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CPE 301 Final Project

Project Description

This project tasked us with designing and assembling an evaporating cooler system, also known as a swamp cooler. We based our system on the Arduino 2560 Mega and used additional hardware including sensors and motors. The cooler monitors water levels in a cup to ensure that there is adequate water to run the cooler and will switch to an error state if the water is not present. The cooler also allows for the user to open and close a vent and will automatically turn on and off based on the ambient temperature in the room.

Component Details

This project was built upon the Arduino ATMega 2560 microcontroller. Devices and sensors used (with datasheets):

- ATMega 2560
  - https://ww1.microchip.com/downloads/en/devicedoc/atmel-2549-8-bit-avr-microcontroller-atmega640-1280-1281-2560-2561_datasheet.pdf
- 1602 16-pin LCD Display
  - https://www.waveshare.com/datasheet/LCD_en_PDF/LCD1602.pdf
- DS1307 RTC Module
  - https://www.analog.com/media/en/technical-documentation/data-sheets/ds1307.pdf
- 28BYJ-48 5v DC Stepper Motor
  - https://www.mouser.com/datasheet/2/758/stepd-01-data-sheet-1143075.pdf?srsltid=AfmBOoqY1c31Tws6FZAJ1qkvvqpf8ZW7P6v_fyQM-SZBjGY6pubLPS0t
- ULN2003 Stepper Motor Driver
  - https://www.electronicoscaldas.com/datasheet/ULN2003A-PCB.pdf?srsltid=AfmBOorfdAKlqMNF7yQlJmEIS7533GUVyRHsXqDCGjiJqQTanQXQPkMf
- DHT11 Temperature and Humidity Sensor
  - https://www.mouser.com/datasheet/2/758/DHT11-Technical-Data-Sheet-Translated-Version-1143054.pdf?srsltid=AfmBOopl3YgbhH-85fllBMUdrM29lWLHwF6NmfvSMRWx8dJ9nwlxpvYU
- 5v DC Motor (w/ fan blade)
- Resistive Water Level Sensor
  - https://www.biomaker.org/block-catalogue/2021/12/17/water-level-sensor-tzt-water-level-sensor

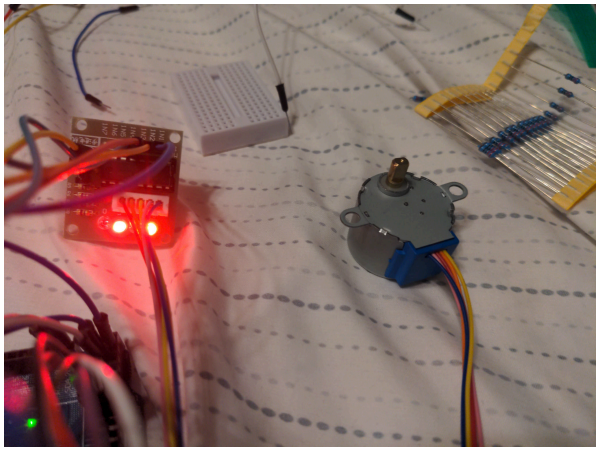
- 1N4007 Diode
    - https://www.vishay.com/docs/88503/1n4001.pdf
- S8050 NPN Transistor
    - https://www.mouser.com/datasheet/2/149/SS8050-117753.pdf?srsltid=AfmBOoohaI1OCbi4xRQ0hTCu90r1amFECW7h2W9Fp2vgmcveESXLrMxA
- 3x Push Buttons
- 4x LEDs (Green, Yellow, Red, and Blue)
- 10k Ohm Potentiometer
- 4x Resistors (220-330 Ohm)
- 5v Power Supply Module
- Large Breadboard
- ~30x Jumper Wires

