Iot-Based Monitoring System For Crop Parameters In Greenhouse

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Abstract

Greenhouse monitoring and control systemshave become increasingly popular due to their ability to provide real-time monitoring and control of environmental conditions in greenhouses. These systems use a variety of sensors and actuators to measure parameters such as temperature, humidity, light, and carbon dioxide levels, and control devices such as heaters, coolers, fans, and lighting to maintain optimal environmental conditions for plant growth. In recent years, the use of Telegram bots has become moreprevalent in WSN greenhouse monitoring and control systems due to their user-friendly interface and ability to provide remote access to the control system. Telegram bots allow users to receive real-time notifications aboutenvironmental conditions in the greenhouse and control devices from their smartphones or other devices.

This paper discusses the working principles of a WSNgreenhouse monitoring and controlling system using a Telegram bot, with a focus on the components of the fan and relay with H-bridge. The fan component is responsible for controlling the ventilation in the greenhouse, while the relay with the H-bridge component is responsible for controllingelectrical devices such as heaters, coolers, and lighting.

The integration of the fan and relay with H-bridge components with the control system and Telegram bot enables efficient and remote control of the environmental conditions in the greenhouse. This paper provides an overview of the key components of a WSN greenhouse monitoring and controlling system using a Telegram bot, highlighting the benefits of this system for efficient and remote control of greenhouse environmental conditions.

Keywords- IoT, Greenhouse, WSN

I. INTRODUCTION

Agriculture is the backbone of our country. About 70% of India's revenue comes from agriculture. In this project, we are proposing a model that prevents spoilage of crops due to heavy and uneven rainfall. This objective is achieved with Embedded System Design using GSM technology.

The greenhouse is a structure like a house that is covered with a plastic material or glass mainly designed to cultivate multiple crops m any season. It 1s expected that more cropland and water will be needed to meet the future food demand globally. Furthermore, other challenges such as abrupt changes in climate, lack of labor, and water scarcity spiral the pressure on agriculturists and farmers. The challenges faced by traditional agriculture and greenhouse farming need a fundamental change to develop sustainable and ecologicalfood. Greenhouse farming is one of the best alternatives to overcome the food crisis as well as to ensure the sustainability of ecology.

In conventional greenhouses, climatic variables and other growing methods depend upon the cultivator's assessment and demand for the number of growers. In the last few years, the smart farming concept has attracted the broad attention of farmers, agriculturists, and researchers. Smart greenhouse farming is an enclosed cultivation process that manages the farm by using information and communication technology (ICT) to enhance the quality and quantity of crops with minimal human involvement.

The actual concept of this project is protecting the crops fromheavy rainfall by covering the field automatically and also saving the collected rainwater. To achieve this weare interfacing the bidirectional de-motor GSM module with Arduino UNO.

II. METHODOLOGY

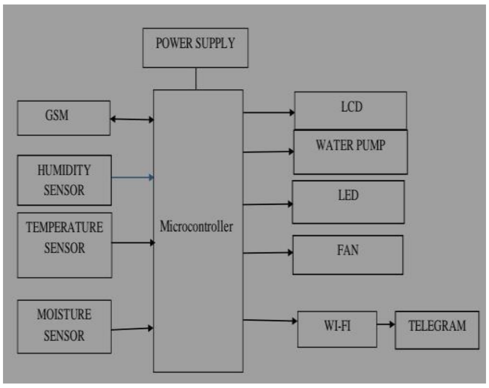


Figure 1: Block diagram of an IoT Based Monitoring System for Crop Parameters in Greenhouse

To enhance operational efficiency and reduce maintenancecosts by real-time monitoring of temperature, humidity, lightlevels, and soil moisture in the greenhouse through IoT sensor Integration. To optimize resource usage and improve crop yield by monitoring environmental conditions in a greenhouse using IoT

DEMO POINTS:

A prototype module will be developed for the project. It includes individual Arduino Uno boards for all interfaces according to the block diagram. The hardware and software used to design the IoT-based monitoring system for crop parameters have also been presented in the same work

LCD: For demo concerns and is used to display all ongoing information

GSM: It will be responsible for sending and receiving the messages.

