



# ETEC 3173

## Instrumentation

### Group Assignment

### Final Design Report

### Green House Monitoring System

Group No 06

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# Introduction

Plants can grow effectively in a controlled environment in a greenhouse, but it takes constant observation and prompt modifications to maintain the proper temperature, humidity, and water availability. Conventional manual control techniques are frequently laborious, unreliable, and slow to react to abrupt changes in the environment. Automated monitoring systems are now crucial to contemporary agriculture in order to get around these restrictions.

This project introduces a Smart Greenhouse Monitoring System that uses embedded sensor and control technology to automatically adjust the interior temperature. Without human interaction, the system continuously measures temperature, humidity, and water tank level. Based on predetermined threshold readings, it turns on the fogger valve, pressure pump, and water tank filling motor. The system guarantees consistent environmental conditions and continuous water supply for fogging operations by integrating sensors like a DHT temperature-humidity module and an ultrasonic water-level sensor with a microcontroller-based decision-making unit.

The suggested design promotes healthier plant development, lessens human effort, conserves water, and increases greenhouse efficiency.

## Features

- Real time data on web-based dash bord.  
We can observe greenhouse environmental real time data like Temperature, Humidity and water level of the tank by through the web-based dash bord (currently it working only local host network only).  
And can be controlled manually through the dashboard.
- Automated water level monitoring and controlling.  
uses an ultrasonic sensor to measure the water level and when it falls below 50%, it immediately starts a water tank filling motor.
- Temperature and humidity are controlled by automatically.  
When the temperature and humidity reach or fall below predetermined levels, a fogger valve and pressure pump are activated.
- Pressure pump is controlled by automatically.  
When the one valve like fog valve is activated then the Pressure pump will automatically be activated for the supply water.

## Components

- ✓ ESP 32 microcontroller
- ✓ LED dashboard
- ✓ Three-channel relay module
- ✓ Industrial DHT 11 temperature and humidity sensor
- ✓ Ultrasonic sensor
- ✓ BC547 Transistors -3
- ✓ 220K Resistors -3
- ✓ 4.7k Resistors - 3

