

CPE 301 Final Project – Swamp Cooler

Group Members:

Gavin Casper, Carter Webb, Ryan Du, Tyler Sar

GitHub Repository Link:

<https://github.com/unr-s22/CPE301FinalProject.git>

Video of Operation:

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

Project Overview:

Purpose:

The goal of this project is to build an evaporative cooling system, also known as a swamp cooler, utilizing the Arduino Mega 2560. We resolved this by assigning each member a role. Ryan and Carter were mostly in charge of the code, while Gavin and Tyler focused on the hardware component. We begin by testing each component independently to ensure that everything works properly before integrating them into a single main branch.

Labor Management:

Gavin was responsible for the DHT sensor and the clock code/RTC, Carter was responsible for LCD screen, write/read functions, and U0 functions. Ryan was responsible for the vent control stepper motor and the fan motor. Tyler was responsible for the ISR function and the water level sensor. Everybody used a separate branch to create their original code for each sensor/part. Carter and Ryan both combined the branches and created the states and their respective functions. Gavin created the schematic and Tyler was mainly responsible for creating this PDF. Carter and Ryan debugged the final code.

Constraints:

The system contains red, yellow, blue, and green LEDs to signify the error, disabled, running, and idle states, respectively. The temperature threshold is 79°F and the water level threshold is 70. The power going into the motor power supply is 5 V and the power coming from the Arduino is also 5 V.

Design Specifications:

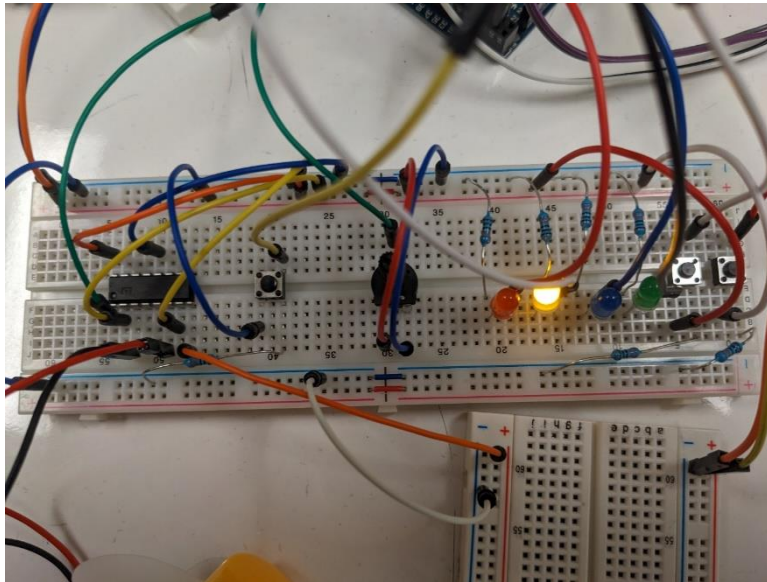


Figure 1: On the left, a motor controller is used to allow the Arduino to turn the motor on/off while using the power module to power it. There are 3 buttons connected to the Arduino (the start button, stop button, and reset button). Additionally, there are 4 LEDs that indicate which state the swamp cooler is in. There is also a potentiometer in the center of the breadboard used to control the stepper motor.