*ESP*8266: it is a Wi-Fi module self-contained SOC withintegrated TCP/IP

III. IMPLEMENTATION

The complete implementation of the system is shown in Fig 2. The following components are used

- Arduino UNO
- Relay
- LCD
- Wi-Fi Module ESP8266
- LDR
- Moisture Sensor
- Embedded C
- Arduino IDE
- Temperature & Humidity Sensor

Figure 2: Overall schematic diagram of an IoT-based monitoringsystem for crop parameters

A. AT Mega 328 Microcontroller

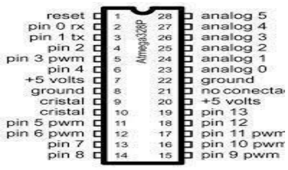


Figure 3: AT Mega 328 Microcontroller Pin Diagram

- The Arduino microcontroller is the heart of the system.
- micro-controller performs the required actions by employing relays until the strayed-out parameter has been brought back to its optimum level.
- The 28-pin microcontroller chip used on Arduino is the ATmega328.

B RELAY

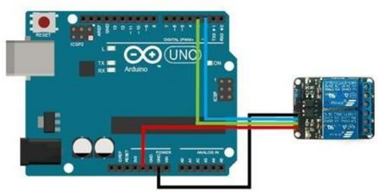


Fig4: Relay

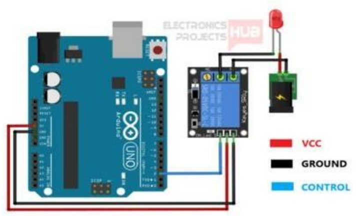


Figure 5: Two-Channel Relay

The module contains four control pins that are pins 1,2, 3, and 4. Pin 1 is the power supply pin to power the optocoupler in the module. Pin 4 is for the ground. While pin 2, and 3 is to control the relay.

C. A Light Dependent Resistor (LDR)

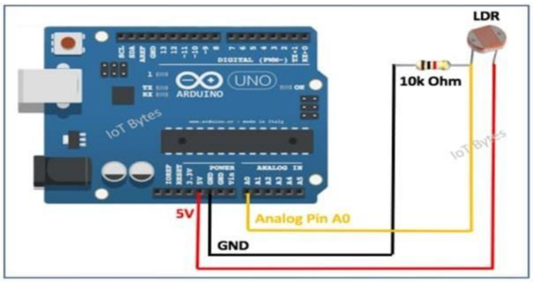


Figure 6: Light Dependent Resistor

They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate an LDR, one of the most commonly used symbols is shown in the above figure

The first terminal should be connected to analog pin 0 (A0) of Arduino. The second terminal should be connected to 5V and also to the resistor. Another leg of the resistor should be connectedto the Gnd of Arduino. Led connections.

D. MOISTURE SENSOR

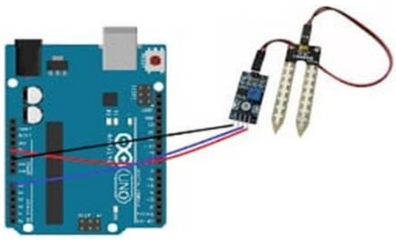


Figure 7: Moisture Sensor

- The YL69 is an expensive soil moisture sensor used to detect the amount of moisture content present in thesoil. The operating voltage is 3.3v to 5v and the current is 35mA. This sensor consists of two electrodes which when comes in contact with the soil the voltage fluctuates i.e. theoutput voltage decreases when the moisture is present and the output voltage increases when the soil is dry.
- Connect the wires from the other (4-pin) side of the amplifier to an Arduino board. The VCC goes to 5V,GND to ground, A0 to an analog pin, and D0 to a digital Arduino pin. You can then run the code found here to get it tooutput the sensor value via the serial port.

E. LCD INTERFACING

- Connect the VCC pin of the LCD to 5V on the Arduino.
- Connect the GND pin of the LCD to the GND on the Arduino.
- Connect the SDA pin of the LCD to a digital pin (e.g.,Arduino pin 12).
- Connect the SCL pin of the LCD to another digital pin(e.g., Arduino pin 11).
- Connect the V0 pin of the LCD to the middle pin of theSensor.
- Connect one end of the sensor to 5V and the other end toGND.

