CPE 301 Final Project Report

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1 Project Description

In this project, the objective was to simulate an evaporation cooling system. The components involved in building this include an ATmega 2560, water level sensor, a stepper motor with a driver module, an LCD display, a real-time clock module, the temp/humidity sensor DHT11, a kit motor, and fan blade. The project is designed to have several functions, separated into four system states. These states include DISABLED, IDLE, ERROR, and RUNNING. In terms of functionality, the system operates by monitoring water levels and, when a threshold is not being met, an alert will be displayed on the LCD. The current air temperature and humidity are also monitored and displayed. If the air temperature is not within a specified range, a fan motor will be turned on. User input is taken in that they are allowed to control and adjust the angle of a vent using a potentiometer, in addition to enabling and disabling the system using a button. Lastly, the date and time of any state transitions or any changes in stepper motor position are recorded and transmitted to the computer and displayed on the serial monitor.

2 Component Details

1. Water level sensor: The water level is monitored and detects when a certain threshold is not reached.
2. Stepper motor: The stepper motor is used with its driver module to adjust the angle of a vent when prompted by the user.
3. LCD display: The liquid crystal display is used to display several different messages for different states, including an error message, the current air temperature and humidity, and when the system is disabled.
4. Real-time clock module: This component is used to report the exact time of a change in state, as well as the time in which the stepper motor changes position.
5. Temp/humidity sensor DHT11: This sensor is used to monitor air temperature and humidity.
6. Kit motor and fan blade: These are used together and are turned on when the air temperature falls outside the specified range.
7. Potentiometer: This is used by the user to adjust the angle of the stepper motor vent.
8. Button: Allows the user to prompt the system to either enable or disable.

3 System Overview

Constraints include the air temperature in which testing occurs as it could be difficult in certain conditions.

