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Cpe 301 Spring ‘24
5/10/24

Final Project Overview

Overview:

This project aims to create an evaporation cooling system (a swamp cooler). The system uses an Arduino Mega and multiple sensors to monitor and control the cooling process. In addition, we can indicate which state the system is in by changing the color of led lights on it and logging the time/dates of the transition states.

Project Requirements

- Monitoring water levels in the reservoir with alerts for low levels.
- Displaying air temperature and humidity on an LCD screen.
- Controlling fan motor based on temperature range.
- On/off system control via a user button.
- Logging time and date of motor activation/deactivation.
- *Led’s* that correlate to state of system

Hardware Component description

- Water level sensor for monitoring with threshold detection.
- Stepper motor.
- LCD display for output messages.
- Real-time clock module for event reporting.
- DHT11 sensor for temperature and humidity readings.
- Motor and fan blade with a separate power supply board.

- *Documentation/links for these shown in schematic section*

System States

The cooler operates in several states with Led colors correlating to each state:

System States and LED colors:

- **DISABLED**: Yellow *Led* on, others off. No monitoring. Start button monitored.
- **IDLE:** Green *Led* on, others off. Water level monitored. Transition times recorded.
- **ERROR:** Red *Led* on, others off. Motor off. Reset button changes to *IDLE* if water level is above threshold.
- **RUNNING**: Blue *Led* on, others off. Motor on. Transitions to *IDLE* if temp low or *ERROR* if water low.

All states except DISABLED:

- Monitor and report humidity and temperature on LCD every minute.
- Stop button turns the motor off and goes to DISABLED.

All states:

- Record state transition times using a real-time clock.

Operating Temperatures:

The DHT11 sensor operates at a threshold of $26^{\circ}C \; or \; 79^{\circ}F$, which allows the swamp cooler to be used in dry, hot climates where evaporation cooling is most effective. These conditions are ideal for the process that cools and humidifies the air.

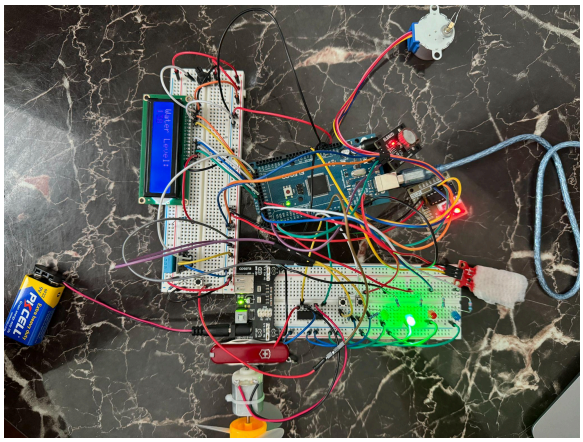
Power Requirements:

A dedicated power supply board is used to safely power the fan motor and board. This separate power supply ensures adequate power management in the embedded system design. The power used for the fan is 6V, and for the circuit is 5V.

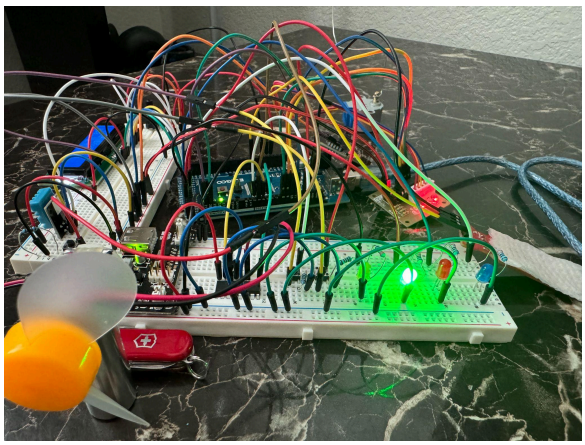
Final System Pictures w/video link:

https://drive.google.com/file/d/1-cBQ-8gxt2DP7--STzRgNJXBkg23tMsw/view?usp=sharing

