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# Automated Farming in Greenhouse Using Smart Field Sensor Network

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**ABSTRACT:** A greenhouse is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown. The objective of the traditional greenhouses growers can control the environmental parameters through a proportional control mechanism which involves manual intervention, often resulting in production loss and increased labor cost. With the existing method growers included cloud based event and data management which plays the major role. Some of the previous systems used android phone to monitor the green house but lacked to control it using android from remote locations. One of them was based on Global System for Mobile Communications (GSM) in which notifications are sent via SMS, but disadvantage of this system was every time user had to type commands which was time consuming and costly. The biggest disadvantage of these systems was that one person always had to be present in the green house or in the vicinity of the green house. Whereas in proposed method an internet of things based smart sensor network that is intended to use in a greenhouse environment. Plants which are grown in green house need a controlled environment. Factors like accuracy of monitoring parameters, structure of shed, covering material to control wind effects, ventilation system plays a major role. Software included in proposed system is Aurdino IDE. The data from the sensors are collected by the software and then the simulation results are obtained in Arduino IDE. The parameters like light, moisture content of soil, humidity and temperature are monitored by the variety of sensors and the microcontroller supports to control the overall system.

**KEYWORDS:** Microcontroller ESP32, Temperature Sensor and Humidity Sensor, Light Sensor, Relay, Sprinkler, Fan, LDR.

## I. INTRODUCTION

The objectives of this report is to proposed IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done. A greenhouse is a building with glass walls and a glass roof. Greenhouses are used to grow plants, such as tomatoes and tropical flowers. A greenhouse stays warm inside, even during the winter. In the daytime, sunlight shines into the greenhouse and warms the plants and air inside. Greenhouse Automation System is the technical approach in which the farmers in the rural areas will be benefited by automatic monitoring and control of greenhouse environment. It replaces the direct supervision of the human. Greenhouse is a building where plants are grown in a controlled manner. Nowadays due to urbanization and lack of land availability there is a great need to construct the Greenhouses which will be reserved mainly for growing crops. With the advancement of technology, we can control and monitor the multiple Greenhouses using IoT from the central location. Greenhouse farming is a technique that enhances the yield of crops, vegetables, fruits etc. A smart greenhouse through IoT embedded systems not only monitors intelligently but also controls the climate. There by eliminating any need for human intervention. Different sensors that measure the environmental parameters according to the plant requirement are used for controlling the environment in a smart greenhouse. Then, a cloud server creates for remotely accessing the system when it connects using IoT. The different sensors that are used to measure the environmental parameters to the plant requirement for controlling the environment in smart greenhouse.

II. PROPOSED SYSTEM

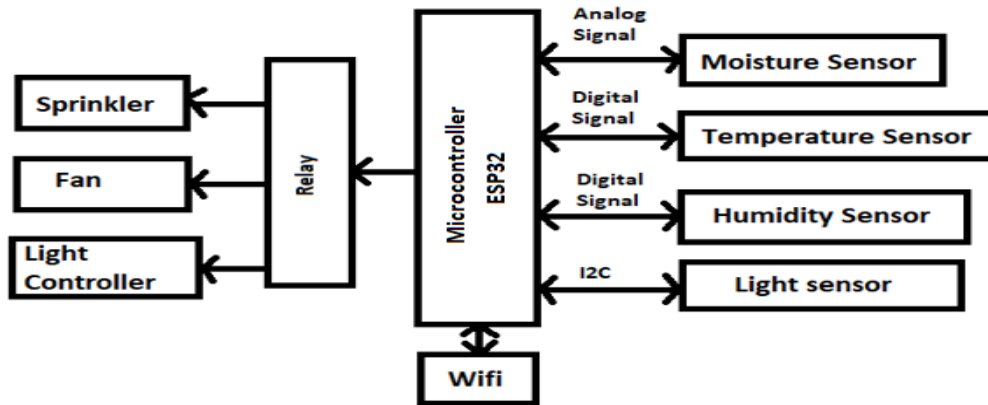


Figure.1. Block Diagram of the Automated Farming

Microcontroller ESP32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth.



Figure 2. Microcontroller ESP32

Soil Moisture Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.