4 Circuit

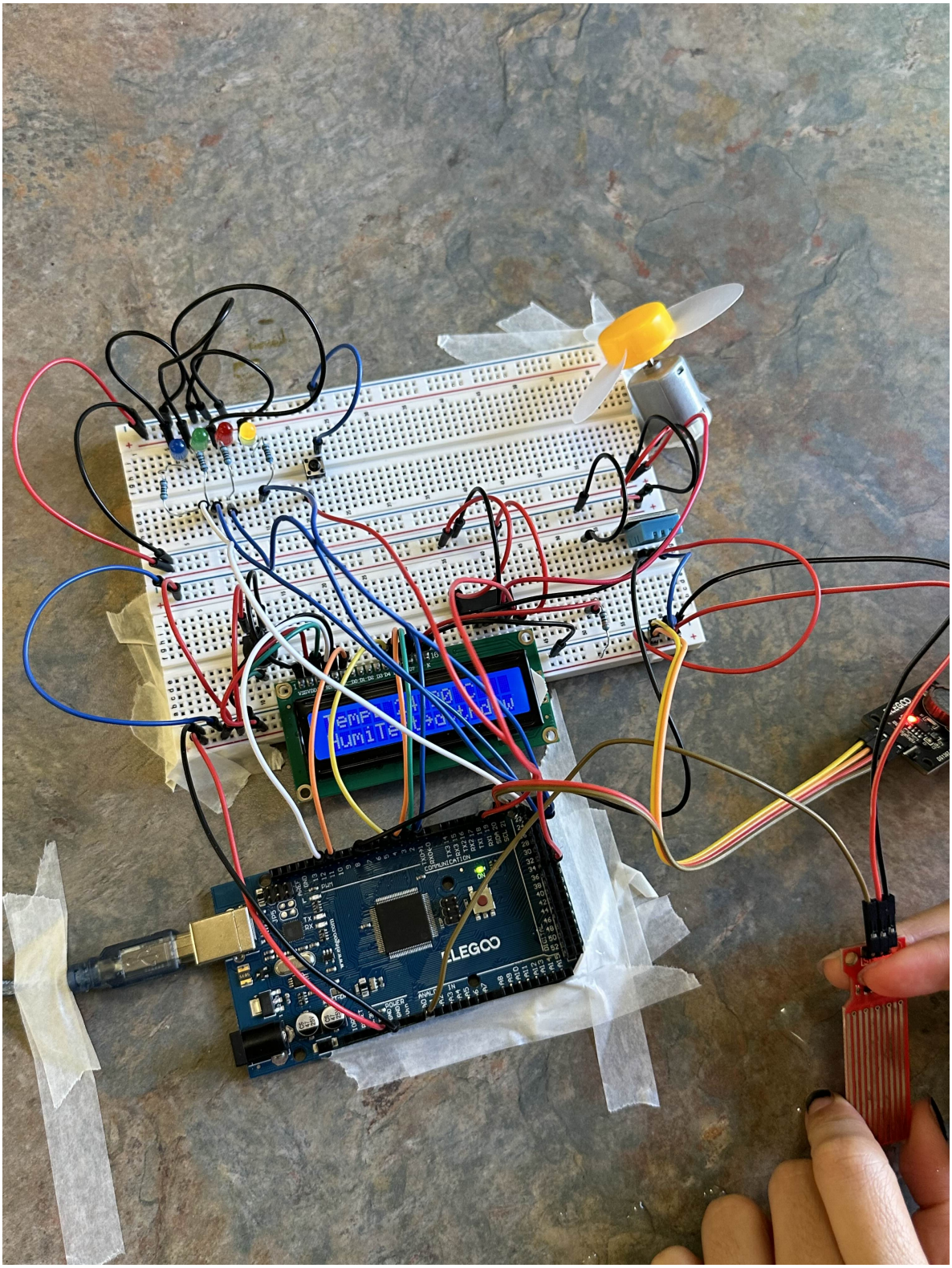

Figure 1: This is a full-image view of the cooler circuit (stepper motor and vent are not shown but are present at the end of the system demonstration).