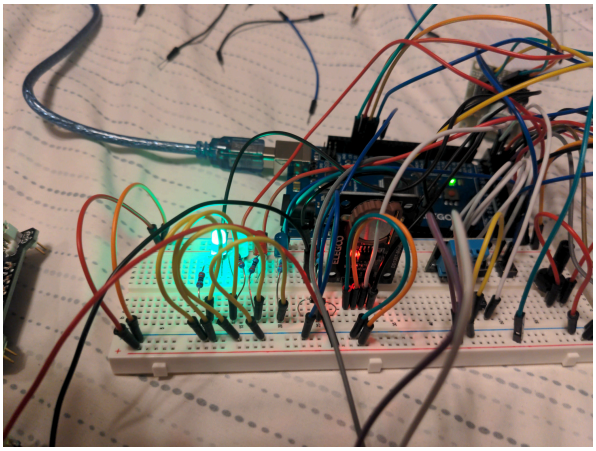
System Overview

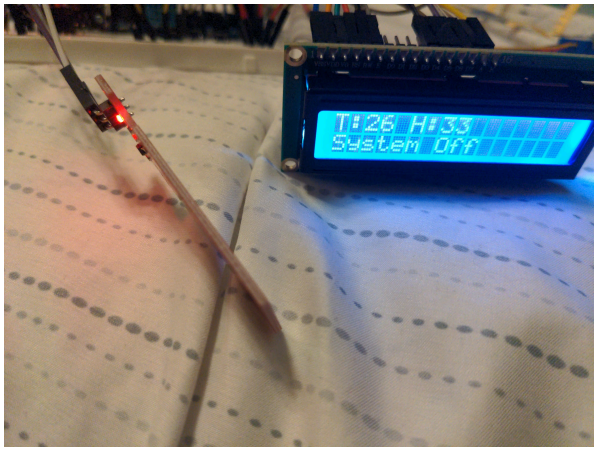
The evaporating cooler is fully automated and runs off of the Arduino Mega 2560 for all logic and input and output. The DHT11 Sensor provides the Arduino with temperature and humidity input which it then uses to run or idle the cooler. The RTC module allows for all sensors to track data in real time and make any necessary adjustments. The water level sensor provides as an input letting the cooler know if it can continue to run or if it needs to move into an error state and wait for additional water to be added. Lastly the two motors allow for the fan to run alongside the cooler to push cold air out and for the user to adjust a vent as needed to change the direction of the airflow

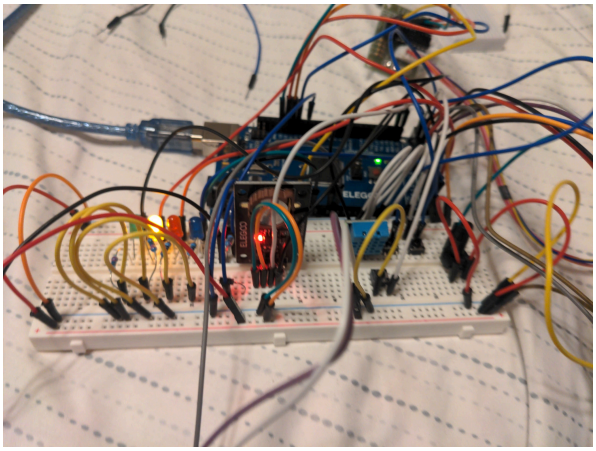
The system has four operating states: Disabled, Idle, Running, and Error. In the disabled state the cooler is off and will wait for the start button to be pressed while showing a yellow LED. In the idle state the cooler will show a green LED and monitor the water and temperature/humidity inputs and do one of three things, either stay in the idle state if the ambient temperature is low enough or if the temperature is above the set threshold the cooler will switch to the running or error state depending on the water level. In the running state the cooler will display a blue LED and continue to run until it runs out of water or the ambient temperature drops low enough. Finally in the error state when the cooler is low on water a red LED will be turned on and the cooler will stay in the error state until the reset button is pressed when it will then move into the idle state.

Circuit Images

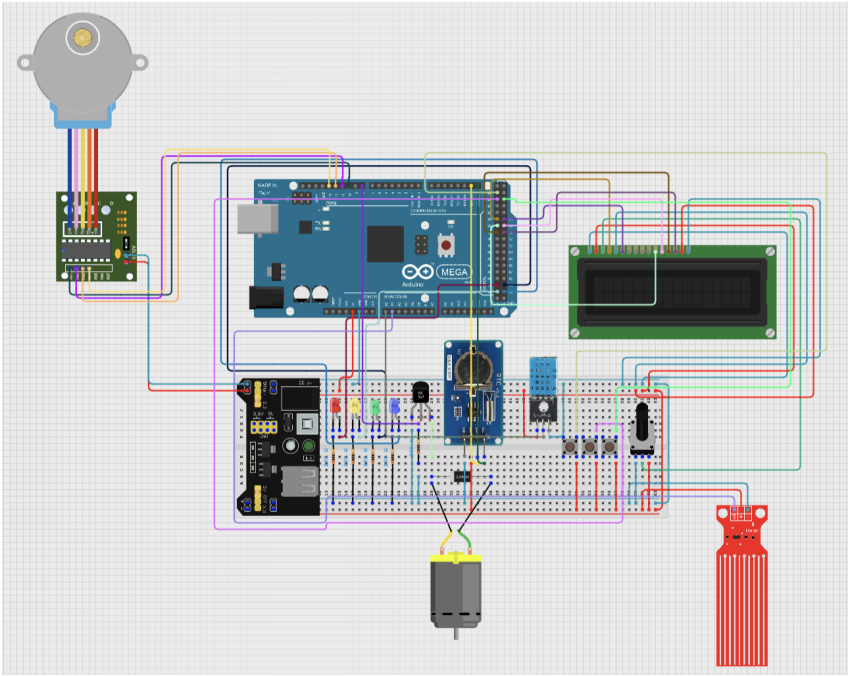








Schematic Diagram



System Demonstration Video
https://drive.google.com/file/d/1r5dOy-iIlEBVS9Mw9bcHfl1wzNjLtdRr/view?usp=sharing

Additional Links (Github)
https://github.com/WeiLiBryan/CPE301-final