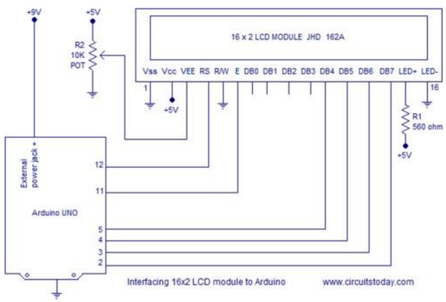


Figure 8: LCD Interfacing

F. TEMPERATURE & HUMIDITY SENSOR (DHT11)

- Connect the positive (VCC) pin of the DTH sensor to the5V pin on the Arduino UNO.

- Connect the negative (GND) pin of the DTH sensor to theGND pin on the Arduino UNO.
- Connect the data (OUT) pin of the DTH sensor to a digitalpin on the Arduino UNO (e.g., Arduino pin 2).

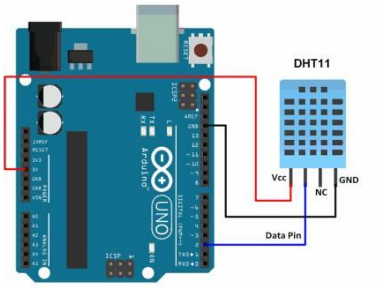
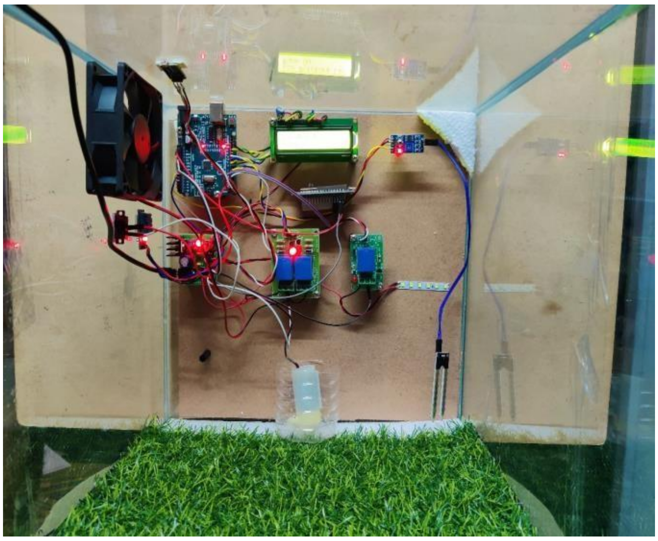


Figure 8: Interfacing Temperature &Humidity Sensor

IV. Results & Discussion



Obtained results are shown in this section. The implemented greenhouse structure.

A lot of greenhouse monitoring and control systems using a Telegram bot can provide a range of benefits for greenhouse operators, including improved efficiency, increased crop yields, and cost savings.

Obtained results are shown in this section. The implemented greenhouse structure is shown in Fig

The Temperature and Humidity of the greenhouse is displayed on LCD as well as on the Telegram server

The DC Fan used in the greenhouse is turned on once the Temperature has exceeded 30°C as illustrated otherwise it is timed Off

The Soil Moisture module senses the amount of Moisture in the soil and if the Moisture in the soil is sufficient the water pump is Off and if there is insufficient Moisture in the soil the water pump is turned On. The result can be seen in Fig

With the help of an LDR module and LED, the Light Intensity is maintained in the Greenhouse which is a vital factor for plant growth. Fig & identifies the state of the LEDs in the presence of sunlight and identifies the state of the LEDs in the absence of sunlight.

V. Advantages & Disadvantages

ADVANTAGES

- Improved crop monitoring
- Remote monitoring and control
- Precision agriculture
- Data analysis
- Scalability

DISADVANTAGES

- Pest and disease control
- Labor requirements
- Limited crop diversity
- High capital costs

VI. Conclusion

By implementing this project, we can avoid crop damage against rains and floods and as well a good yield can be achieved in farming lands. In greenhouse technology, a greater number of parameters are to be controlled because the varieties of the crop are large. They are increasing day by day because of the development of agricultural technology. In this situation, the wireless sensor network with additional hardware and software is an efficient solution for greenhouse control. Experimentally itis proven the best solution which works on low power with less complexity and high reliability for greenhouse control. In the future, if the parameter still increases, then WSNtechnology with currently available bandwidth, may not be sufficient. Then WSN with cognitive radio technology maybe the solution. This advancement in precision agriculture through Wireless Sensor Networks in greenhouse control isextremely useful.

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