CPE 301 Embedded Systems Design Spring 2024

Final Project Evaporation Cooling System Report

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Final Project Introduction

The main purpose of this project is to create an evaporation cooling system and get a good idea of how the system works. In real life, we use the evaporation cooling system to humidify and cool the air in the house or the car. It's important to use it in hot dry climates but less effective in higher humid climates. The system mainly uses the evaporation principle to lower the temperature. As the outside air goes through the cooling evaporative pads, the heat will be absorbed, and the system will evaporate the water for cooling. For this project, we are building a system that has similar cooler functionalities by using the Elegoo Starter Kit without the actual outer body.

Components and Functionalities for the Circuit

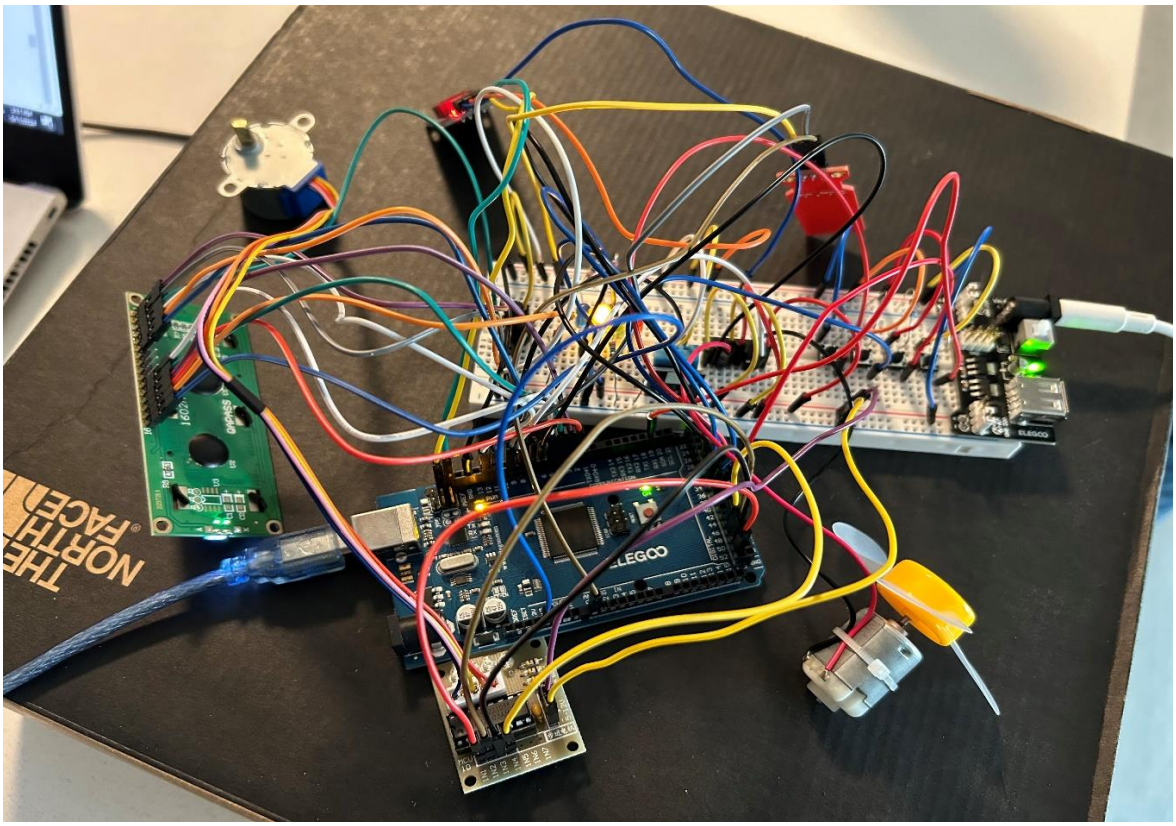
For this project's components, we are using 2560 Controller Board, Breadboard, Jumper Wires, Resistors, 4 LEDs, 4 buttons, Dupont Wires, Potentiometer, L293D IC, DHT11, Power Supply, 3-6V Motor with fan, Stepper Motor with the driver, LCD, Real-Time clock, and Water Sensor. The 4 buttons start from the right side, the first one is the on/off button, the second one is the reset button, and the remaining two are for controlling the Stepper Motor left or right. For the 4 LEDs, green is for the idle state, blue is for the running state, yellow is for the disabled state, and red is for the error state. The potentiometer is for controlling the LCD screen lighting. DHT11 is used for getting the temperature and the humidity values. Power Supply provides the power for the circuit. The 3-6V Motor with a Fan is to cool the water down. Stepper Motor is to control the vent direction. LCD is for displaying the updated temperature value, humidity value, and the error message. The Real-Time Clock is for reporting events. The Water Sensor is used for monitoring the water level. All the components are connected to the Breadboard and the 2560 Controller Board.

