University of Nevada, Reno Computer Science and Engineering Department

Project: Evaporation Cooling System

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An Overview of the Design

The swamp cooler uses a fan to draw in outside air. This is then passed through a wet pad. As a result, the air is humidified and cooled, making it an efficient cooling system. I used the Arduino Mega 2560 and the corresponding starter kit to construct our swamp cooler. I incorporated various elements that functioned together to track water levels, humidity, and temperature. I displayed these results on an LCD display. Furthermore, the design enabled the user to control the angle of the fan, start and stop the device, and keep a record of any changes in the fan motor's state.

The water level sensor was programmed to issue an alert whenever the water level falls below a certain threshold. The vent control utilizes a stepper motor to change the direction of the vent. The LCD screen provides updates on the temperature and humidity levels, which were measured using the DHT11 sensor. The clock module was utilized to keep track of the time, and the motors were powered by a power supply module.

There are four different states of our system. This includes disabled, idle, error, and running. In the disabled state, the yellow LED is turned on. The start button is monitored using an ISR, but the temperature and water are not monitored in this state. The idle state uses the real-time clock to record transition times. In this state, the green LED is on, and the water level is continuously monitored. If the water is too low, the state will change to error. In the error state, the motor is off no matter the temperature. In error, only the red LED will activate and the error message will display on the serial monitor. Simultaneously, if the water level is higher than the threshold and if the reset button is clicked, the state changes back to idle. Lastly, during the running state, the fan motor and blue LED are on. However, if the system temperature drops below the threshold, then the system will transition to idle. If the water becomes too low, then the system will transition to error.

System Restraints

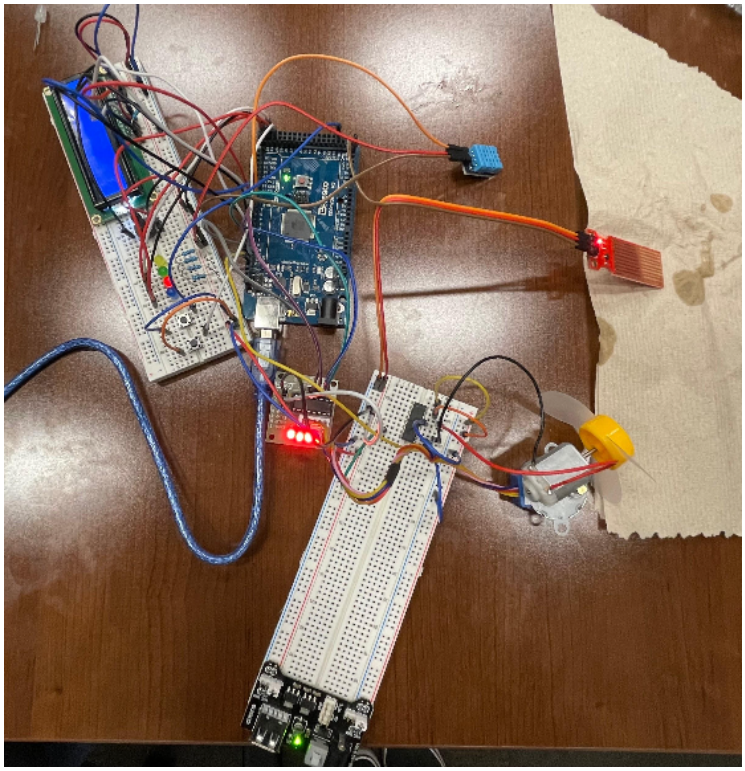
The main restraints faced in our system were related to power, component size, and temperature. The Arduino port supplies only five volts, and with multiple components on the board, power distribution can become unequal. For example, the DC motor needs 1.5 to 6 volts to function, the LCD needs 3 to 5 volts, and the DHT11 requires 3.5 to 5.5 volts, along with the other components. As a result, I have to use a power adapter on the breadboard, since the

microcontroller cannot handle the amount of voltage I need. Another limitation of this system is the need for careful organization in managing its numerous components and pins. Effective communication and planning are crucial for the success of this project, given its complexity. Another limitation I observed was that the temperature could rise significantly as a result of the Arduino's numerous components and power requirements, potentially leading to a system shutdown.

