Evaporation Cooler Final Project

CPE 301 Embedded System Design

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An overview of the design

The evaporation cooler is an effective cooling system. It uses a fan to take in outside air passing through a wet pad in the process. After passing through the pad, the air is humidified and cooled.

In this project, an Arduino Mega 2560 along with the starter kit was used to build a mini evaporation cooler. The design had multiple components that tied together would monitor water levels, temperature, and humidity and would display outputs on a LCD screen. The design also allowed for fan control and fan angle, user start/stop and would record when the motor changed states.

The water level sensor printed an alert when the water level was too low. It was coded with a sample using the ADC. When the water level was too low the voltage on the water level sensor would dip below a threshold and an alert was printed. The vent control used a stepper motor to control the direction of the vent. The LCD screen displayed humidity and temperature and updated every minute. The time was measured using a real-time clock.. The temperature and humidity was measured using the DHT11 sensor. And the kit motor and fan used a separate power supply to run. The diagram below, figure 1, was pulled from the lab manual and shows the states and operation of the evaporation cooler. The kit motor and fan blade was used for the fan motor and made use of a separate power supply as seen in figure 3.

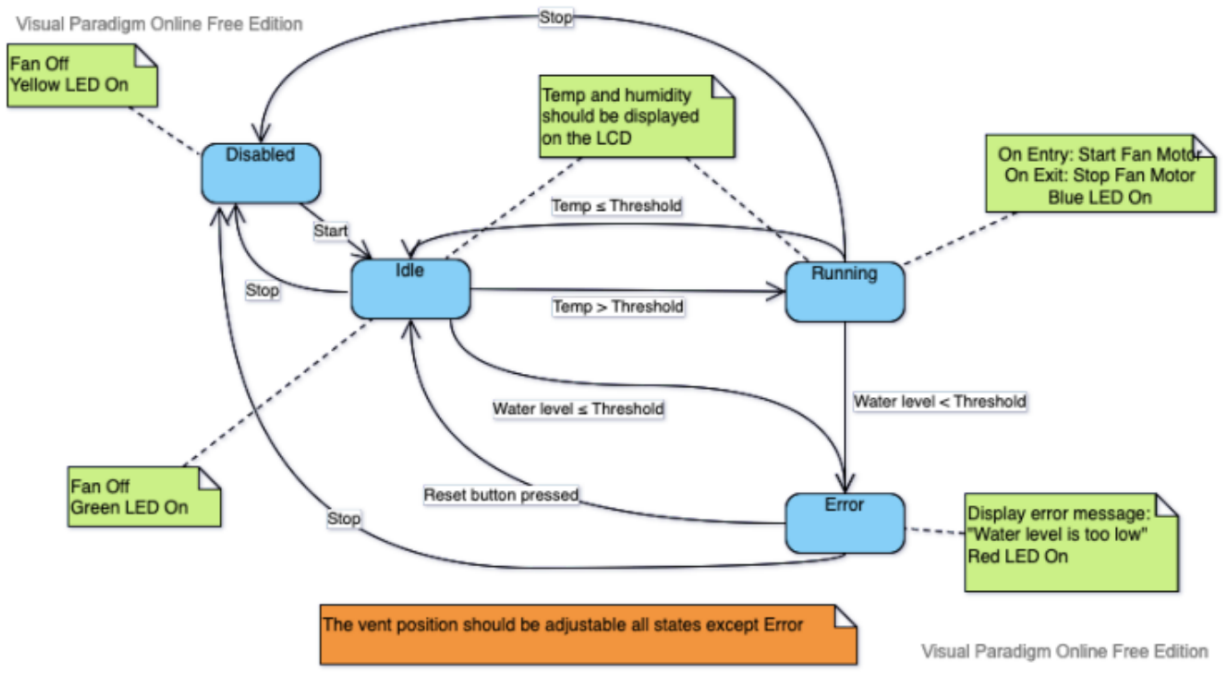

Figure 1: State Diagram for the Evaporation Cooler

The system had 4 states, running, idle, error, and disabled. In the running states, the fan on the LCD screen used the clock to report temperature and humidity readings every minute, as well as any change to the stepper motor position. The blue LED was on. In the disabled states, the cooler had a yellow LED turned on, no reading was being taken and the start button was monitored using an ISR. In the idle state, the time and date was being recorded along with the water level and similarly to the running state, the humidity and temperature, and vent positions were monitored and the green LED was on. During the error state, the motor was off and the LCD displayed an error message. The LED was turned on and red.