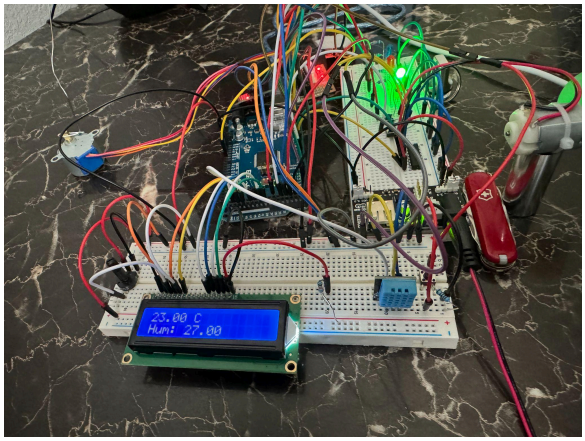
Top Down:



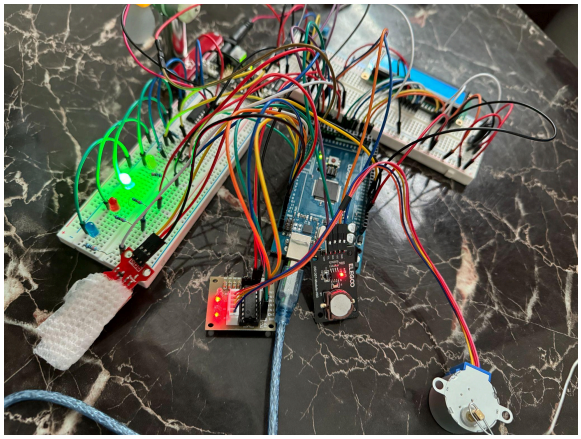
BreadBoard 1:



BreadBoard 2 w/ temp/humidity LCD:

