CPE 301 Final Project

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1 Introduction

The purpose of this project is to develop the components of a swamp cooler using an Arduino Mega 2560. The final system monitors water levels, monitors and temperature and humidity of the environment and displays it on an LCD, has a vent that can be moved using a potentiometer, and logs all state changes on the serial monitor with real time timestamps. The code for the project was developed on the Arduino IDE using a combination of Arduino libraries and register manipulation.

2 Components

This lab used the following components

- **Arduino ATmega 2560**: Main controller of the embedded system
- LCD Monitor: Used to display the temperature and humidity while in idle/running mode as well as display when the system is in error.
- **DHT11 Temperature and Humidity Sensor**: Used to obtain the temperature and humidity of the environment
- **28BYJ-48 Stepper Motor**: Used to change the angle of the vent
- **ULN2003 Stepper Motor Driver Board**: To connect the stepper motor to the Arduino
- **Potentiometer**: Two were utilized, one to control the position of the vent, connected to an analog pin, and one to control the contrast of the LCD
- **RTC Module**: Records the timestamps of each state change that is then logged on the serial monitor
- Water Sensor: Monitors the water level so the system can go into error if it is too low
- **LEDs**: Four of different colors were used to indicate the current state of the system, another was used to indicate the state of the fan.
- **DIP Buttons**: Three were used, a start button to get the system out of disabled mode, a stop button to go into disabled mode, and reset button to get the system out of error.
- **Power Supply Module and 9V Battery**: Used to provide external power to the system and prevent current draw.

3 States

There are 4 system states

1. **Disabled**: This state is indicated by a yellow LED and an LCD message displaying "disabled". In this state, the DHT11 is not active. The system is in this state at boot.

2. **Idle**: This state is indicated by a green LED. The LCD is displaying the current temperature and humidity of the environment. The system is in this state once the start button is pressed from Disabled mode, and when the temperature is below the threshold

3. **Running**: This state is indicated by a blue LED. The LCD is displaying the current temperature and humidity of the environment and the fan is running. The system is in this state when the start button is pressed and the temperature is above the threshold.

4. **Error**: This state is indicated by a red LED. This LCD displays "Error: water level low". The system enters this state when the water level being retrieved by the water sensor is below the threshold. The only way to exit this state is to raise the water level and press the reset button.

4 Environmental Impact

The system demonstrates energy efficiency because it uses an evaporation cooling system, which uses less power than a traditional air conditioning system. Additionally, the fan only runs when the temperature is too high. The system demonstrates safety by using an external power source to run the motor and fan, as well as entering a shut off mode when the water level is too low. The system demonstrates affordability as it uses very inexpensive parts that are commonly found in Arduino kits. The system demonstrates sustainability in its energy efficiency, as well as it modular design, allowing parts to be swapped as needed, reducing waste. Finally, the system demonstrates accessibility in its clarity of state changes from the LEDs, as well as the clear messaging on the LCD screen of the temperature readings as well as the error message.

5 Final Design

The code and video for this project can be found in the Github repository. Images of the final circuit are included in this report.