State Changes:

The states changed when a user presses the start or reset button.

When the water level goes below a certain, the water level sensor has a voltage below 500mV and the system goes into an error state.

The temperature threshold is 78 degrees fahrenheit. The system goes into idle once the temperature drops below 78 degrees.

The LDC display updated the humidity and temperature values displayed every minute.

Pictures

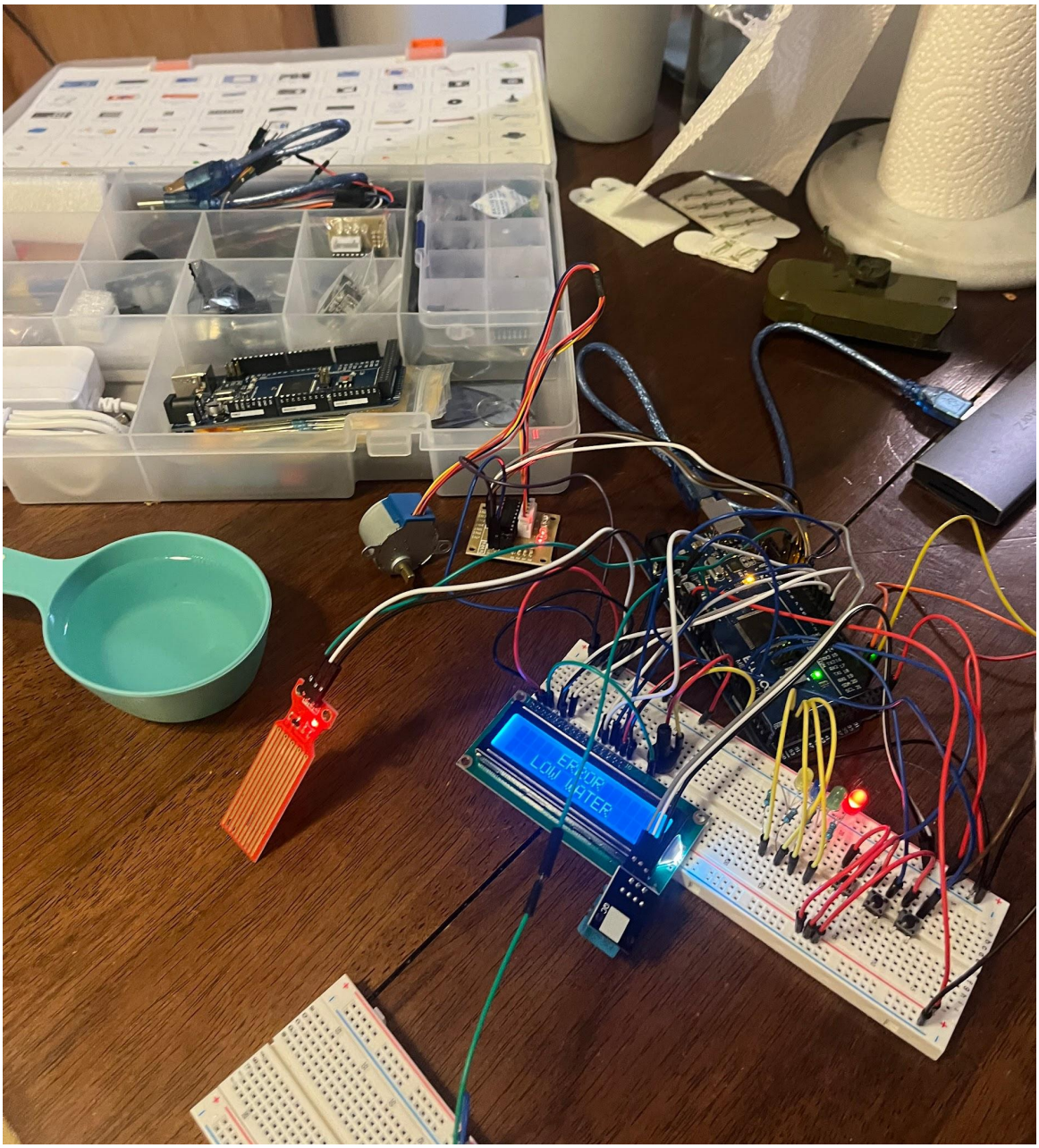

Figure 2: The Evaporator Cooler Setup

Final system video link

https://drive.google.com/file/d/1HSTcrN9kGiJLQ6r1-3OpIrxOkHA9tMuv/view?usp=drivesdk

A complete schematic

Figure 3 shows a complete wiring schematic of the project. The wiring schematic below was used to plan and build out the swamp cooler.

