Swamp Cooler Final Project

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Introduction

Swamp coolers are very efficient air conditioning units that work by using a small reservoir of water and a pump to keep the pads inside constantly wet. Then, they draw air through these pads to cool it and push it back out into the surrounding area. The reason they are a better alternative to traditional air conditioners, is because they consume less energy and work more efficiently in hot, dry climates. The project we created is a circuit version of a swamp cooler using the Arduino Atmega 2560.

Hardware

Using the components in the Arduino kit, our circuit simulates every function that an actual swamp cooler has. The main unit operating the entire circuit is the Arduino Microcontroller which was followed by LED's, the LCD screen, the sensors, and the motor drivers.

Our first installation was the LED's which signal the state that the swamp cooler is in. The circuit starts in the disabled state being yellow, then green for the idle state, blue for running, and then red for error. Next, we installed the temperature/humidity and the water sensors. The DHT11 temperature sensor wasn't amazingly accurate but it allowed us to measure the temperature of the surrounding air and turn the fan on when it exceeded a certain point. When placed in a small reservoir of water, the water sensor measured its level and alerted the system if the water needed to be refilled. This sensor wasn't perfect either but I would attribute that to being moved in and out of water constantly, a problem that wouldn't arise in real swamp coolers.

Before moving onto the motor drivers we installed a few smaller components. The 4 buttons were put into place to toggle on/off, reset the error state, and control the stepper motor. The LCD display screen was also put in to display the temperature and humidity and to display a warning when in the error state. Along with that came the potentiometer to be able to adjust the contrast on the display. Finally, we installed the RTC to record the exact date and time to the serial monitor whenever the fan motor is turned on or off.

Powered by a separate Power Supply Unit, we installed the motor drivers and the motors. First was the DC motor which functioned as the fan and was driven by the L293D motor driver. The other driver was the ULN 2003 which controlled the stepper motor. While in our circuit it was only connected to a piece of paper, it was used to simulate a vent that was opening and closing. The stepper motor is uniquely qualified for this job because of its ability to very accurately rotate open and closed like a vent would.

