CPE 301, Section 1001

CPE 301 Final Project - Swamp Cooler

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Description

Component List:

- Solderless Breadboard (2)
- Arduino Mega 2560 Controller (1)
- USB Cable (1)
- Male-to-Male Jumper Cable Kit
- Female-to-Male Jumper Cable Kit
- 330 Ohm Resistors (4)
- 2000 Ohm Resistors (4)
- 1000 Ohm Resistor (1)
- Push Button (4)
- Red LED (1)
- Blue LED (1)
- Yellow LED (1)
- Green LED (1)
- Potentiometer 10K (1)
- LCD1602 Module (1)
- Fan Blade and 3-6V Motor (1)
- Power Supply Module (1)
- 9V1A Adapter (1)
- Stepper Motor (1)
- ULN2003 Stepper Motor Driver Module (1)
- Water Level Detection Sensor Module (1)
- DS1307 RTC Module (1)
- DHT11 Temperature and Humidity Module (1)
- L293D Motor Controller (1)

States and Functionalities:

Error State:

Occurs when the water level sensor detects the water level to be too low. This disables all functionality with all other components, displays an error message on the LCD screen, and turns on the red LED. Displays error statements to the serial monitor as well as the time.

Disabled State:

Occurs when the system is automatically turned off. This also disables the functionality of all other components, displays “Disabled” on the LCD screen, and turns on the yellow LED. Tells the serial monitor that it is disabled along with the time.

Idle State:

Occurs when water level is at an acceptable level, and the system is turned on. At this point it will read the humidity and temperature of the room to which it will display that onto the LCD screen. During this time, the green LED will be on. Tells the serial monitor that it is idle as well as the time

Active State:

Occurs when the water level is at an acceptable level, when the system is turned on, and when the temperature read by the temperature sensor is above 28° celsius. At this point, the DC motor with the fan will turn on and the blue LED will turn on, this will happen until the temperature goes below 28° celsius to which it will return to idle state. If at any point during either idle or active state the water level dips below acceptable range, it will turn it to the error state. Tells the serial monitor that it turned on at a specified time.

On-Off Button:

This button toggles the system between idle/active and disabled state. Tells the serial monitor that it is active in the event that it is on.

Reset Button:

This button restarts the system, mostly used in the context of if any error state occurs. When the error state is hit, it will stay in that state, even if the water is returned to an acceptable level. If you hit the reset button, it will bring it to an idle/ disabled state if the water was then found to be at an acceptable state. Tells the serial monitor that it is active in the event that it is on.

Open Vent Controller Button:

Turns the stepper motor to allow more airflow into the system. Tells the serial monitor that the vent angle has been increased.

Close Vent Controller Button:

Turns the stepper motor to inhibit airflow into the system. Tells the serial monitor that the vent angle has decreased.

Component Functionalities:

Solderless Breadboard (2)

Used to house multiple components and connect the different aspects of power, ground, and information.

Arduino Mega 2560 Controller (1)

The overall brain of the operation. It transmits the code into the circuit board to receive and transmit data. It is also able to supply a voltage and ground to the circuit.

USB Cable (1)

The functionality of this cable is to attach the arduino to the computer.

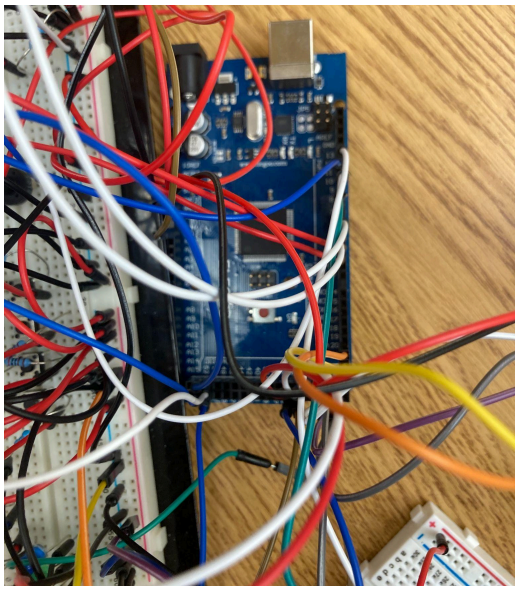
Male-to-Male Jumper Cable Kit

Used to connect different components of the circuit together, usually color coordinated and used in short distance applications.