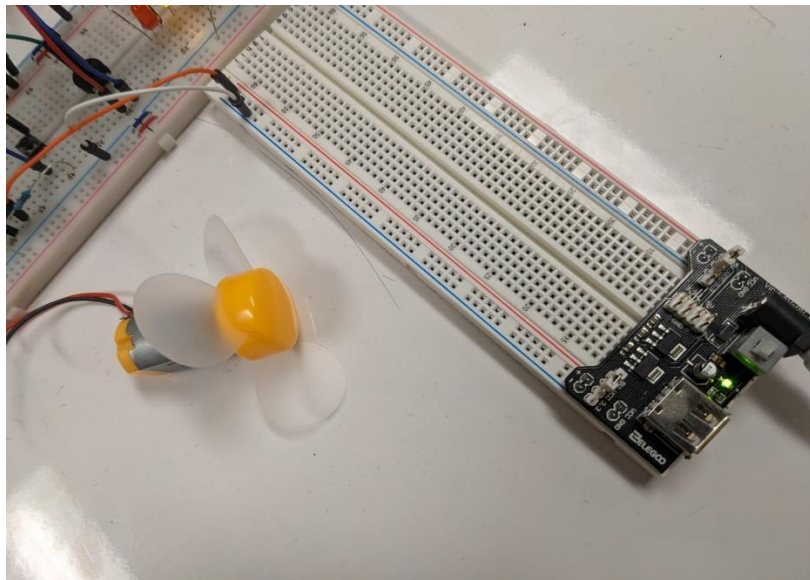


Figure 2: The power supply module used to power the DC motor and stepper motor was kept on a different breadboard than the rest of the components because the stepper motor generated a lot of electrical noise and interfered with the other components.

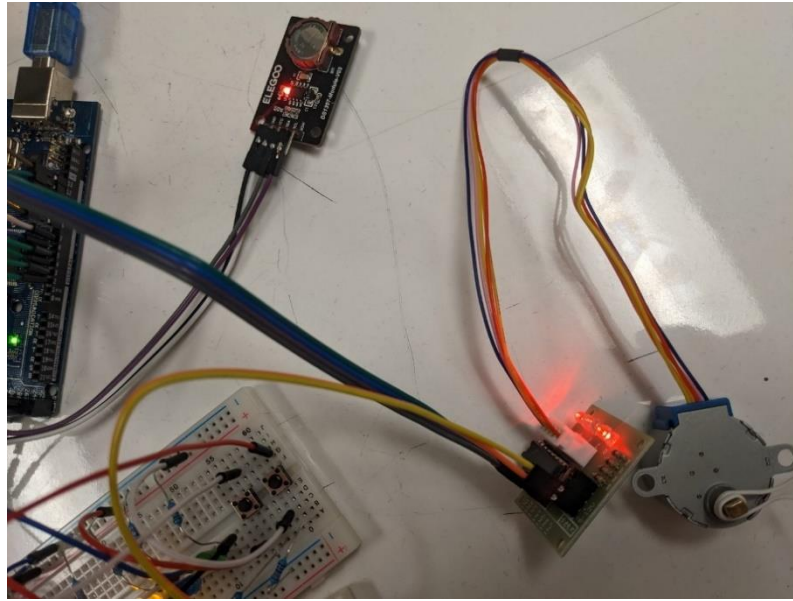


Figure 3: When creating the system, we found that using an interrupt was not necessary, so the RTC was not needed. The Stepper Motor allowed us to easily control the vent angle using a library.

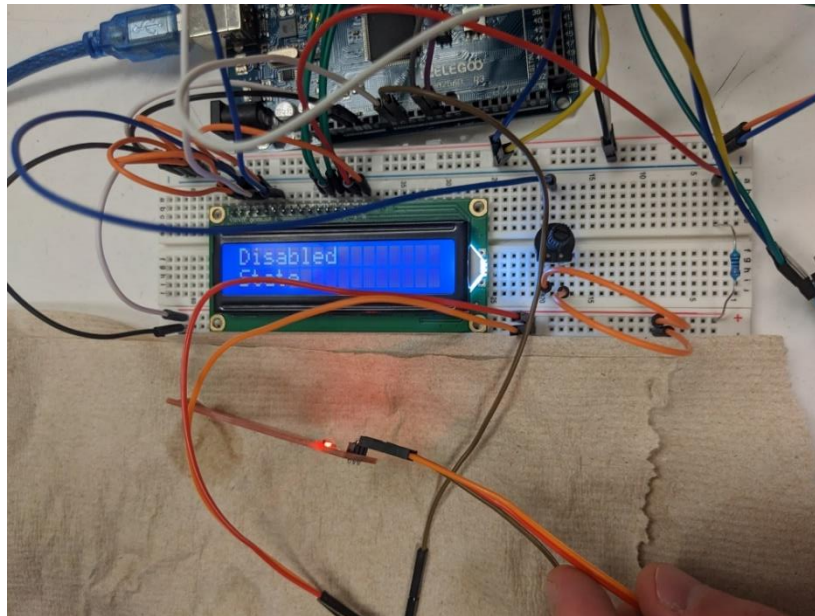


Figure 4: In this system, the LCD provides an update to the user. If there is an error, it will show what the error is; If the system is in a disabled/stopped state, the LCD will output that the system is in that Disabled State, as seen in the picture; The LCD, when in idle or running will display the Humidity – In percentage – and Temperature – In Fahrenheit. The LCD will also respond to the potentiometer, which provides how transparent or opaque the LCD can be displayed.