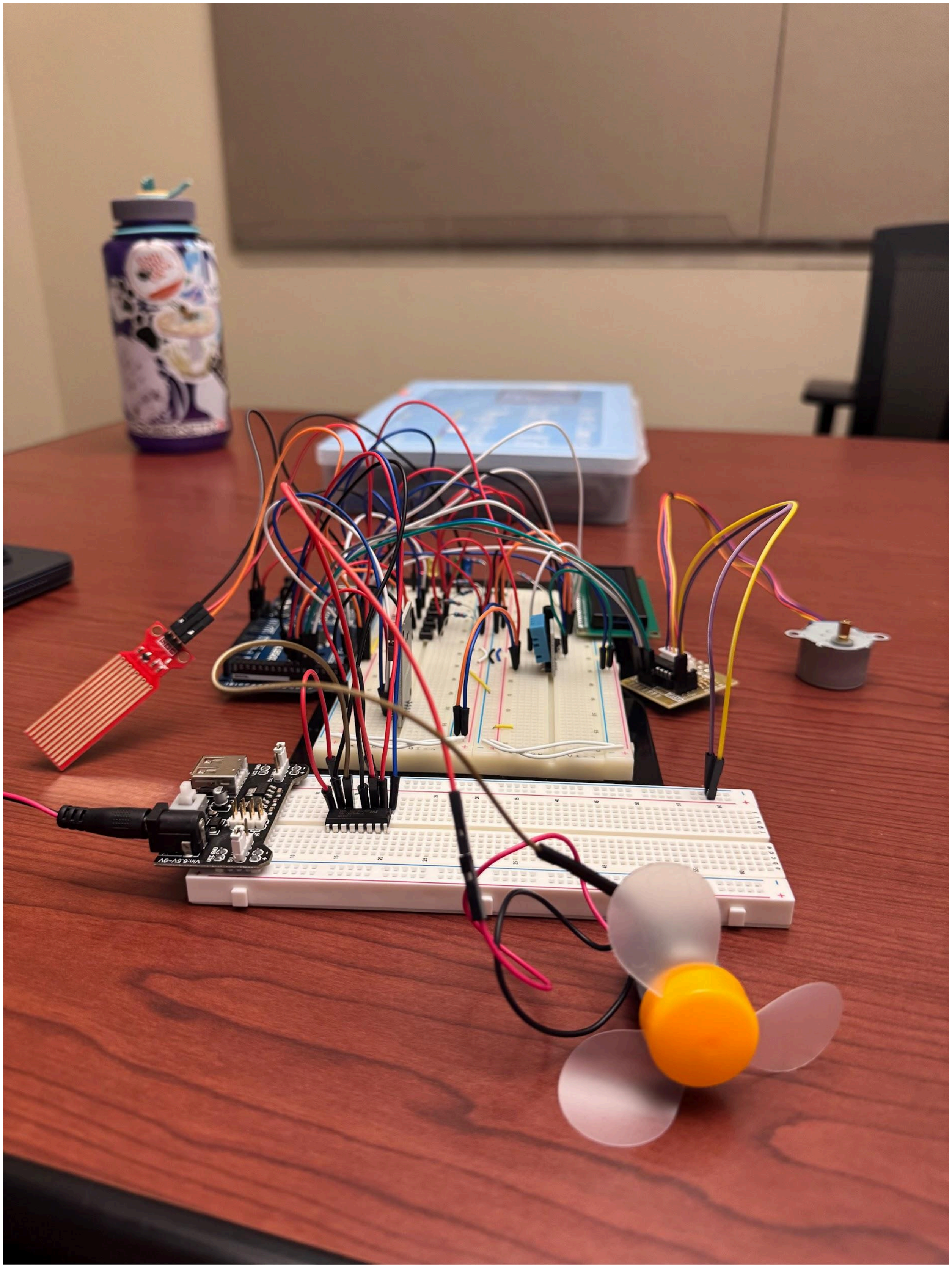
Software

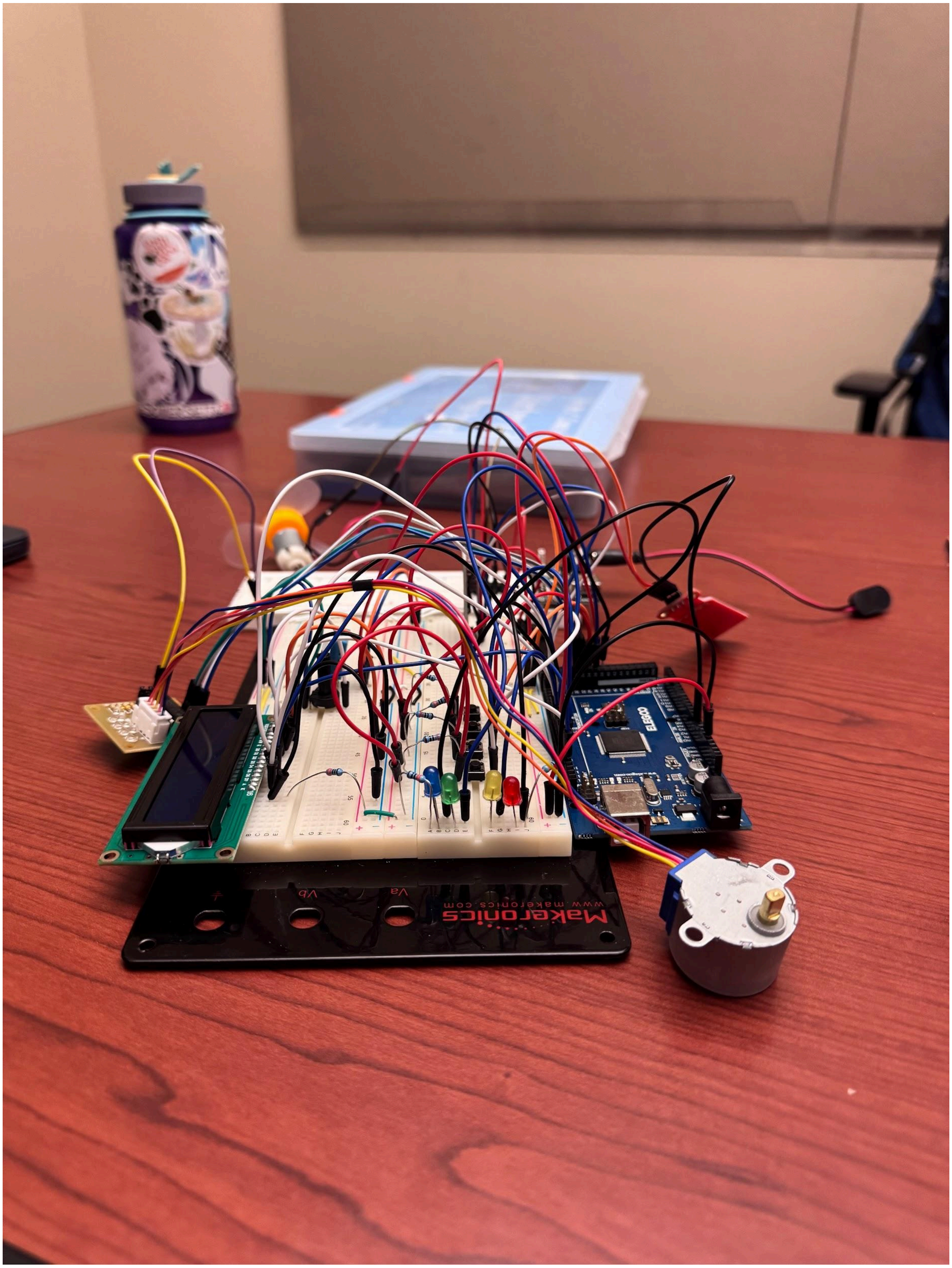
The software used in the arduino directly correlates with what we have done for all of our previous labs. Many different types of functions (such as UART and ADC) are used in this project to code the arduino to achieve our end goal of creating a swamp cooler.