Female-to-Male Jumper Cable Kit

These were consistently used for either extending a male to male wire or connecting the arduino to a component that only has the male side.

Image of Solderless Breadboard, Arduino Mega 2560, USB Cable, Male-to-Male Jumper Cable Kit, and Female-to-Male Jumper Cable Kit



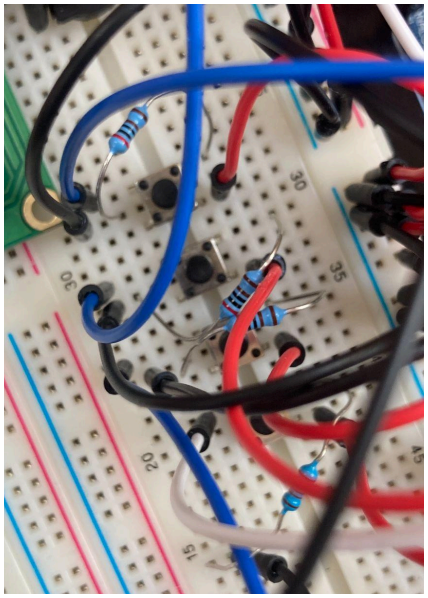
2000 Ohm Resistors (4)

They were used for the push buttons to prevent too much voltage going into the arduino. During the testing phase, we realized that too much voltage going into the arduino caused the system to shut down. Putting in these resistors was a means of limiting the voltage applied back to the arduino.

Push Button (4)

The four different push buttons were used to transmit data back to the arduino. If pushed, they would allow a voltage to flow into the arduino, allowing the arduino to recognize the outside input. One of these buttons were used for an on/ off switch, one was used as a reset button, one was used to increase vent angle, one was used to decrease the vent angle.

Image of 2000 Ohm Resistors (4) and Push Button (4)



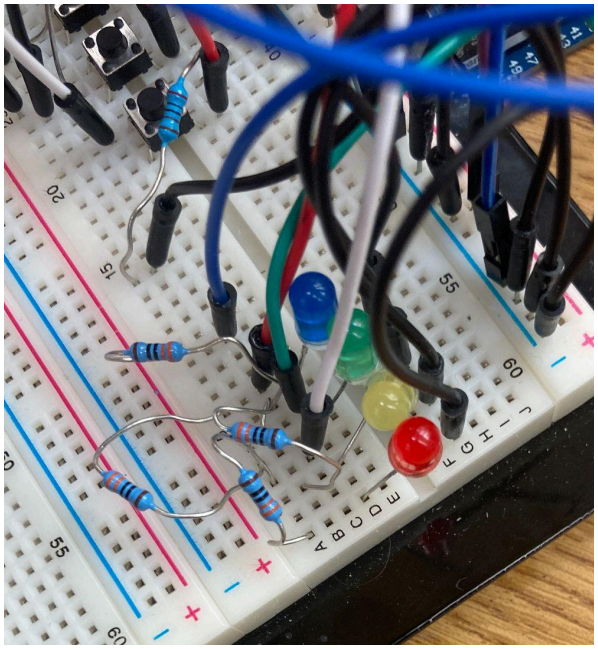
330 Ohm Resistors (4)

These resistors were used for the LEDs, to ensure that there wasn't too much voltage applied to them to ensure they weren't too bright or didn't burn out.

LEDs(4)

The LEDs shine different colors depending on what state the cooler is in. As stated before, the red LED is on when it has an error, yellow when in the disabled state, green while idle, and blue while active.

Image of 330 Ohm Resistors (4) and LEDs(4)



1000 Ohm Resistor (1)

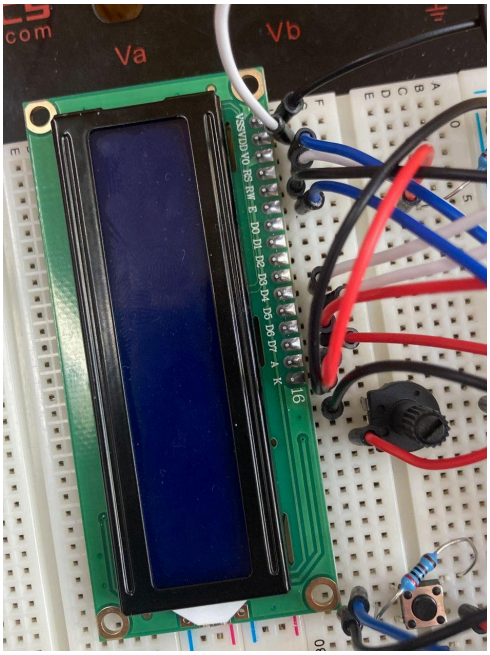
This was used for the LCD screen as we realized during the testing phase that too much voltage was being used to power the thing, leading to it not working properly. This resistor was a means of enabling the LCD to work.

