture has a threshold value of 2.4v, which may vary from crop to crop. The soil is identified as dry if the reading is less than the defined threshold (2.4v in this case), and a signal is issued to turn on the water pump. Otherwise Because the soil is damp, the motor will be turned off. The data collected by the sensors is uploaded to the cloud and made available to the farmer via his or her mobile device or computer. The mechanism informed the farmer when the water pump should be turned on or off. [2]

3. D. Mishra, A. Khan, R. Tiwari, and S. Upadhay (2018). "An IoT-based Approach to an Automated Irrigation System." 3rd International Conference on IoT: Smart Innovation and Applications (IoT-SIU). http://ieeexplore.ieee.org/document/8519886 [As of November 25, 2019].

The goal of this system is to reduce resource waste (water, labor) and boost yields by using a single sensor. Add humidity sensor (humidity in air), pH sensor, water level sensor, weather monitoring sensor, GPS technology for geographical region identification to the system provided in [3] [4]. The resolution of data transport is not indicated. Machine learning (ML) will make the system even smarter and more automated. [3]

4. S. P., V. R., and L. G. (2017). IoT-based smart agriculture system and its social impact 10.5120/ijca2017915500, International Journal of Computer Applications, 176(1), pp. 1-4.

Water management, crop monitoring, and pesticide control are all made easier with an IoT-based solution. The system is divided into two sections: an agricultural logger and a cloud interface with a mobile app. The agro logger is made up of an Arduino mini pro microcontroller board, five sensors (LM35 temperature sensor, moisture sensor, barometric pressure sensor, humidity sensor, and light sensor), and actuators (sprinkler irrigation valve, fertilizer controlling valve, and humidity water spray valve), all of which are linked to Xively (an IoT open source platform that allows developers to connect sensor data to the Web and shape their own applications on it). In this system, there are two modes of operation: manual and automatic. In manual mode, the operator must operate the sprinkler irrigation valve, fertilization supplements, and water spray valve, but in automatic mode, the system handles these tasks. If the sensed data exceeds a predetermined threshold, the heater or fan will be turned on or off. Water consumption is controlled manually using an Android app. [4]

## 3. Advantages and Disadvantages

Advantages-

- Modern machines can monitor and control farmers' efforts.
- The amount of time saved as a result of the IoT program could be significant. And, in today's world, we could all use a little more energy.
- Maintain a successful soil moisture monitoring system.
- We can program the system to automatically irrigate a plot of land.
- We may use your smartphone to spray fertilizers and insecticides on the crops remotely.
- Lessen the influence on the environment.

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Disadvantages-

- Smart farming necessitates constant internet access. The rural section of emerging countries did not meet those standards, thus the internet is slower.

• Even with security precautions in place, the system has limited power and can lead to a variety of network attacks.

• The expense of upkeep is prohibitively high.

## 4. Objective and Scope-

**Objective-**

Farming is India's most common occupation, accounting for more than 60% of the country's GDP. The use of inefficient agricultural methods results in a reduction in crop output, necessitating the use of a considerable amount of labour. Many farmers have stopped farming because they are unable to make a profit. We, as engineers, are prone to suggesting cost-effective farming methods that would help enhance the economy.

- Using our phone, automatically irrigate a plot of land and wirelessly spray fertilizers and insecticides.
- Examining the state of the environment in agriculture and taking corrective action.
- Irrigation efficiency from a faraway site

**Scope-**

Farmers will benefit greatly from our suggested approach, as farming accounts for more than 60% of all occupations in our country. Our technology, which employs IoT and various sensors to gather information about irrigation outputs and also provides farm protection, will also boost crop productivity. Farmers can also utilize remote technology to turn on and off water pumps that are fueled by renewable energy sources, helping to keep the environment clean.

We designed our project to be user-friendly, bearing in mind that our primary consumers are uneducated farmers. First and foremost, we must teach and demonstrate how our project works and how customers will benefit.

## 5. Methodology-

**5.1.1 Relay Module-**

An electromagnet operates a power relay module, which is an electrical switch. When the relay is de-energized, the armature, which is held in place by a spring, leaves a gap in the magnetic circuit. One of the two sets of contacts is closed in this state, while the other stays open.