6 Results

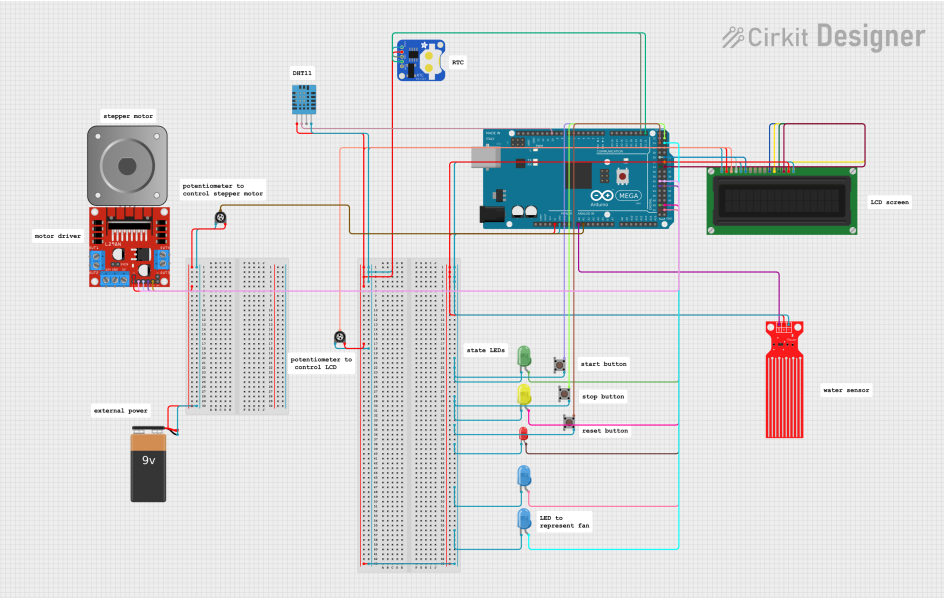

Figure 1: Schematic Diagram of Final Circuit create in Cirkit

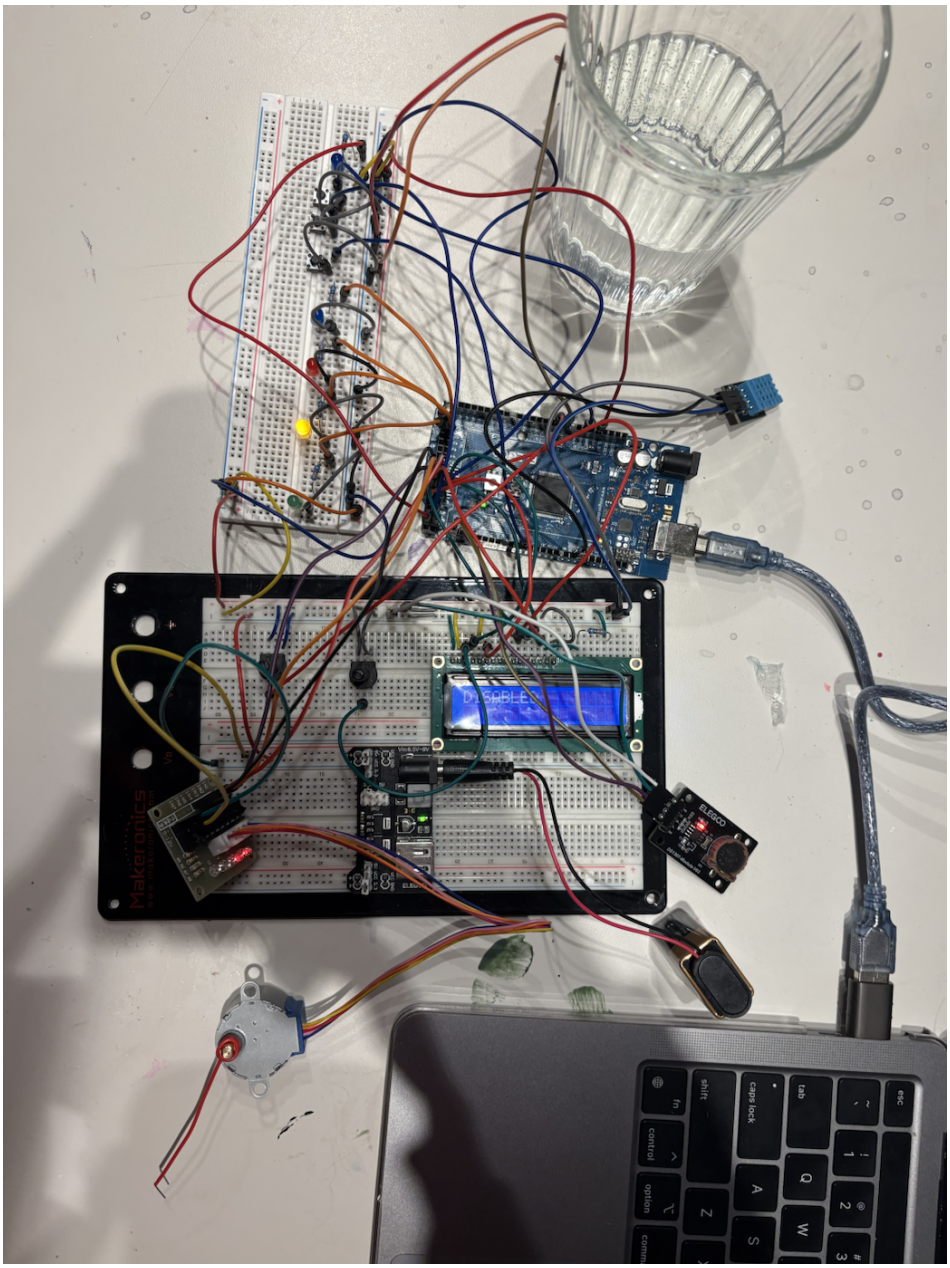

Figure 2: Final Circuit Image