5 Schematic Diagram

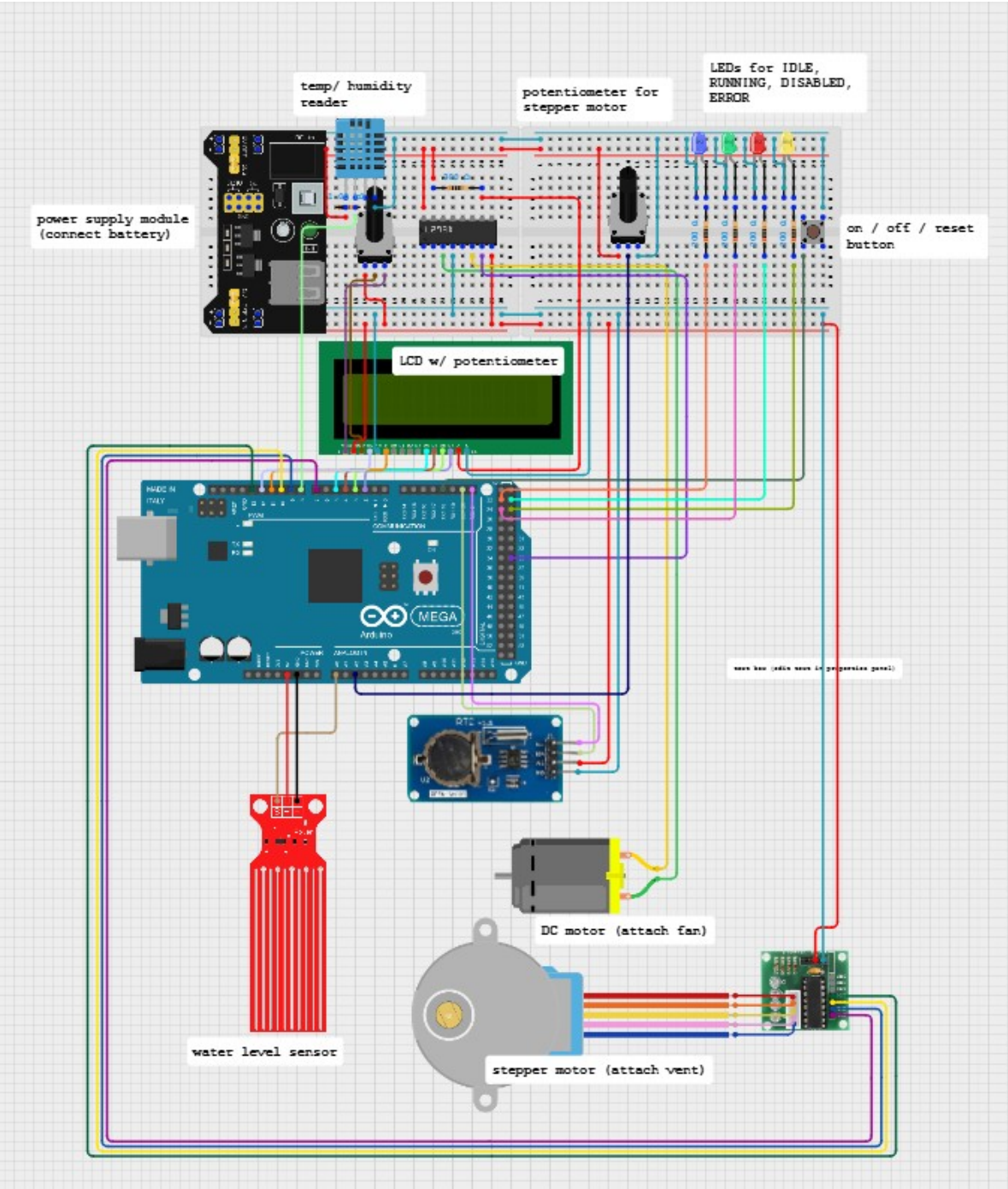

Figure 2: This is the schematic diagram for the cooler's circuit.

Schematic Diagram Link: https://app.cirkitdesigner.com/project/7830adcc-a6e1-4757-b749-8e18e83bdb02

