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Section: CPE 301 Embedded Systems Design
Professor: Dr. Bashira
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CPE 301 - Final Project

Introduction:

The purpose of this project was to create a swamp cooler using ideas and practices learned from the course material throughout the semester. The project aims to implement some of the following systems which include;

- Temperature, humidity, and water level monitoring
- Main fan control
- User Control (Start, Stop, Reset, Vent Control)
- Status LED outputs
- Event Reporting

State Descriptions:

- Disabled State:
  In this state many of the functions are disabled. The disabled state is indicated by the Yellow LED. The system will exit the state when the Start/Stop button is pressed and enter the running state.

- Idle State:
  In this state many of the functions are enabled. The idle state is indicated by the Green LED. The fan motor is turned off and the temperature, humidity, and water-level monitoring is enabled and output to LCD.

- Error State:
  In this state many of the functions are disabled. The error state is indicated by the Red LED. temperature, humidity, and water-level monitoring is disabled. Error message will be shown on the LCD.

- Running State:

In this state all functions are enabled. The running state is indicated by the Blue LED. The fan motor is turned on and the temperature, humidity, and water-level monitoring is enabled and output to the LCD.

Video Demonstration:

- https://www.youtube.com/watch?v=GLaw1zXHMZw

Experimental Design:

- Code:
  Most of my code was reused from past labs. When it came to coding with the DHT11 and the DS1307 RTC Module I downloaded repositories that I saw best fit what I needed to accomplish. The states, disabled, idle, running, and error, are all included in the main loop of the code. Functions used to assist the main loop of the code can be found underneath the main loop.

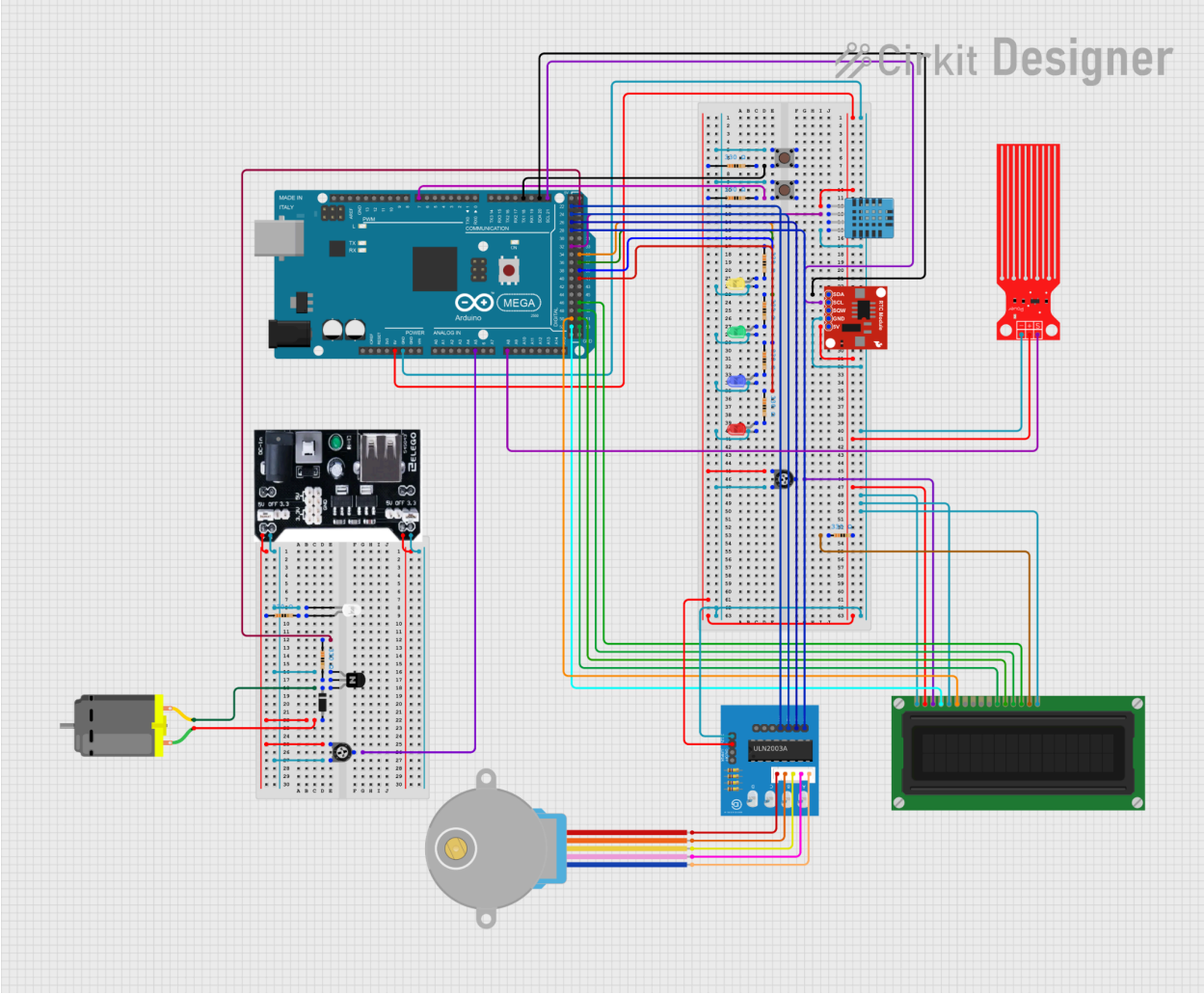
- Circuit Board:
  When building my circuit board I attached everything in a pretty simple way and for those things that I didn't really understand how it worked I looked at the data sheets provided below. I put the status LEDs, start/stop and reset buttons, temperature and humidity sensor, RTC, LCD potentiometer, and stepper module on the 850 pin main board as I saw it to best fit power distribution. When attaching pins to the arduino I tried to make sure not to put them too close together to avoid confusion. This idea was also reflected in the code. For the smaller 400 pin board I attached my power supply, dc motor, potentiometer (for stepper motor), and a simple LED circuit. I don't think my motor works as it does not seem to power on at all even with a simple motor circuit. I used the LED to make sure power was going to the board and the potentiometer was to control the stepper motor for ventilation.