## Function of the Circuit

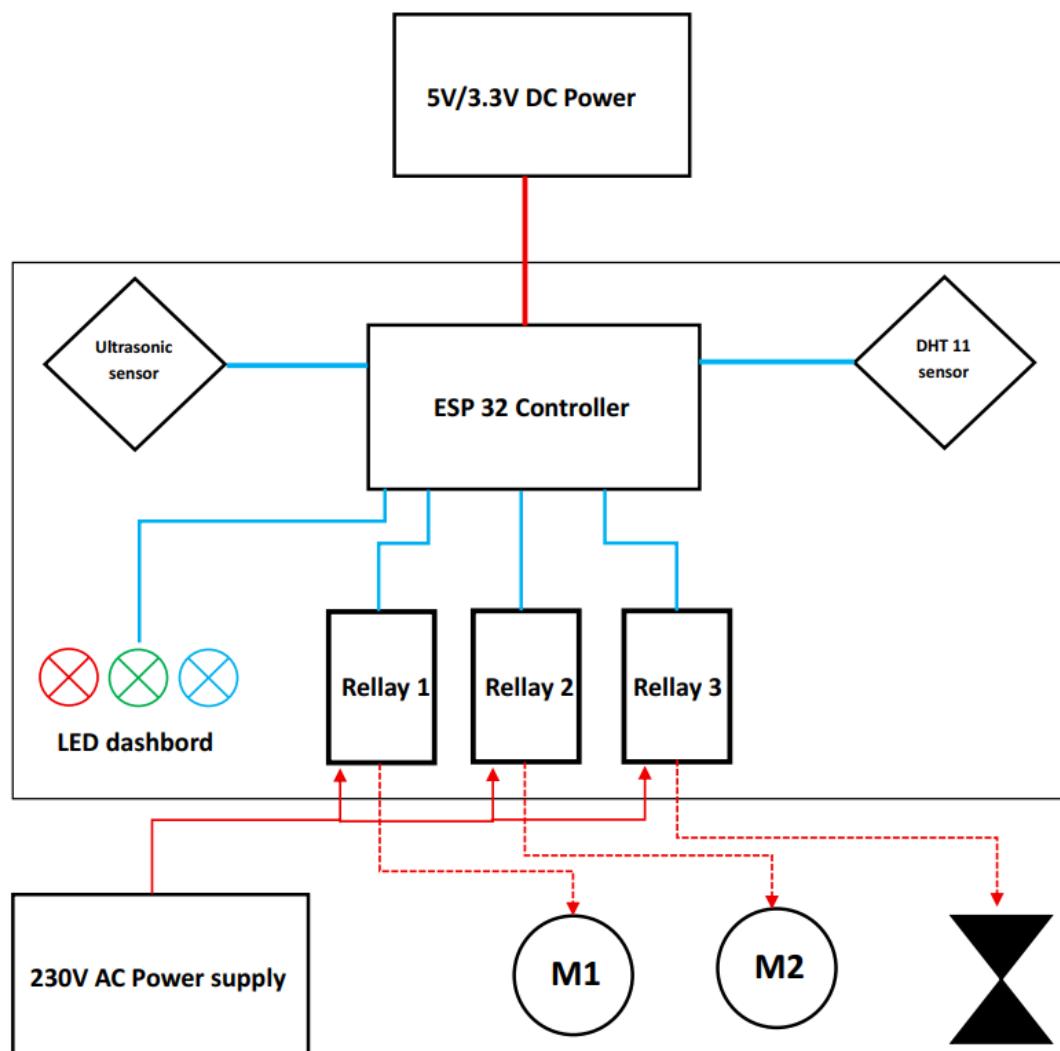


Figure 1 Block Diagram of the circuit

5V and 3.3V DC power supply used for the powering entire circuit. Ultrasonic sensor used for the identifying the water level of the tank and it measured only distance between water level and the sensor position. By using code function, we convert that in to percentage value and it displayed on our web-based dash bord. Same as the temperature and humidity level inside the green house measured by using the DHT11 temperature and humidity sensor. It can be also monitor with dash bord.

At the beginning the checking the sufficient water level was in the tank by using ultrasonic sensor. The water is available in the tank then only go through the others functions.

The water is not enough to the supply then automatically turn ON the Motor 1 (M1). For the controlling high-power motor, we used 5V /230V AC relay module. That relay module controlled by esp32 microcontroller. After the water tank is filling, the Motor 1 was deactivated.

According to the pre-defined threshold value of the temperature and humidity, the irrigation valve and motor 2 was activated. That actuators controlled by relay2 and relay3. After the environmental condition is come to normal, then the motor 2 and valve was deactivated automatically.

In here we can see all of the data from web-based dash bord as follow. And also, physically can identifying which actuator was active or inactive by using LED dashboard.