Potentiometer 10K (1)
The use of the potentiometer is to add a form of variable resistance into the LCD screen which helps to adjust the contrast of the LCD to ensure it displays correctly.

LCD1602 Module (1)

The Liquid Crystal Display (LCD) is used in this circuit to relay information regarding the state that the circuit is in. If there is an error the LCD displays “Water level is too low”. While running the LCD will display the humidity and temperature as sensed from the Temperature and Humidity Sensor.

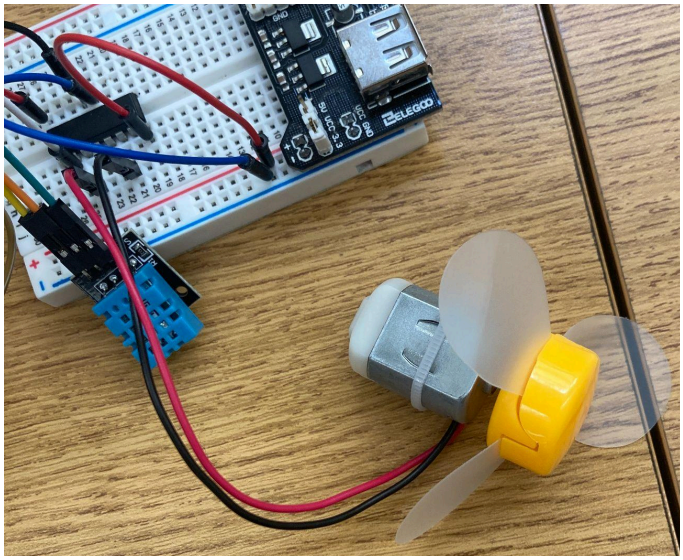
Image for 1000 Ohm Resistor, Potentiometer 10K, and LCD1602 Module



Fan Blade and 3-6V Motor (1)

The fan and motor are used to cool the water and temperature sensor down. Once the aforementioned sensor reaches a certain temperature the fan will activate, sending the cooler into active mode until the temperature is below the threshold.

Image for Fan Blade and 3-6V Motor



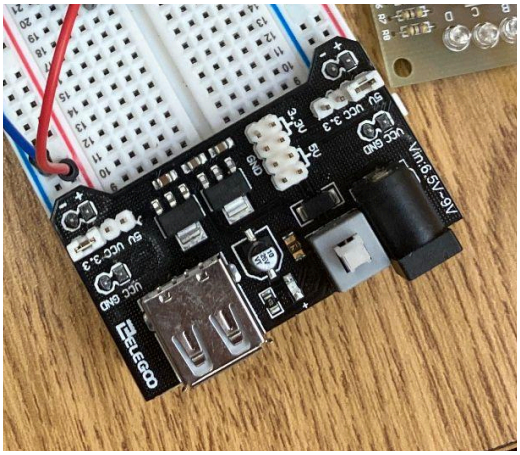
Power Supply Module (1)

The purpose of this part was to supply more power to the circuit itself. By doing so, it reduces the load that the arduino has to undergo. We came to this conclusion after the arduino was overheating due to it having to supply a voltage to so many components at once

9V1A Adapter (1)

In order to supply a constant voltage, we decided to connect the power supply to a power outlet.