6 System Demonstration

System in operation: https://www.youtube.com/watch?v=Va7PK4WJ424

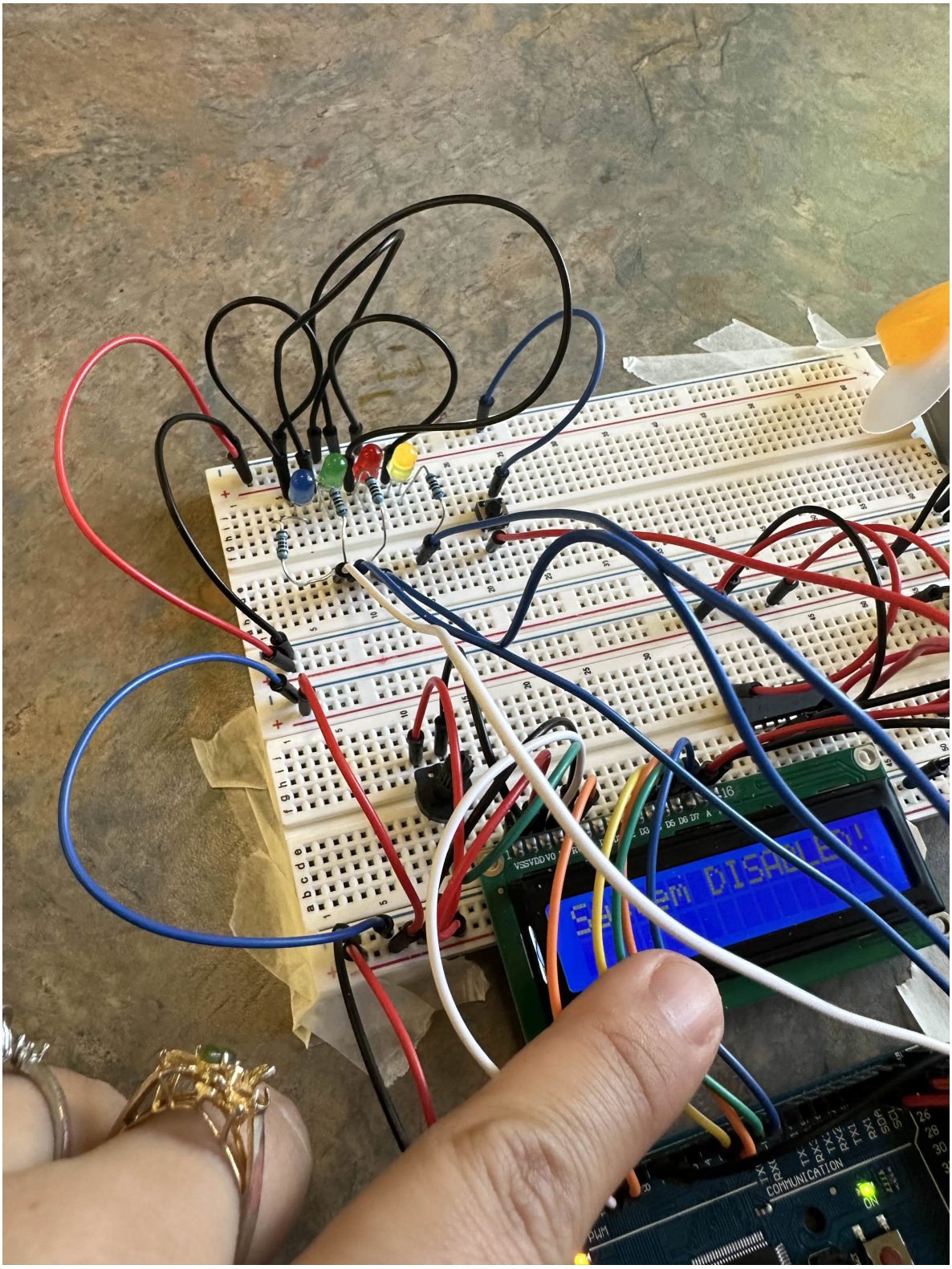

Figure 3: This is the cooler circuit when disabled, represented by a yellow LED. No monitoring occurs in this state, and the system is only enabled once the start button is pressed.