A relay is a switch that is controlled by electricity. A magnetic field is created by current flowing through the coil of the relay, which attracts a lever and switches the switch contacts. Relays feature two switch positions and are double throw (changeover) switches since the coil current can be on or off.

Relays enable one circuit to control a second circuit that is fully independent of the first. A relay, for example, can be used to switch a 230V AC mains circuit from a low voltage battery circuit. There is no electrical connection between the two circuits inside the relay; the connection is magnetic and mechanical.

The coil of a relay passes a significant amount of current, typically 30mA for a 12V relay but up to 100mA for relays designed to function at lower voltages. Most integrated circuits (ICs) are unable to deliver this current, so a transistor is typically employed to boost the IC current to the higher amount necessary for the relay coil. Because the common 555 timer IC's maximum output current is 200mA, these devices may power relay coils directly without amplification.

Relays are normally SPDT or DPDT, although they can contain a lot more switch connections; for example, relays with four sets of changeover contacts are common.


Fig 5.1.1.Relay Module

**5.1.2: Soil Moisture Sensor-**

A soil moisture sensor, as the name implies, measures the volumetric water content of soil.

To determine the moisture levels in the soil, a resistive soil moisture sensor uses the relationship between electrical resistance and water content. The sensor measures the resistance of the soil between the two probes by sending an electrical current from one to the other.
Water is required for the survival of all living beings. However, having exactly the appropriate amount of water (as opposed to over-watering) is critical for plants and agriculture. Because we can't see moisture levels in the soil with our naked eyes, soil moisture sensors are crucial for providing information about your irrigation systems.
Soil Moisture Sensors also allow us to create smart agricultural systems that automatically adjust to changing environmental circumstances.
For example, we can use an Arduino microcontroller to receive soil moisture data and then switch on sprinklers automatically when moisture levels are low

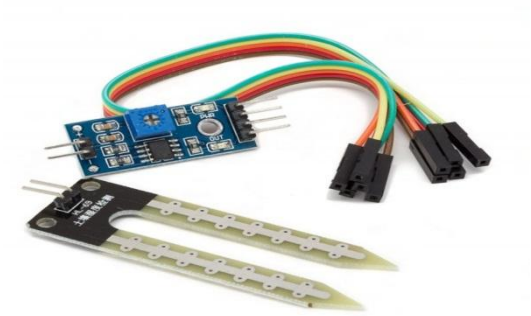

Fig 5.1.2: Soil Moisture Sensor

**5.1.3: Bluetooth HC 05-**

The HC-05 is a Bluetooth module that is used to communicate wirelessly. The HC-05 Bluetooth to serial converter is simple to use. The HC-05 is a Bluetooth-enabled device that connects microcontrollers (such as Arduino) to other Bluetooth-enabled devices. This permits the devices to connect with one another wirelessly.
The HC-05 Bluetooth Module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the construction of a transparent wireless serial connection. There are two modes of operation for the HC-05 Bluetooth Module: Command Mode and Data Mode.
Command Mode: In Command Mode, we can use AT Commands to interface with the Bluetooth module and modify various settings and parameters. This involves altering the firmware, changing the Baud Rate, changing the module name, and so on. It can also be used to make the HC-05 a master or slave. To choose one of the modes, we must first activate Command Mode and send the appropriate AT Commands. In command mode, the baud rate is 38400bps.

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**Data Mode:**

The module is used to communicate with other Bluetooth devices in this mode, and data is transferred. Data transfer between devices. In data mode, the baud rate is 9600bps.