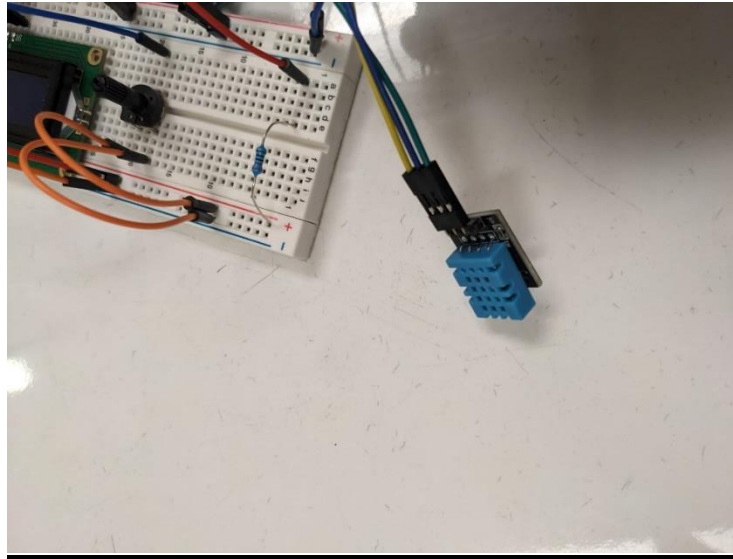


Figure 5: The dht11 sensor allowed us to sense both temperature and humidity. It was slightly inconvenient to blow on it to raise the temperature and it also cooled quickly, but it was very reliable.

Circuit:

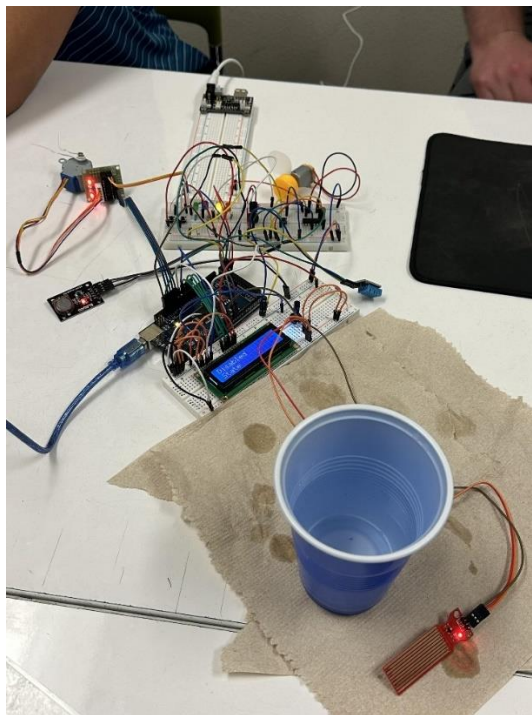
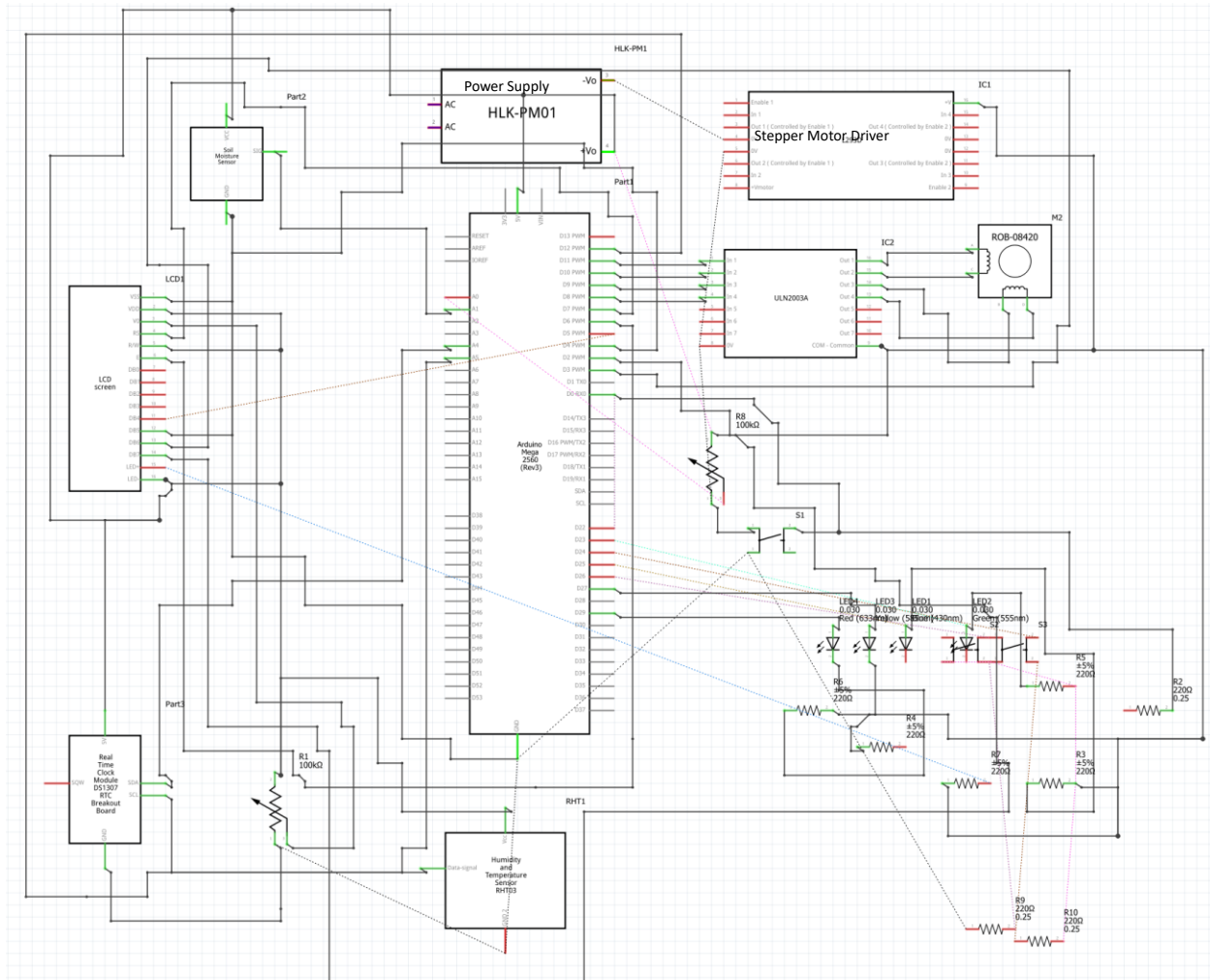


Figure 6: The water cup represented the water level in the swamp cooler and the stepper motor represented the vent angle. The system worked well together but, due to the nature of the breadboards and Arduino, was crowded with wires.

Schematic:



Libraries:

LiquidCrystal by Arduino, Adafruit – <LiquidCrystal.h>

DHT sensor library by Adafruit - <DHT.h>

RTCLib by Adafruit - <RTCLib.h>

“Stepper.h” by Arduino

Specification Sheets:

Arduino ATmega 2560 Pinout: [Mega 2560 Rev3 | Arduino Documentation](#)

Arduino Datasheet: [ATmega640/1280/1281/2560/2561 datasheet \(microchip.com\)](#)

DHT11 Temperature/Humidity Sensor: [Using DHT11 | Arduino Project Hub](#)

RTC DS1307: [DS1307 Real Time Clock RTC With Arduino : 4 Steps - Instructables](#)

LCD: [Liquid Crystal Displays \(LCD\) with Arduino | Arduino Documentation](#)

Stepper Motor: <https://www.mouser.com/datasheet/2/758/stepd-01-data-sheet-1143075.pdf>

Stepper Motor driver board: <https://www.hadex.cz/spec/m513.pdf>

DC motor driver: <https://www.ti.com/lit/ds/symlink/l293.pdf>

Arduino Water Level Sensor: <https://lastminuteengineers.com/water-level-sensor-arduino-tutorial/>