Electronic Components:

- Arduino Mega 2560
- 830 Tie-Points Breadboard
- 400 Tie-Points Breadboard
- Breadboard Jumper Wires

- LCD1602 Module
- Power Supply Module
- 9V Battery
- Stepper Motor
- ULN2003 Stepper Motor Driver Module
- Water Level Detection Sensor Module
- DS1307 RTC Module
- DHT11 Temperature and Humidity Module
- Fan Blade
- 3V - 6V Motor
- Potentiometer 10K (x2)
- LED (White, Yellow, Green, Blue, Red)
- Buttons (x2)
- 330 Ohm Resistors (x10)
- NPN Transistor PN2222
- 1N4007 Diode Rectifier

Schematic:



Libraries:

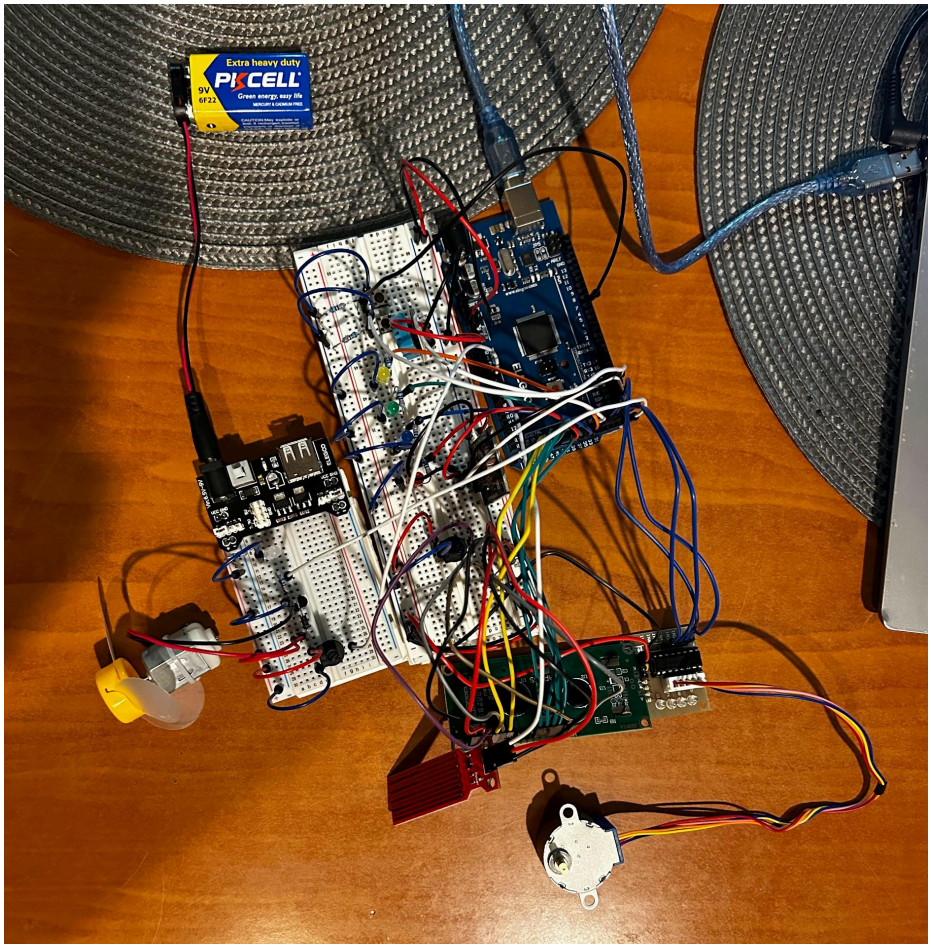
- Liquid Crystal by Arduino: https://docs.arduino.cc/learn/electronics/lcd-displays/
- DHT11 by Dhruba Saha: https://github.com/dhrubasaha08/DHT11?tab=readme-ov-file#examples
- Stepper by Arduino: https://www.arduino.cc/reference/en/libraries/stepper/
- DS1307 by Rinky-Dink Electronics: http://www.rinkydinkelectronics.com/library.php?id=34