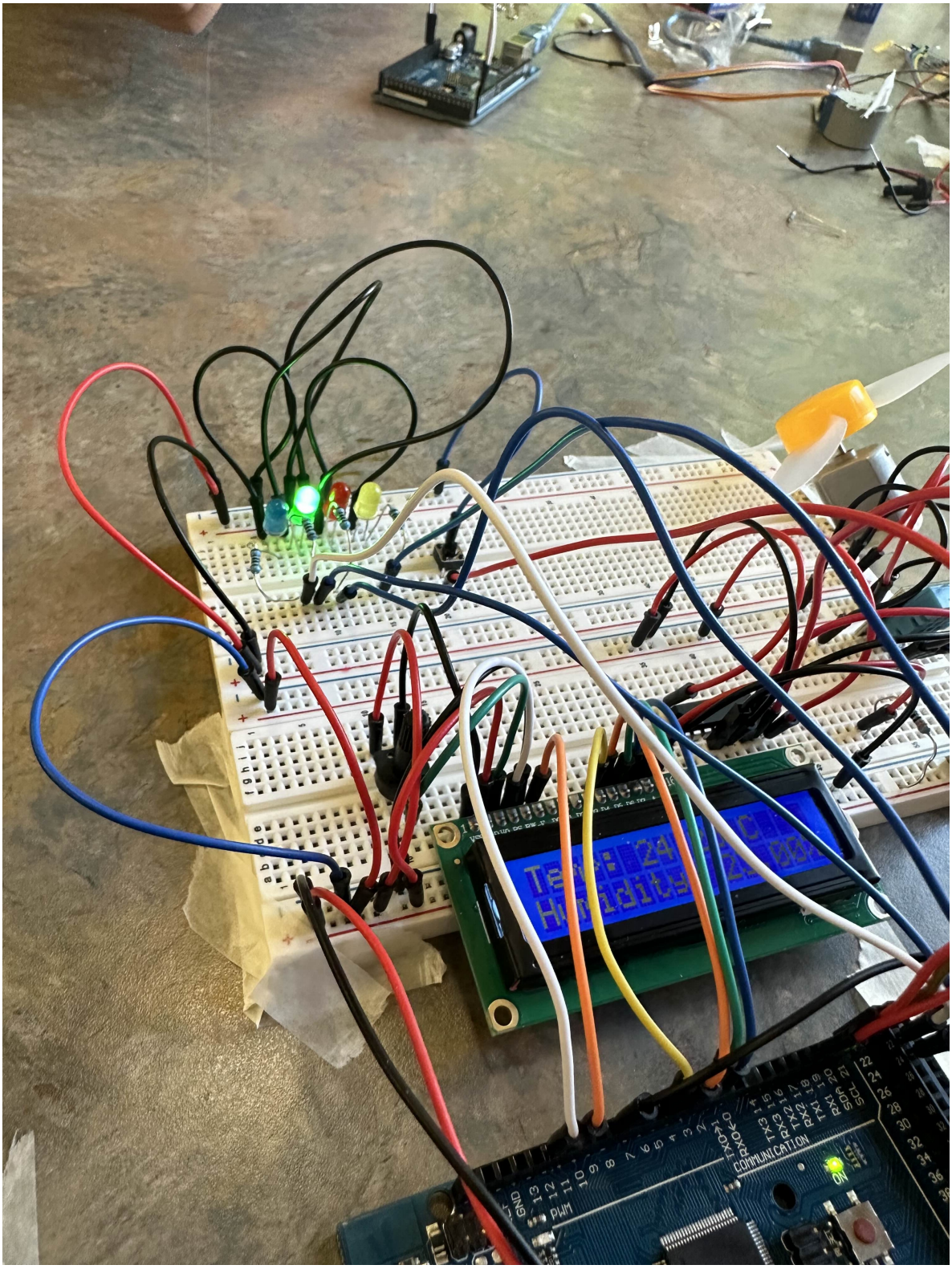

Figure 4: This is the cooler circuit in its idle state, represented by a green LED. Transitions to other states, the current air temperature, and current air humidity will be recorded.