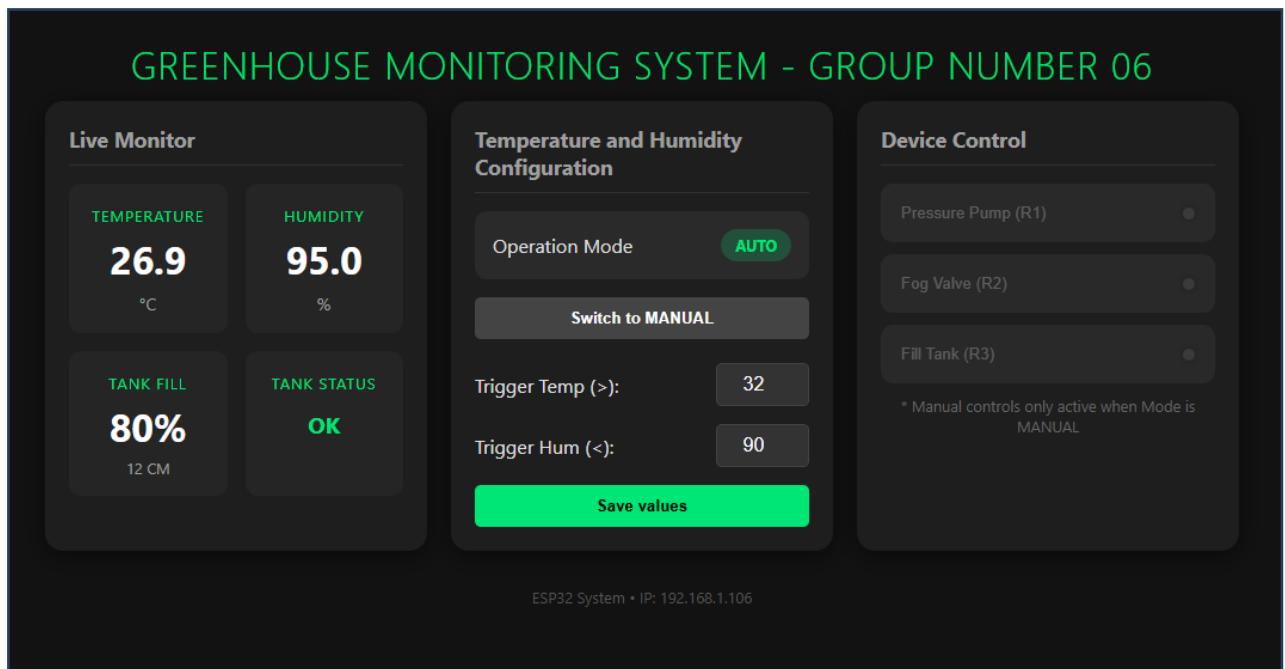


Figure 2 Web based dash bord

## Control flow

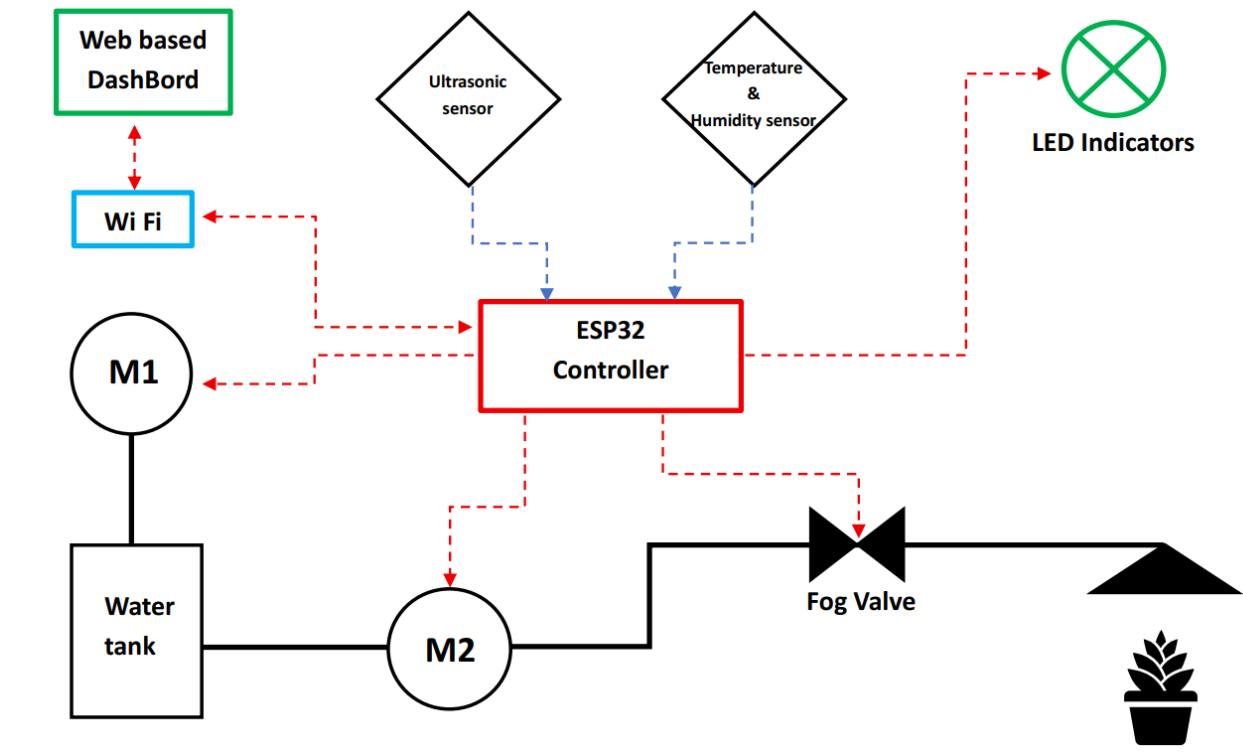


Figure 3 Block diagram of the Data Acquisition System

The control logic for managing the irrigation system is implemented using an ESP32 microcontroller, which monitors temperature and humidity levels and operates one valves and a pressure pump based on those environmental conditions. The water pump activated for the water level of the tank.

The main components of the control logic are outlined below:

### Motor Control

- Motor 1 is used for the tank filling by identifying the water level of the tank is lower than 50%. If that condition is true then the M1 is activated and filling the tank.
- If the water level of the tank was lower than 50% then the any kind of valve or other motor were not activated because of the safety reasons.
- Motor 2 is activated for the supply water if the valve is activated. If the valve is off then the motor 2 should off to conserve energy and prevent unnecessary operation.

### Valve Control (Fogging)

- Valve 1 is responsible for irrigation based on temperature and humidity conditions.
- If the temperature exceeds 40°C or the humidity drops below 60%, Valve is activated to start irrigation.
- Simultaneously, the motor 2 (M2) is turned on to ensure water flow through Valve.
- Once the temperature falls below 40°C and humidity rises above 60%, Valve is deactivated and same as pressure pump was deactivated.

By implementing this control logic, the system efficiently manages irrigation supply, ensuring optimal plant growth conditions while conserving resources. The automated operation based on environmental conditions and predefined schedules provides a robust solution for agricultural automation.