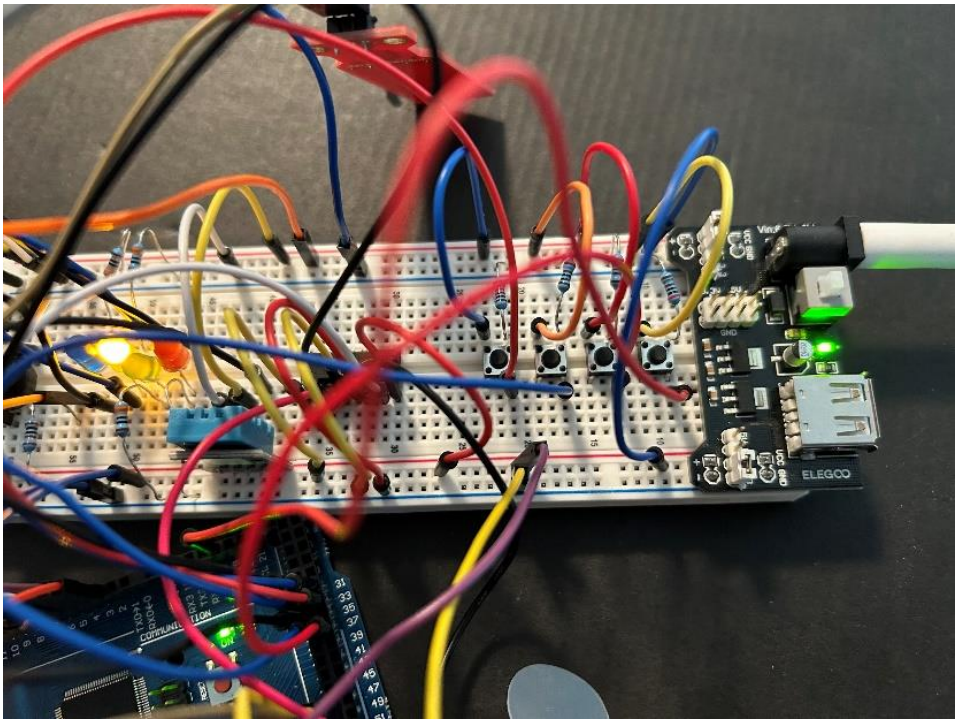
States and Design Overview

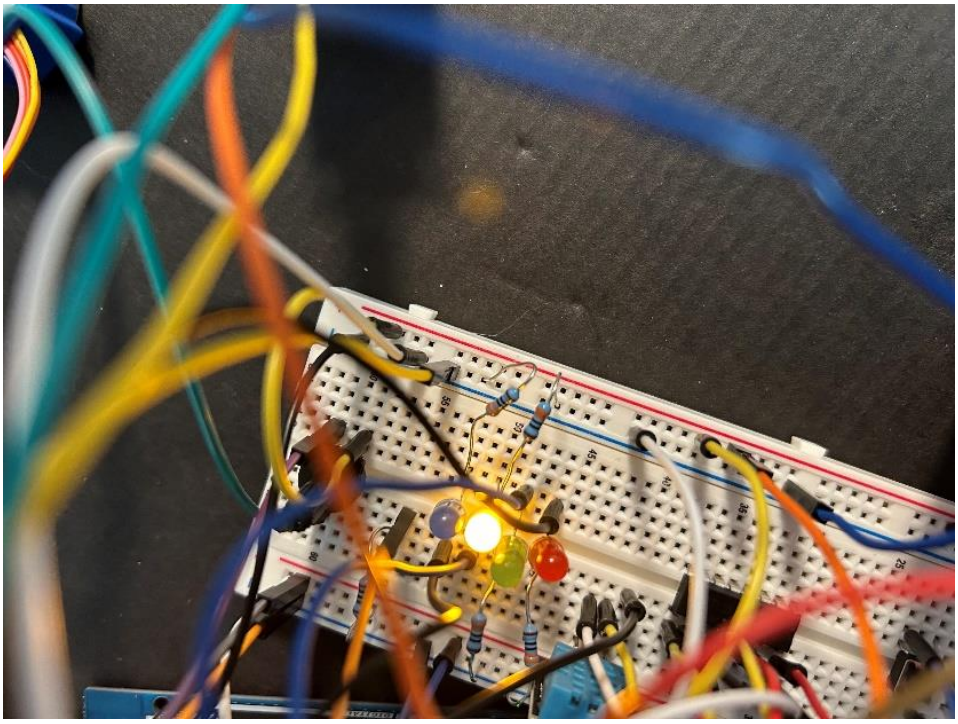
At the beginning of the Cooling system, the circuit should be in the disabled state since no water is on the water sensor, which means the fan is off and the yellow LED is on. To start the circuit, we need to press the on/off button then it should enter the idle state. In the idle state, the LCD should display the temperature and humidity values, the green LED should be on as well and the fan should be off. The idle state should be able to go back to the disabled state by clicking the on/off button. To enter the running state, we must make sure the temperature value is higher than the threshold value. During the running state, the fan is on, the blue LED is on, and temperature and humanity value are both displayed on the LCD screen. During any of the 3 states of disabled, idle, and running, the vent position (rotating left or right) can be changed by using the left or right button. To enter the error state, we need to make sure the water level is lower than the threshold