Image of Power Supply Module and 9V1A Adapter



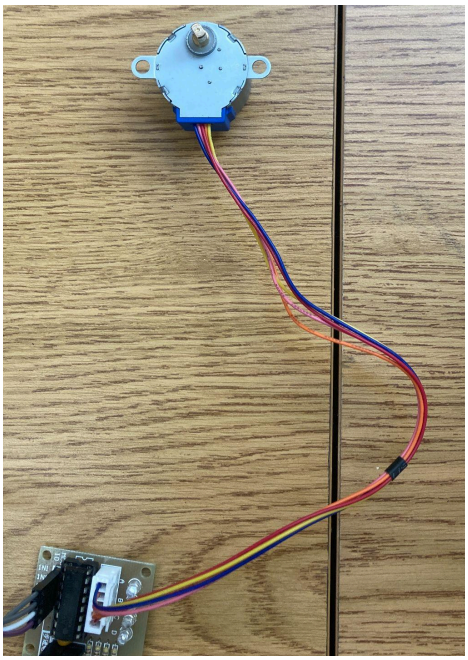
Stepper Motor (1)

The Stepper Motor rotates when given a command to rotate. In the case of this circuit it is called to rotate using one of two buttons depending on the desired direction to rotate. For the cooler it would be used to increase or decrease a vent angle.

ULN2003 Stepper Motor Driver Module (1)

The Stepper Motor Driver contains a logic chip that is used to better control the stepper motor. It is key to the stepper motor's functionality.

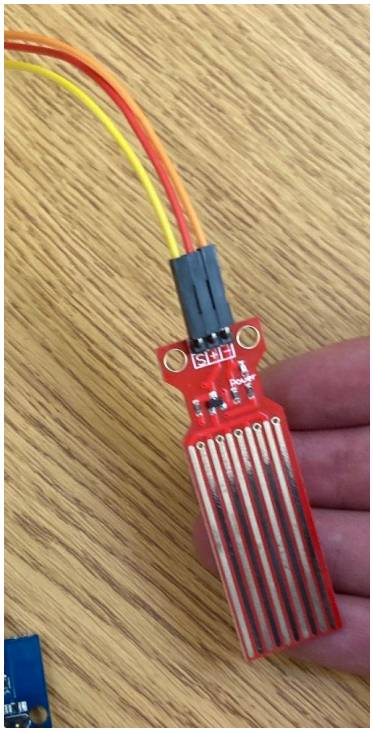
Image of Stepper Motor and ULN2003 Stepper Motor Driver Module



Water Level Detection Sensor Module (1)

The Water Level Detector senses what level the water that it is placed in is at. For its use in the cooler, if it detects that the water level is too low it immediately shifts the circuit into the error state, thus disabling the rest of the circuit from functioning.

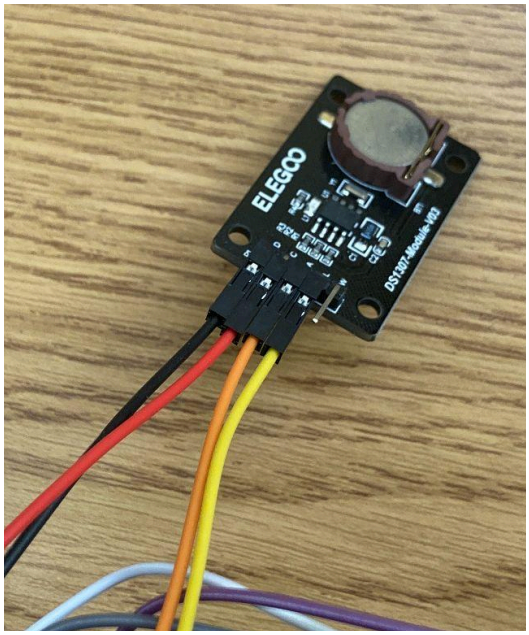
Image of Water Level Detection Sensor Module



DS1307 RTC Module (1)

The Real Time Clock Module is used to tell the time. In the cooler it delivers timestamps of any important changes such as a shift in state. These will print into the serial monitor and allow better tracking of how the circuit is functioning

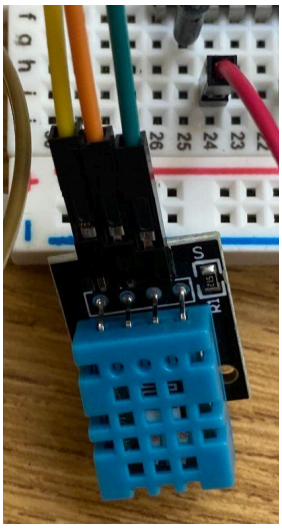
Image of DS1307 RTC Module



DHT11 Temperature and Humidity Module (1)

The Temperature and Humidity Module has two functionalities as stated in its name. The temperature tracking we used to determine when the fan motor is to activate. Once it goes below its shutoff threshold the fan motor will stop functioning. The humidity is also tracked, and both the humidity and temperature are displayed on the screen in both the idle and active states.