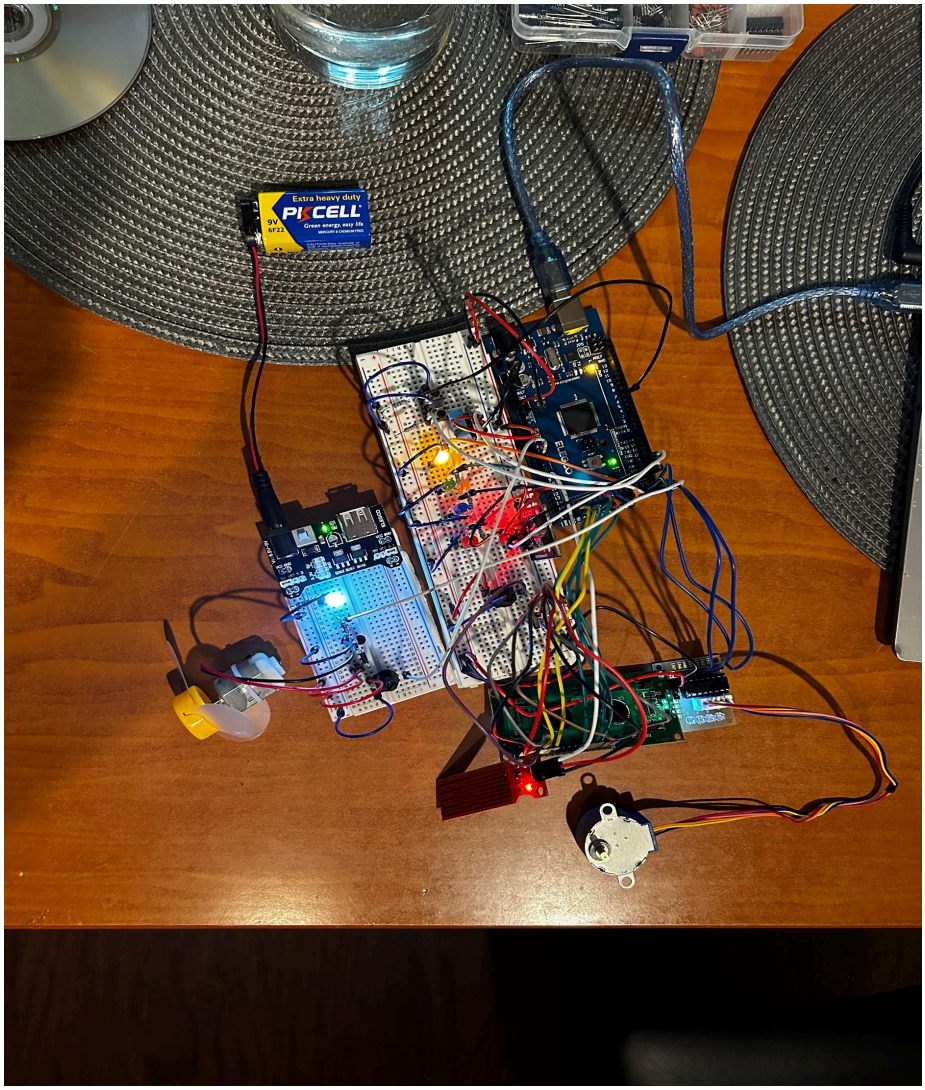
Data Sheets:

- Arduino Mega 2560 Full Datasheet: https://ww1.microchip.com/downloads/en/devicedoc/atmel-2549-8-bit-avr-microcontroller-atmega640-1280-1281-2560-2561_datasheet.pdf

- Arduino Mega 2560 Pinout: https://electronicshub.org/wp-content/uploads/2021/01/Arduino-Mega-Pinout.jpg
- LCD Datasheet: https://docs.arduino.cc/learn/electronics/lcd-displays/
- Stepper Motor: https://www.mouser.com/datasheet/2/758/stepd-01-data-sheet-1143075.pdf
- ULN2003 Stepper Motor Driver Module: https://www.electronicoscaldas.com/datasheet/ULN2003A-PCB.pdf
- DS1307 RTC: https://www.analog.com/media/en/technical-documentation/data-sheets/DS1307.pdf
- DHT11 Temperature and Humidity Module: https://www.digikey.at/htmldatasheets/production/2071184/0/0/1/dht11-humidity-temp-sensor.html
- Water Level Sensor: https://www.biomaker.org/block-catalogue/2021/12/17/water-level-sensor-tzt-water-level-sensor
- 3V - 6V Motor: https://www.moog.com/content/dam/moog/literature/MCG/moc23series.pdf
- Power Supply Module: https://www.handsontec.com/dataspecs/mb102-ps.pdf

Pictures:


Extra heavy duty
PKCELL
9V
6F22
Green energy, easy life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