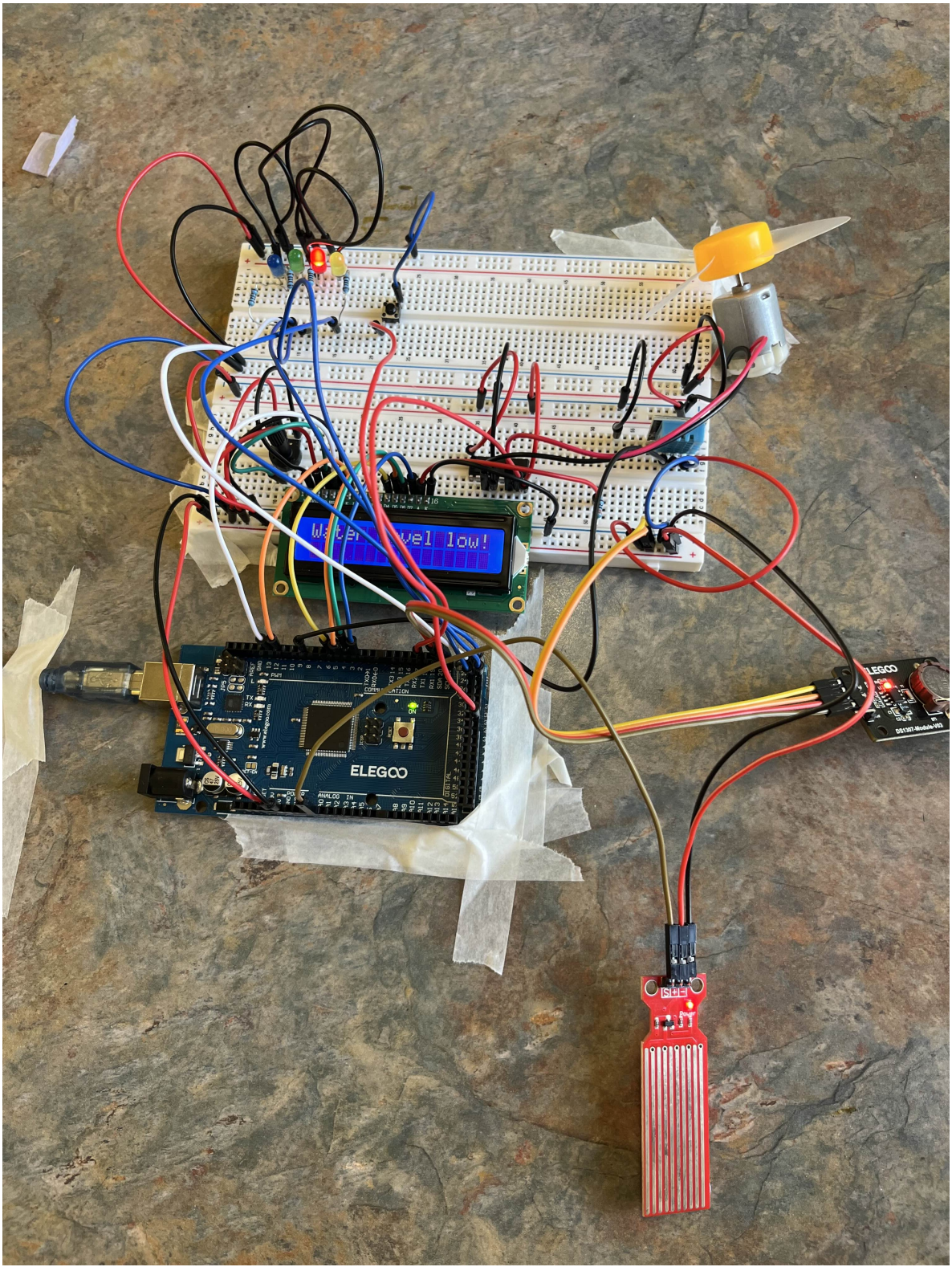

Figure 5: This is the cooler circuit in the error state, represented by a red LED and an error message on the LCD. This occurs when the water level becomes too low, and in which the motor stays off. Pressing the button should cause the system to transition back to the idle state if water level is above the threshold.