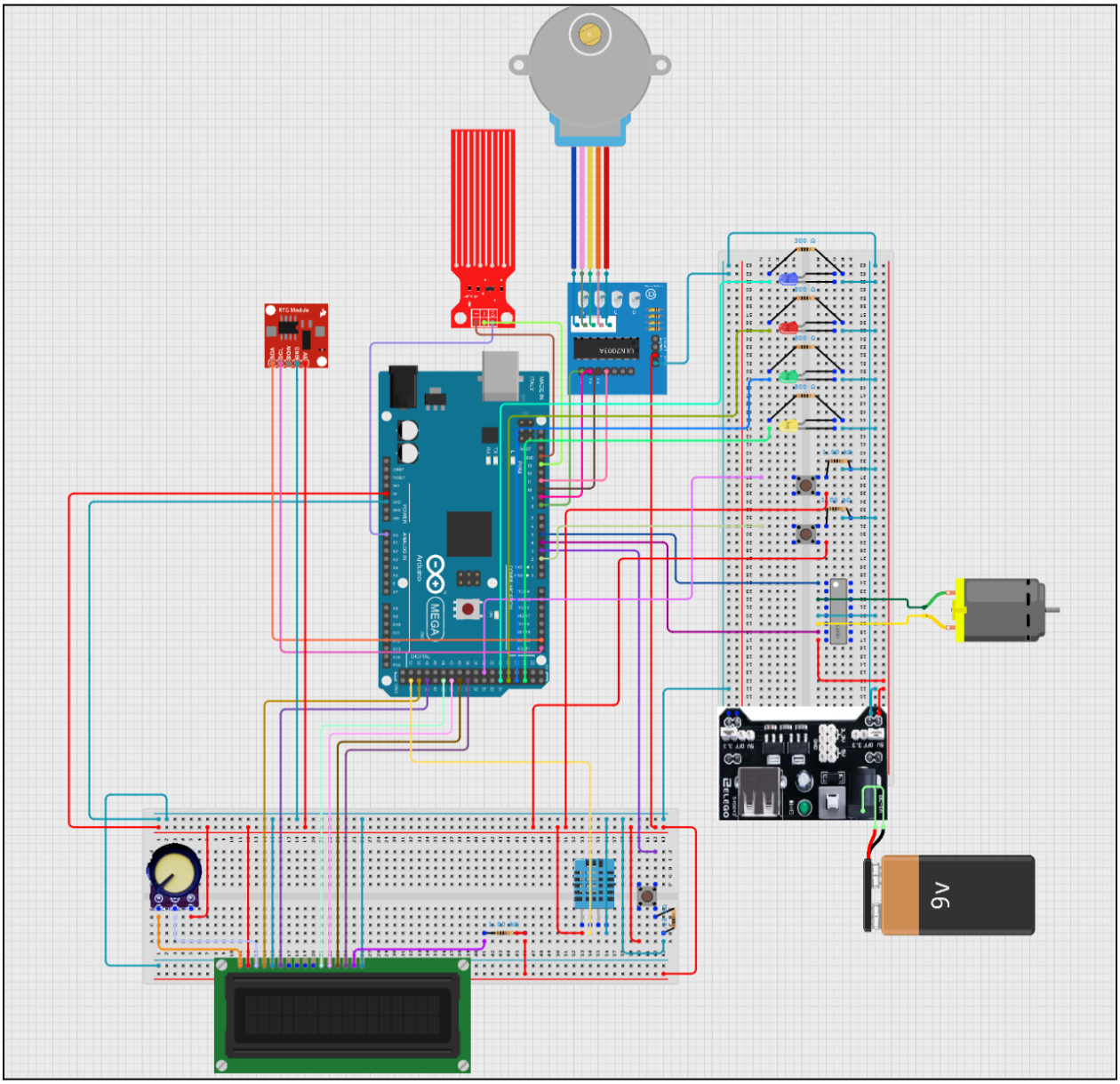


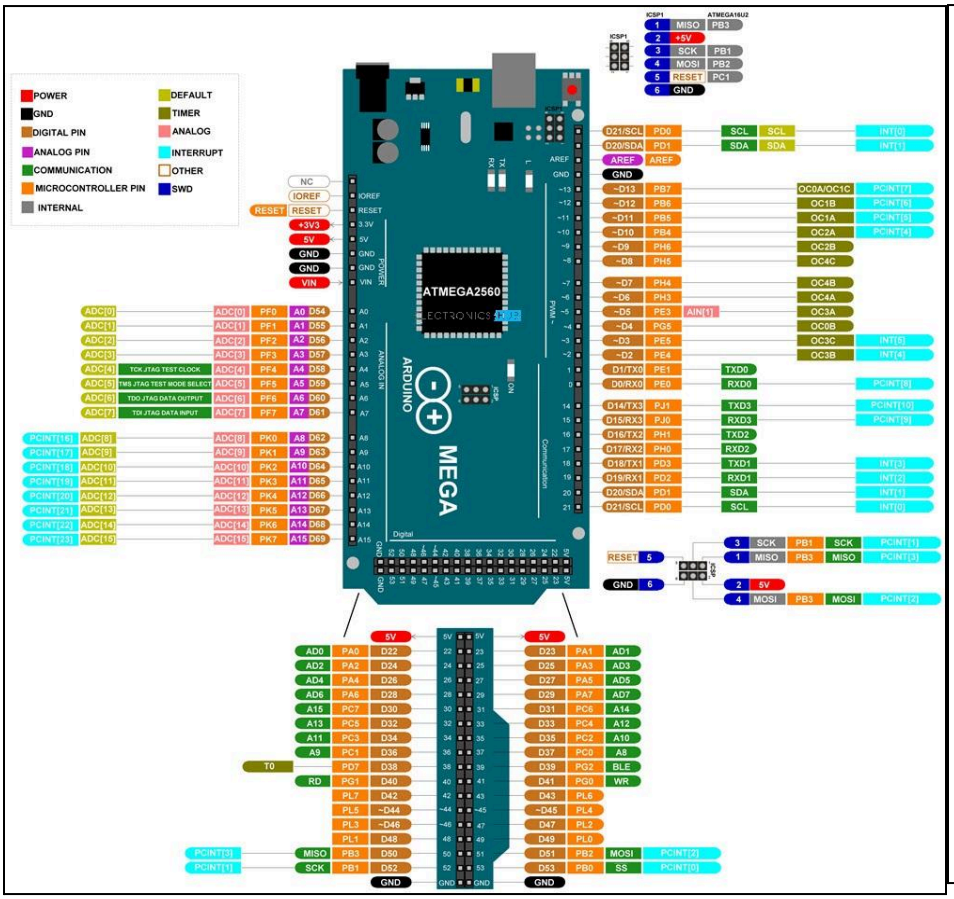
Atmega board:



Schematics:

Also in github repository





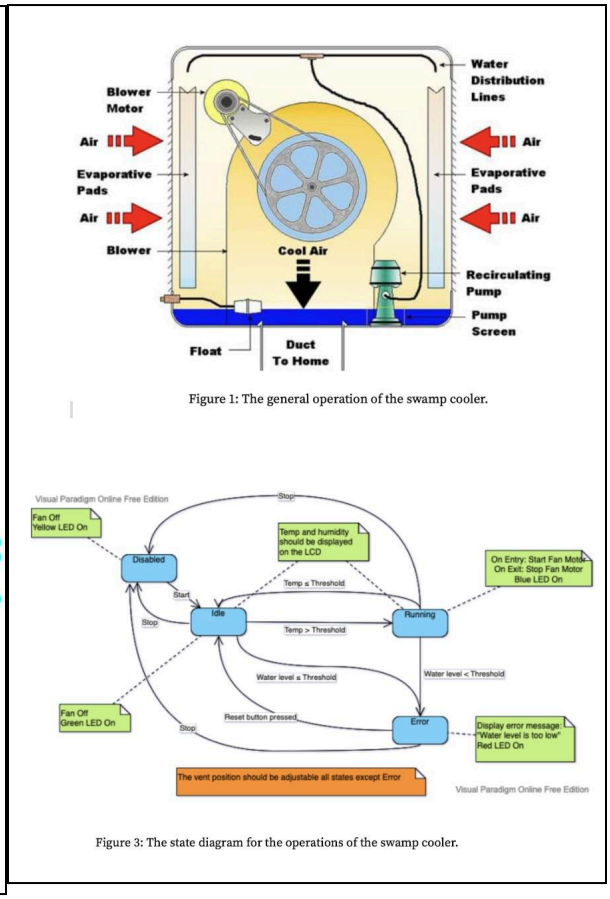


Figure 1: The general operation of the swamp cooler.

Figure 3: The state diagram for the operations of the swamp cooler.

Documentation/links we used:

Stepper Motor:

- Arduino Stepper Motor Tutorial: https://www.arduino.cc/reference/en/libraries/stepper/

LiquidCrystal Display:

- Arduino LiquidCrystal documentation: https://docs.arduino.cc/learn/electronics/lcd-displays/

Real Time Clock:

- Adafruit RTClib Guide: https://github.com/adafruit/RTClib/tree/master/examples/

DHT Sensors:

- DHT11/DHT22 with Arduino: https://randomnerdtutorials.com/complete-guide-for-dht11dht22-humidity-and-temperature-sensor-with-arduino/

Fan:

- Fan tutorial/example online: https://docs.sunfounder.com/projects/uno-mega-kit/en/latest/mega2560/simple_creation_small_fan.html/

RTC:

- Real time clock tutorial online: https://howtomechatronics.com/tutorials/arduino/arduino-ds3231-real-time-clock-tutorial/

Water Sensor:

- Water sensor documentation/tutorial: https://arduinogetstarted.com/tutorials/arduino-water-sensor

Other resources:

- Used in-class canvas slides to help with setup of each component
- Also used some of the code in slides to create small tests to see if each component was set up correctly

Github repository:

https://github.com/MattStanl3y/301FinalProject

Group members:

- Matt Stanley
- Jason Parmar