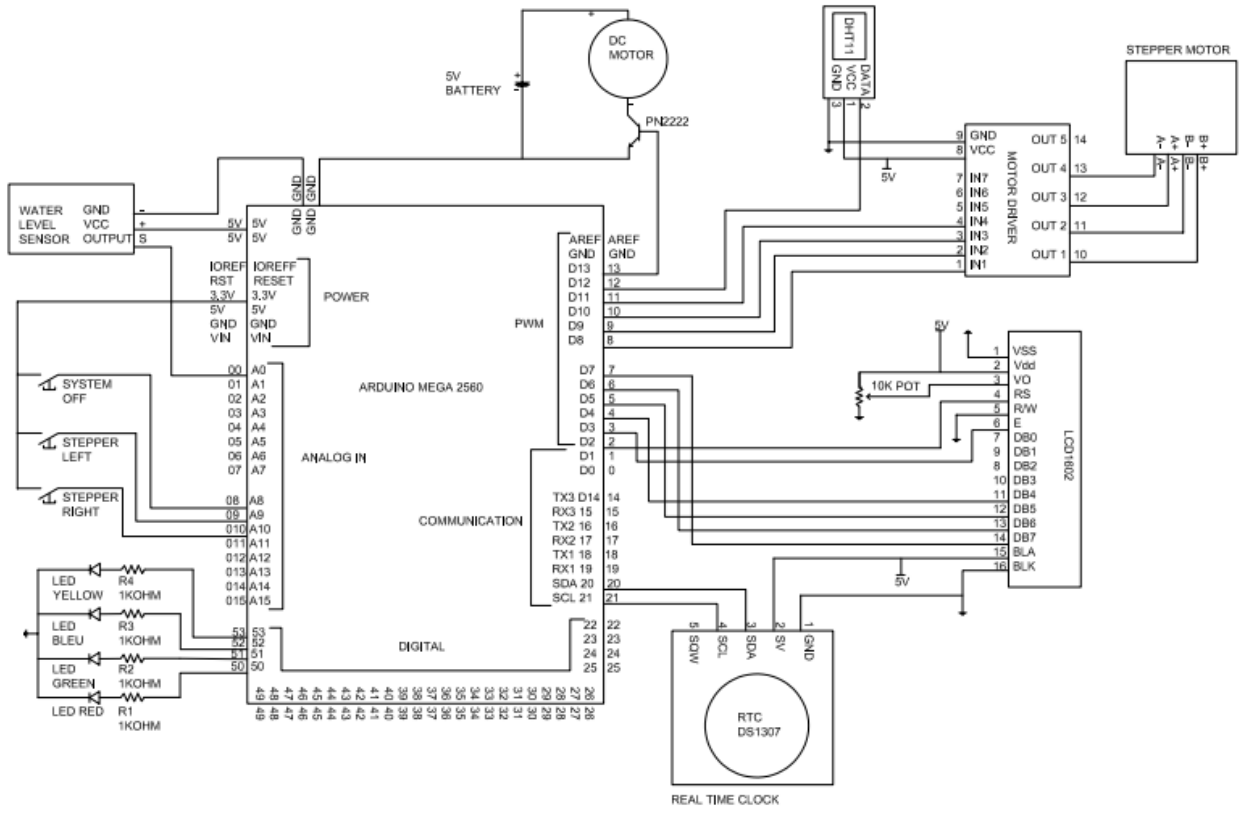

Figure 3: Complete Schematic of the Swamp Cooler

A link to the Github repository

https://github.com/abig-whale/CPEFinal.git

All relevant specification sheets for the components used

Arduino Mega Pinout - https://www.electronicshub.org/wp-content/uploads/2021/01/Arduino-Mega-Pinout.jpg
Atmel 2560 Datasheet - http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-2549-8-bit-AVR-Microcontroller-ATmega640-1280-1281-2560-2561_datasheet.pdf