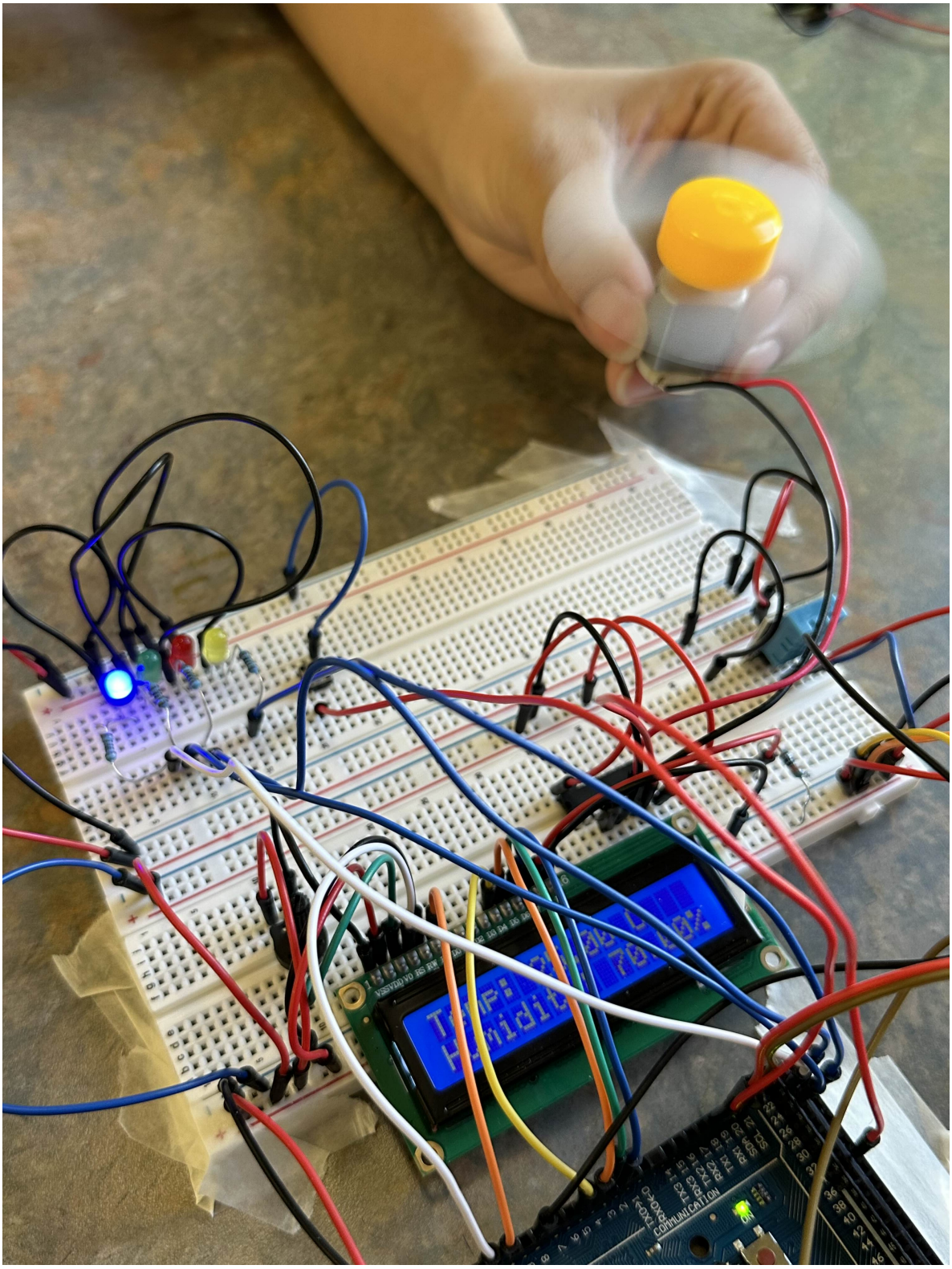

Figure 6: This is the cooler circuit in the running state, represented by a blue LED. The fan motor is turned on in this state, idle occurs once air temperature falls below the threshold, and error can occur if water falls below its threshold.

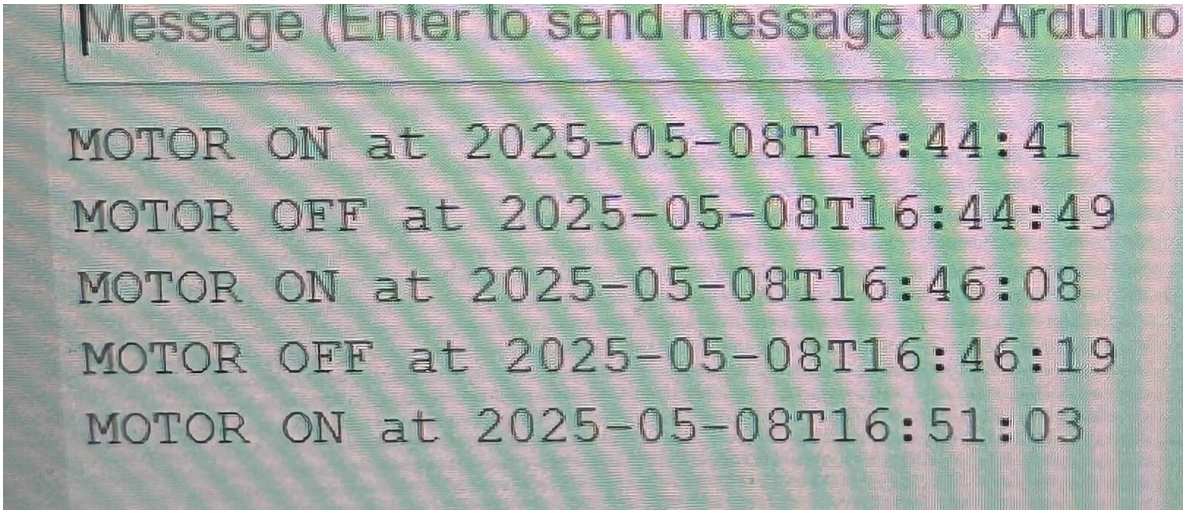

Figure 7: This is an image of the host computer's serial monitor displaying the recorded times when the motor is turned on or off.

7 Github Repository

https://github.com/avalchong/CPE-301-Final-Project