Figure.3. Soil Moisture Sensor

### Temperature Sensor

A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or the temperature of solid matter. There are different types of temperature sensors available and they each use different technologies and principles to take the temperature measurement.



**Figure.4. Temperature Sensor**

### Humidity Sensor

The humidity sensor is a device that senses, measures, and reports the relative humidity (RH) of air or determines the amount of water vapor present in gas mixture (air) or pure gas. Humidity sensing is related to a water adsorption and desorption process. Humidity sensors are used for monitoring industrial as well as agricultural products. Humidity sensors are used in equipment such as incubators, sterilizers, and pharmaceutical processing equipment. Humidity sensors are used to measure and monitor the amount of water present in the surrounding air.



**Figure.5. Humidity Sensor**

### Light Sensor

A light sensor is a photoelectric device that converts light energy (photons) detected to electrical energy (electrons). Seems simple? There is more to a light sensor than just its definition. It comes in different types, used in various applications and more! Hence, in today's light sensor guide, we'll be exploring all you need to know about light sensors.



**Figure.6. Light Sensor**

### Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

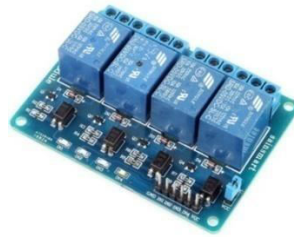


Figure.7. Relay

### Light Controller

A lighting control system is an intelligent network based lighting control solution that incorporates communication between various system inputs and outputs related to lighting control with the use of one or more central computing devices. Lighting control systems are widely used on both indoor and outdoor lighting of commercial, industrial, and residential spaces. Lighting control systems are sometimes referred to under the term smart lighting.

### Wifi

Wi-Fi is the wireless technology used to connect computers, tablets, smartphones and other devices to the internet. Wi-Fi is the radio signal sent from a wireless router to a nearby device, which translates the signal into data you can see and use. These are the most widely used computer networks in the world, used computers, tablet computers, smartphones, smart TVs, printers, and smart speakers together and to a wireless router to connect them to the Internet.

## III.HARDWARE IMPLEMENTATION

This greenhouse project is a plant environment monitoring system that monitors soil moisture level, air temperature, humidity, and water level. Then, depending on the conditions, the system allows users to deliver what is needed remotely through IoT or wifi. Moreover, this system can be scaled and expanded to automate the entire gardening process.

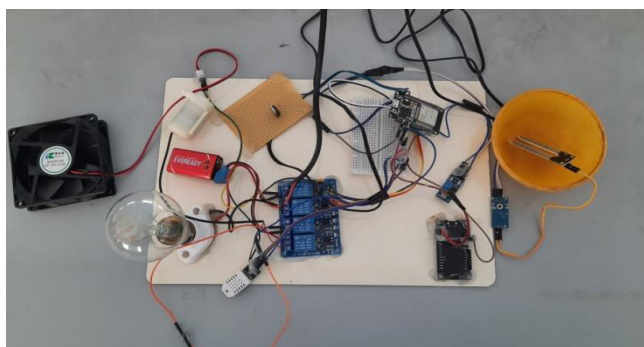


Figure.8. Hardware Implementation

In this setup, we are monitoring the sensor data and interfacing a relay module to control high voltage devices such as motors and lighting devices. We can remotely monitor various parameters in our garden and activate devices as needed. If the water level is reduced to the minimum value, we can switch ON a sprayer motor remotely spray the water. If the temperature is reduced to the minimum requirement, we can switch ON the fan and reduce the Temperature. If your plants need more water, you can open a valve remotely to water the plants.



#### IV.CONCLUSION

Here, proposed design is implemented with Arduino platform for greenhouse monitoring, controlling temperature and soil moisture with the help of Web server using IOT. An internet of things based smart sensor network that is intended to use in a greenhouse environment. The term greenhouse refers to a glass building in which plants that need protection from cold weather are grown. Plants which are grown in green house need an controlled environment. Factors like accuracy of monitoring parameters, structure of shed, covering material to control wind effects, ventilation system etc plays a major role. The use of technology like Internet of thing (IoT) and control system is a key factor in development of connected greenhouse.

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