UART functions were necessary when coding the arduino since the serial monitor is used for multiple things on the arduino. The UART function was used for processing what state each part of the hardware was in. This could have been the state of the whole system, water sensor, or humidity detector.

The ADC function is used to take the signal from the different pieces of hardware that could read changes in the environment. This allowed for the information to be sent back to the arduino and back to the pieces that would change based on these readings.

Circuit

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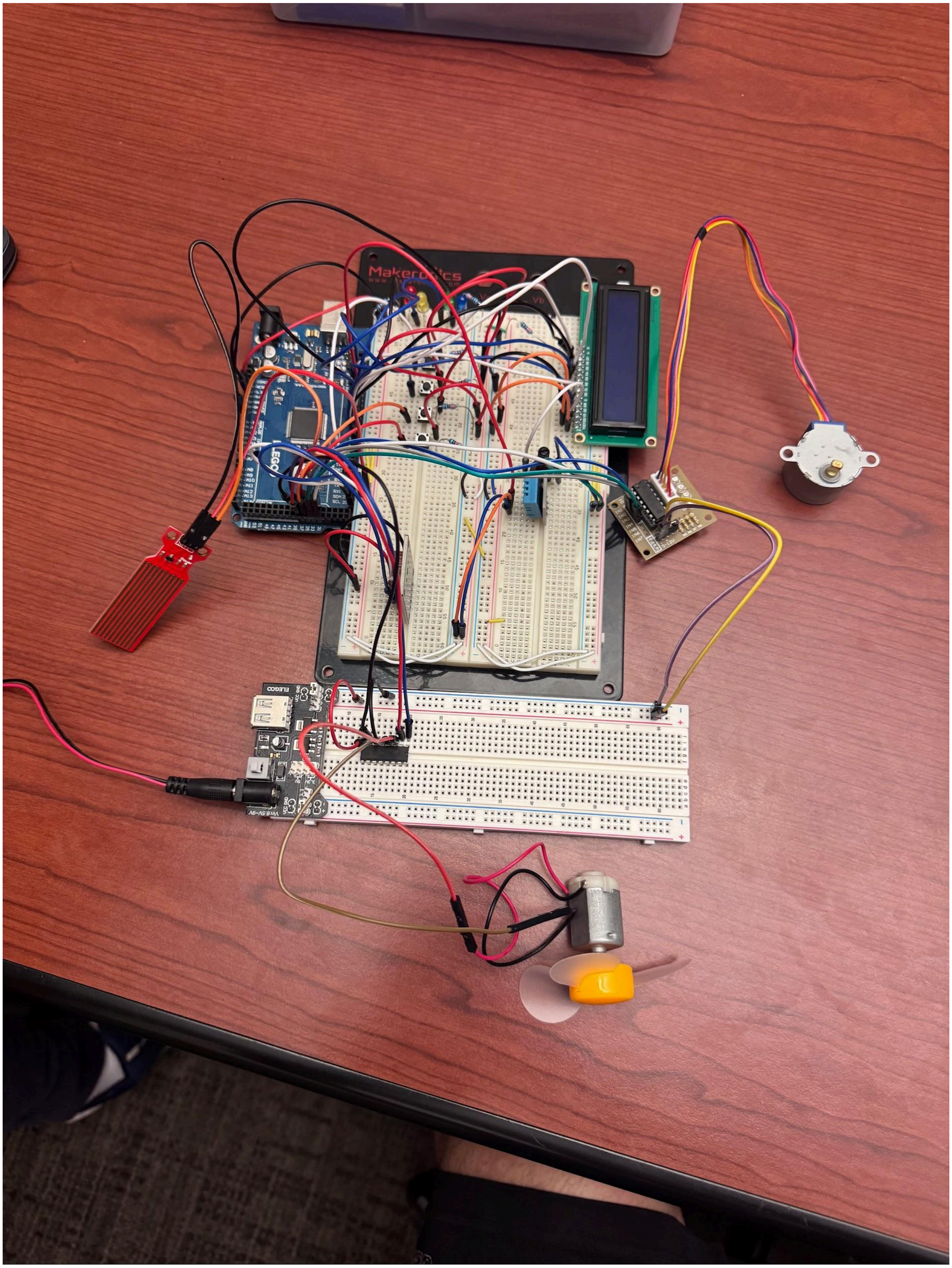
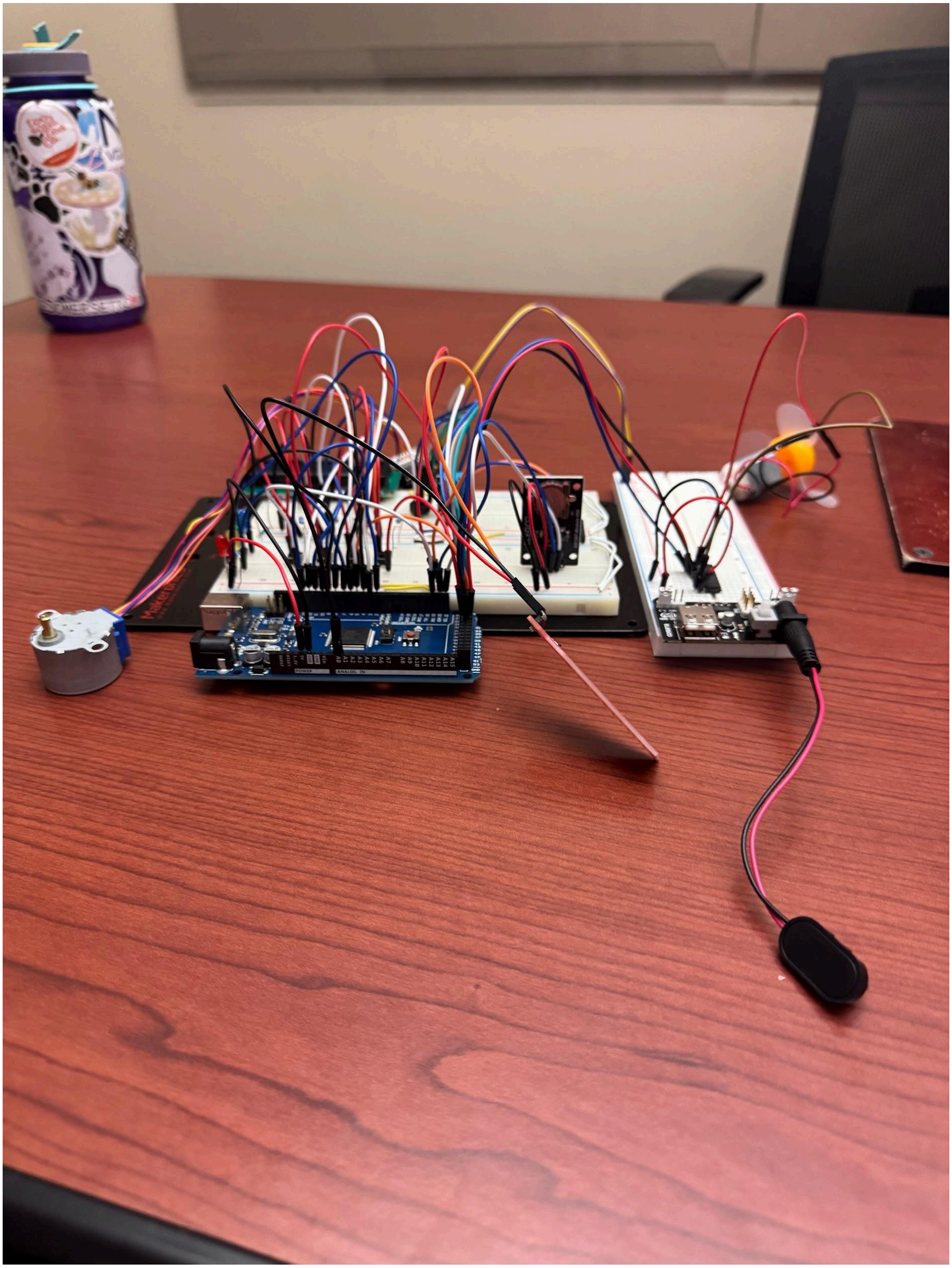
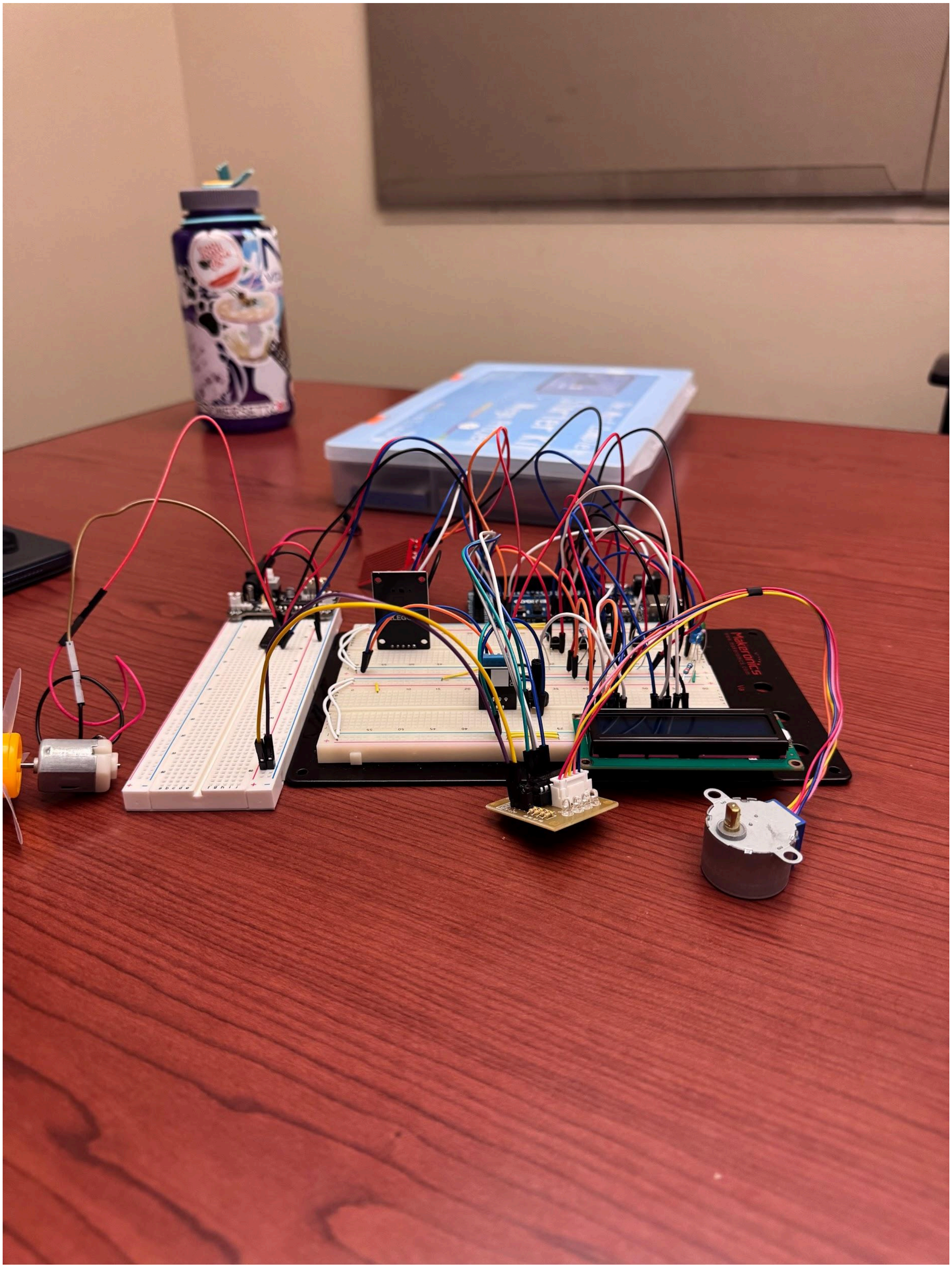
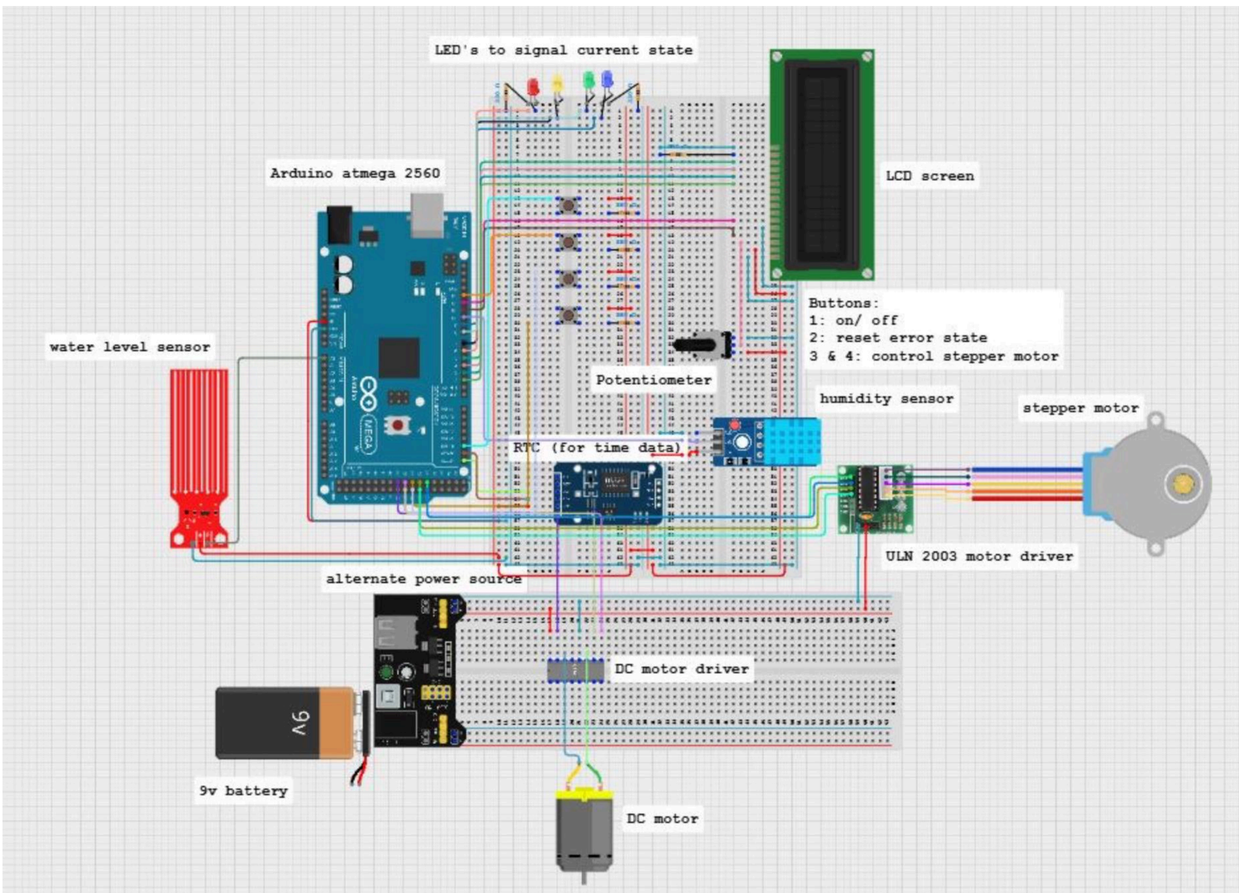






Multiple angles of the circuit.

Schematic



Links:

[GitHub Link] (Everyone participated, but code was uploaded from one computer)
[Demonstration Video 1] (All functions)
[Demonstration Video 2] (60 second update)

Component Data Sheets:

[Arduino Atmega 2560]
[ULN2003 Motor Driver]
[Water Level Sensor]
[Temperature/Humidity Sensor]
[L293D Motor Driver]
[LCD1602 Screen]
[DS1307 Clock]
[Power Supply]
[Step Motor]