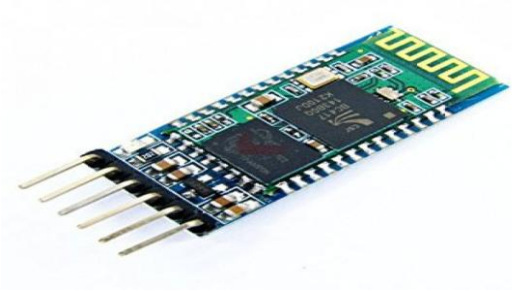

Fig 5.1.3 Bluetooth HC 05

**5.1.4: Solenoid Valve-**

Solenoid valves are control units that shut off or allow fluid flow when electrically energized or de-powered. An electromagnet is used as the actuator. When electrified, a magnetic field forms, pulling a plunger or pivoted armature against the spring's action.
A valve is a mechanism or natural thing that opens, closes, or partially obstructs numerous passages to regulate, direct, or control the flow of a fluid (gases, liquids, fluidized solids, or slurries).

Fluid moves from higher pressure to lower pressure through an open valve.
A solenoid generates an electromagnetic field around a movable core known as an armature. The motion of that armature, when driven to move by the electromagnetic field, opens and closes valves or switches, converting electrical energy into mechanical motion and force. It operates by using an electromagnetic coil to open or close the valve orifice. The plunger is lifted or lowered to open or close the aperture when the solenoid's coil is energized. This, in turn, regulates flow by controlling the passage of gas or liquid. Solenoid Valve (Fig. 5.1.4)

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Fig 5.1.4. Solenoid Valve

## 6. System Configuration

**Hardware Requirement-**

- Processor-Core 2 Duo
- RAM-512 MB (min)
- Relay Module
- Soil moisture sensor
- Bluetooth HC 05
- Solenoid Value
- Wi-Fi- Module

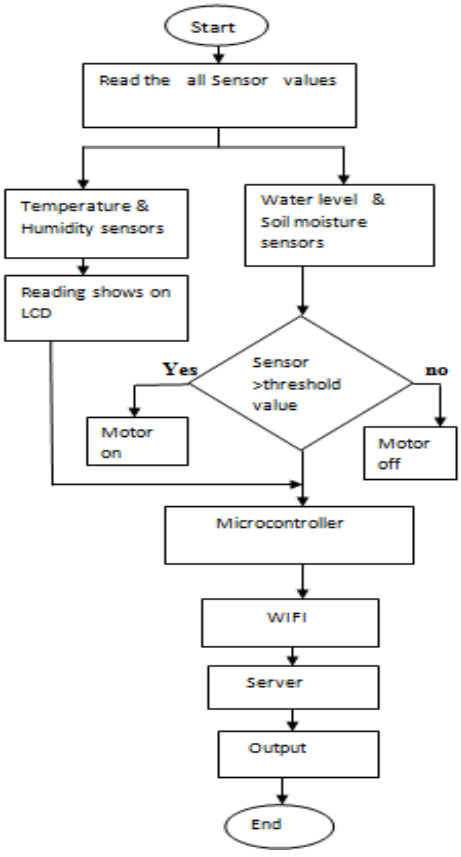
**Software Requirement-**

- Operating System-Windows 7,Windows 8,Android
- Arduino App
- Arduino Compiler
- Languages- Python/Java
- Browser-chrome Firefox, opera, UCB Browser.etc.

**Data Requirement-**

- MySQL

## 7. Flowchart




## 8. Conclusion

Farmers may now use IoT agriculture applications to automatically water a plot of land and wirelessly spray fertilizers and pesticides using their phones. Large landowners and small farmers must recognize the IoT market's potential for agriculture and implement smart technology to improve their production's competitiveness and sustainability. With the world's population continuously increasing, ranchers and small farmers may successfully meet demand provided they use agricultural IoT solutions in a profitable manner.

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[2].Rao R., and Sridhar B. (2018).IoT based smart crop-field monitoring and automation irrigation system. 2Nd International Conference on Inventive Systems and Control (ICISC).doi: 10.1109/icisc.2018.8399118.

[3]. Mishra D., Khan A., Tiwari R., and Upadhay S. (2018). "Automated Irrigation System-IoT Based Approach". 3rd International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU). Available: https://ieeexplore.ieee.org/document/8519886 [Accessed 25 November 2019].

[4]. L. G., S. P., and V. R. (2017). Smart Agriculture System based on IoT and its Social Impact. International Journal of Computer Applications, 176(1), pp. 1-4. doi: 10.5120/ijca2017915500.