by clearing out all the water that's on the water sensor. During the error state, the red LED is on, and the LCD should display "Water level is too low," the fan should be off as well. If we want to get out of the error state, we can put the water sensor back in the water and press the reset button. We can always back to the disabled state by pressing the on/off button at any time during any one of the other 3 states. When every time we press the on/off button or the state is changed, the Serial Monitor should display the status of "ON", "OFF", or "State Change" along with the time from year to second by using the U0putchar function multiple times. One constraint of the system is that the disabled state can only enter the idle state.

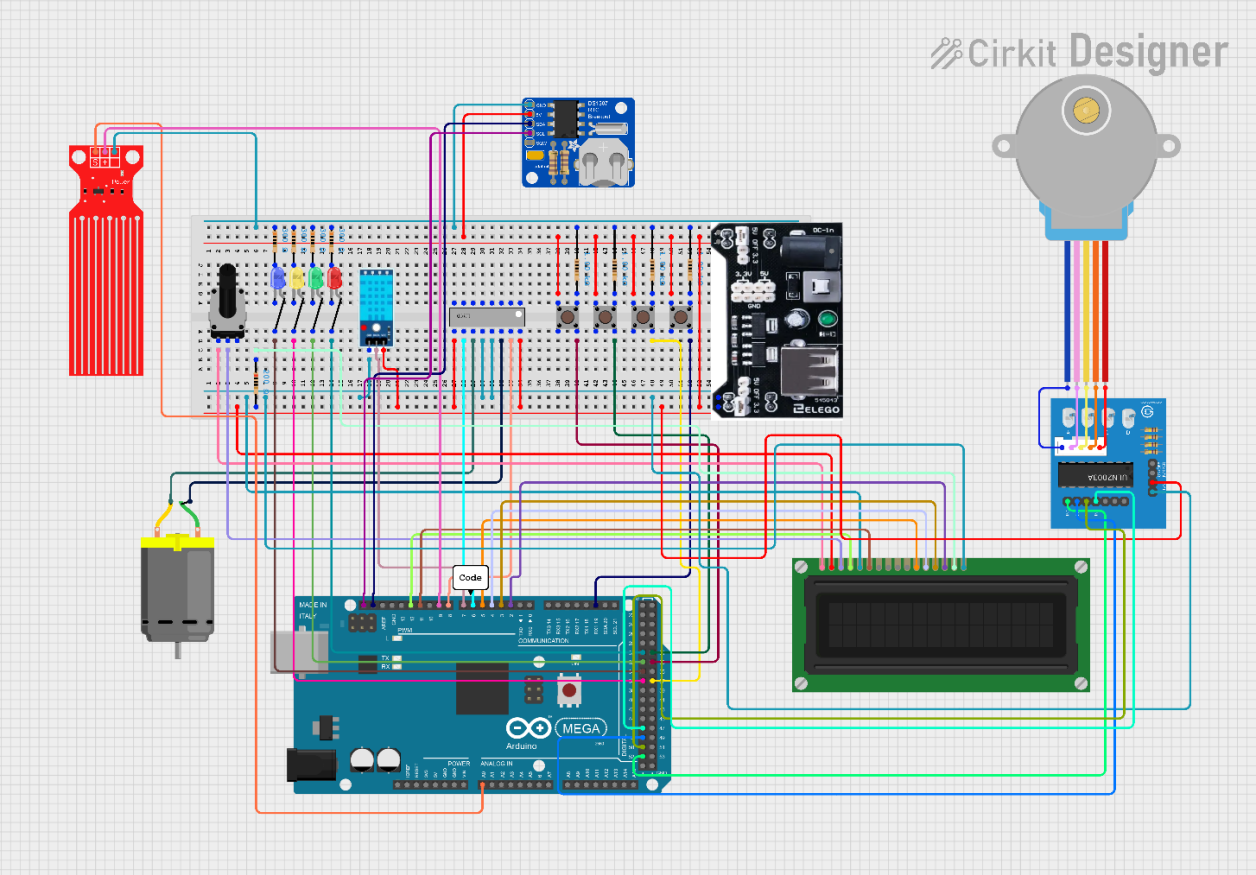
Final Cooler Circuit Pictures




ELEGOO



Schematic Diagram



GitHub Link

https://github.com/trentsmelich/CPE301-Final-Project

Video Link

https://www.youtube.com/watch?v=pAUs3xLKdks