### Circuit Diagram

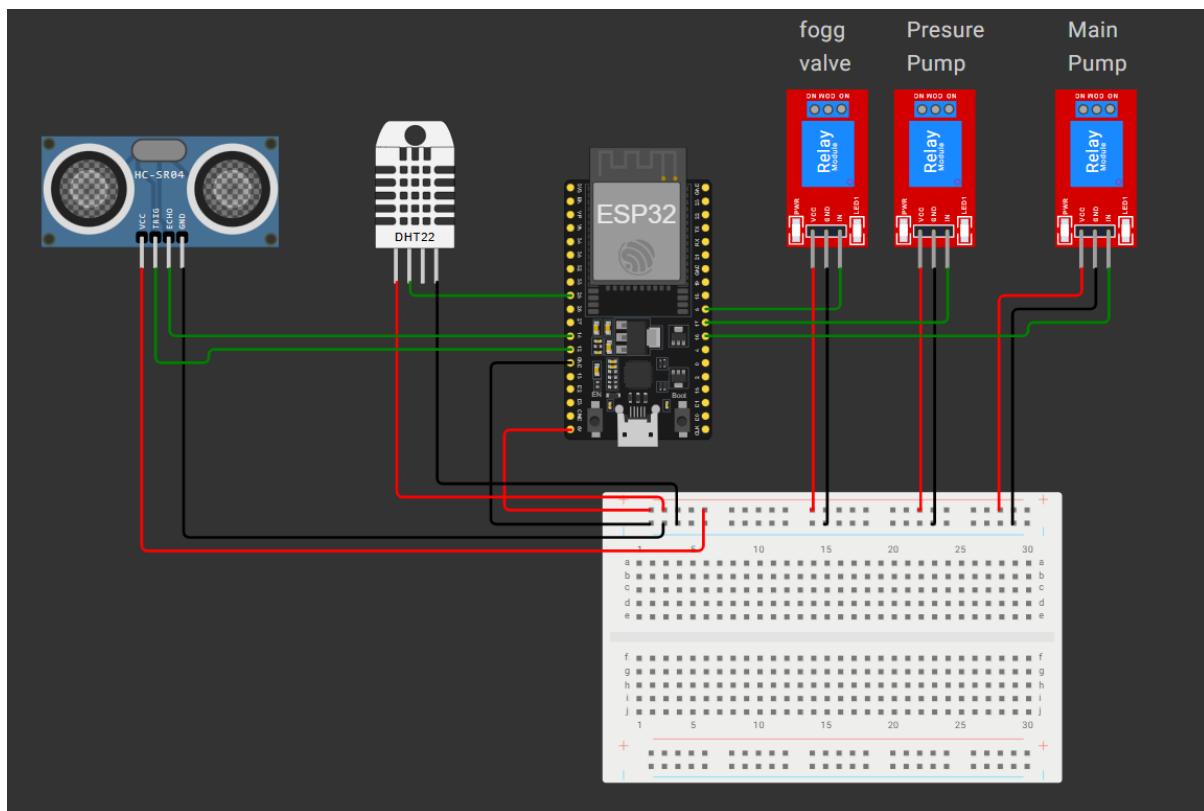


Figure 4 Circuit diagram

# Working Principle of the Circuit

Real-time environmental observations and preprogrammed threshold values are the basis for the greenhouse monitoring system's operation.

## Step 1: Measurement of Temperature and Humidity

The greenhouse's current temperature and humidity are measured by the DHT sensor. The microcontroller receives these values continuously.

## Step 2: Choosing to Turn on the Fogger Pump

The microcontroller triggers the fog valve and pressure pump if either the temperature is higher than the predetermined value or the humidity is lower than the predetermined value. The pump automatically turns off when the environmental values revert to the permitted range.

## Step 3: Measurement of the Water Tank Level

The distance between the ultrasonic sensor and the water's surface is measured. A percentage of the water level is calculated from this distance.

## Step 4: Activating the Tank Filling Motor

The tank filling motor is automatically turned on when the water level drops below 50%. The motor turns off when the tank reaches a safe level (> 50%).

## Step 5: Ongoing Automated Function

The technology maintains ideal greenhouse humidity levels and tank water availability without requiring human interaction.

# Results

Temperature, humidity, and water level were all successfully measured in real time by the device.

The fogger pump turned on precisely when the temperature rose over the predetermined limits or the humidity dropped.

At low water levels, the refilling motor ran automatically thanks to the ultrasonic sensor's accurate detection of the tank's water level.

All things considered, the design kept the greenhouse's temperature and humidity constant while guaranteeing a steady supply of water for the fogging system.

## Difficulties Faced

- ❖ After the soldering all of the components, the relay module was not functioning for the signals because of the internal resistance of the connection wires and solders. To solve that problem we think to use transistors as a switch for triggering relay modules.
- ❖ DHT11 temperature and humidity sensor was not responses for the rapidly changed of the temperature and humidity.

## Future upgrade functions

- Water flow control using a moisture sensor (problem arises: it is difficult to use for every plant).
- Adding the moisture sensor and flow sensor.
- Add the AI features to identify the behaviours of plants.
- Add the display for the controller

## Conclusion

The Smart Greenhouse Monitoring System developed in this project successfully demonstrates how automation can significantly improve environmental control in modern agriculture. By integrating temperature, humidity, and water-level sensing with intelligent decision-making, the system ensures that the fogger pump and water tank motor operate only when required, maintaining optimal growing conditions with minimal human involvement. The use of a microcontroller-based platform provides accuracy, reliability, and real-time responsiveness, making the design both efficient and practical. The project achieves its objective of creating an autonomous, energy-efficient, and user-friendly solution for greenhouse climate management. The implemented system not only supports healthier plant growth but also reduces water wastage, operational effort, and maintenance needs. This idea has great potential for practical agricultural applications and future growth with additional improvements like wireless monitoring or mobile-based control.