Problems Encountered

- Noise in the breadboard prevented the signal between buttons to set state.
- I encountered wiring and coding errors, which were relatively straightforward to
- correct compared to the earlier issues.
- I had to determine how to use port manipulation to convert analog data from the water sensor into a digital format that could be read by the Arduino, without relying on functions such as analogRead or digitalWrite.

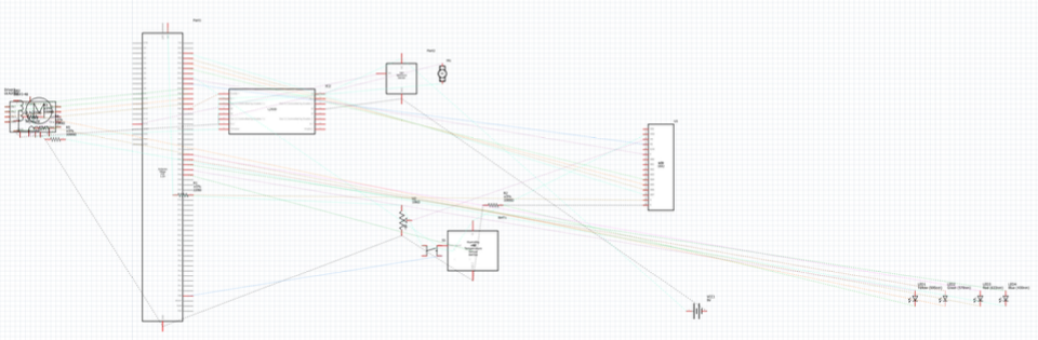
Pictures of the Final System



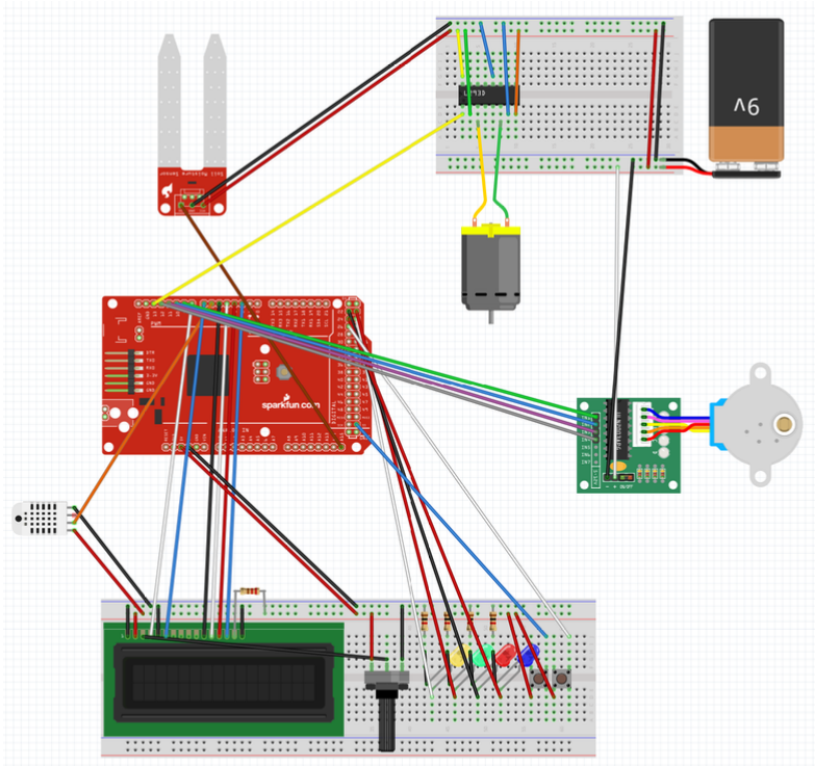
Link to Video of the System in Operation

https://youtu.be/Fx1fFkAI4ZU

Complete Schematic



Circuit Design



Relevant Specification Sheets

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