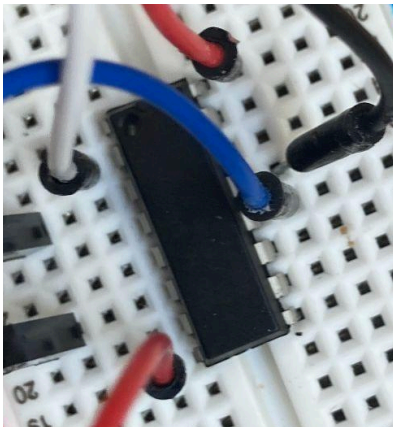
Image of DHT11 Temperature and Humidity Module



L293D Motor Controller (1)

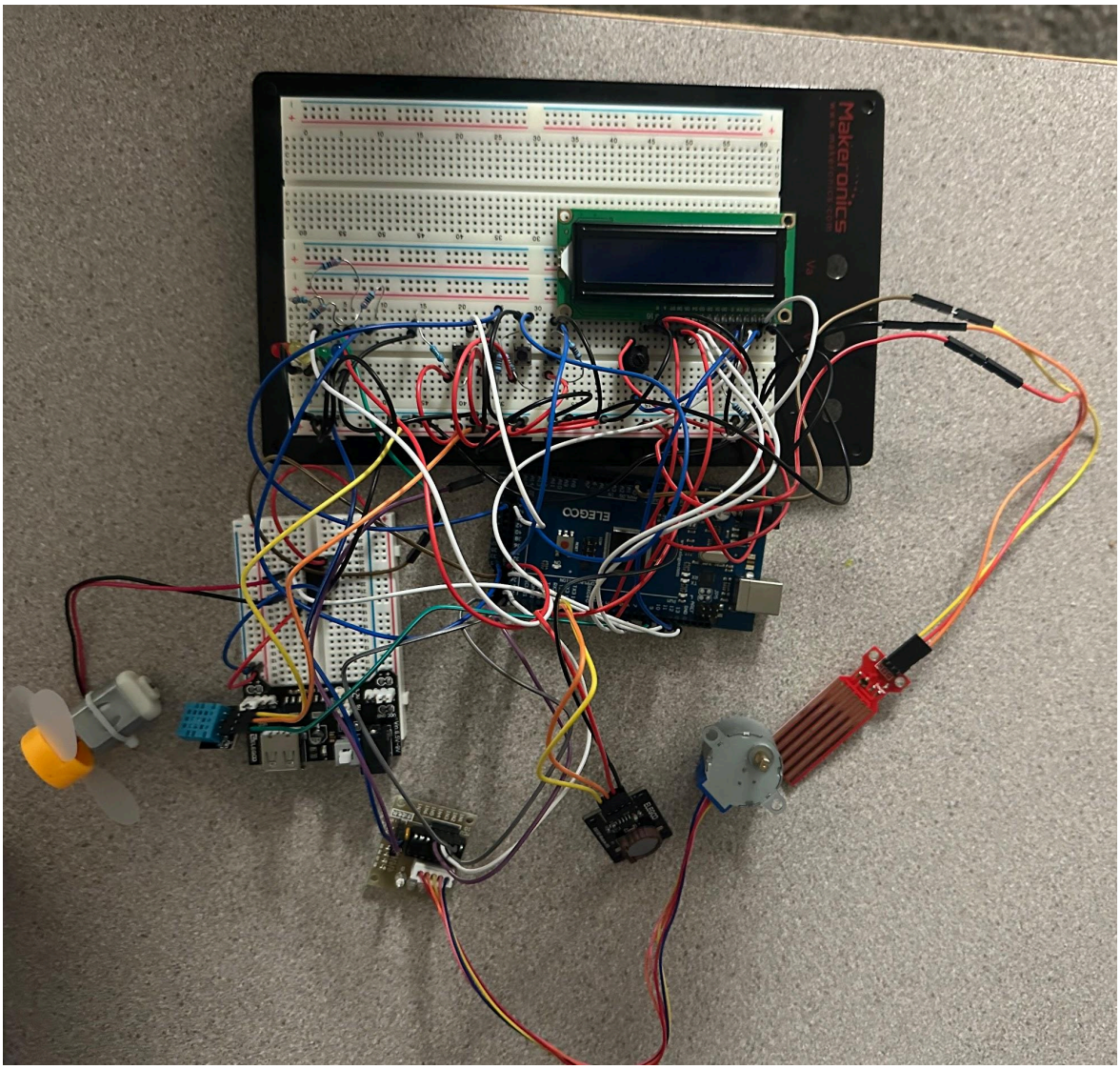
The L293D motor controller is a logic chip used to power the DC motor and fan. The purpose of this is to limit the amount of voltage that would be supplied by the arduino, instead connecting it to an external power source, and using the output from the arduino to turn it on. This prevents any overheating and issues with power supply.

Image of L293D Motor Controller

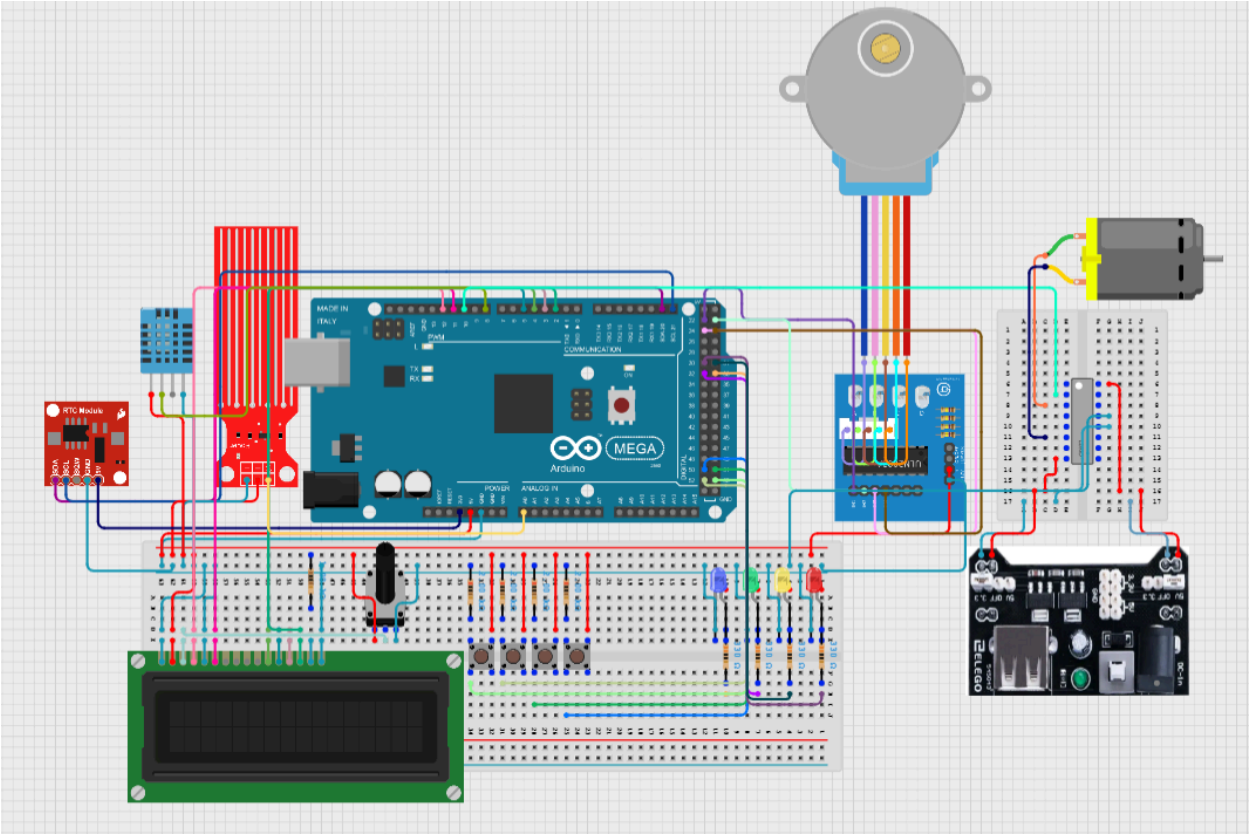


Circuit Diagrams

Full image of cooler circuit:



Full image of schematic:



Github Link

Final Project Link

Video Link

Video Link