

CS/EE 120B Custom Laboratory

Project Report

Mini Air Conditioning Unit

Melissa Hidalgo

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Introduction:

This machine automatically turns on a fan if the surrounding temperature exceeds 80°F (26.7°C) in temperature mode or 40% humidity in humidity mode. Users can also turn off the fan if they wish by pressing a button. The fan can be reactivated once the button is pressed again. A 4 digit segment display shows either the current temperature or humidity based on what mode the user has put the machine in. The modes can also be changed with a button press. Pressing one button activates humidity mode. The second button activates temperature mode and switches between celsius and fahrenheit. Modes include a celsius reading, fahrenheit reading, and humidity reading.

User Guide:

The air conditioning unit starts in Fahrenheit mode, so the temperature in °F will be displayed. To change the reading to Celsius, push the leftmost button. To bring the display back to Fahrenheit, push the button again.

To switch to humidity mode, press the middle button. The humidity percentage should now be displayed instead of a temperature reading. To return back to temperature mode, press the button on the very left.

The fan automatically turns on if the temperature is hot enough or if it is humid enough, however if you do not want the fan on, pressing the rightmost button disables the fan while the temperature/humidity reading will still be displayed. To reactivate the fan, press the button again and then re-select the mode you want using the left and middle buttons.

Complexities:

1. 4 digit 7-segment display with a shift register
2. The temperature and humidity module
3. The DC motor and fan along with the PN2222 Transistor and 1N4001 diode

All the promised complexities were able to be implemented successfully!

Software Libraries:

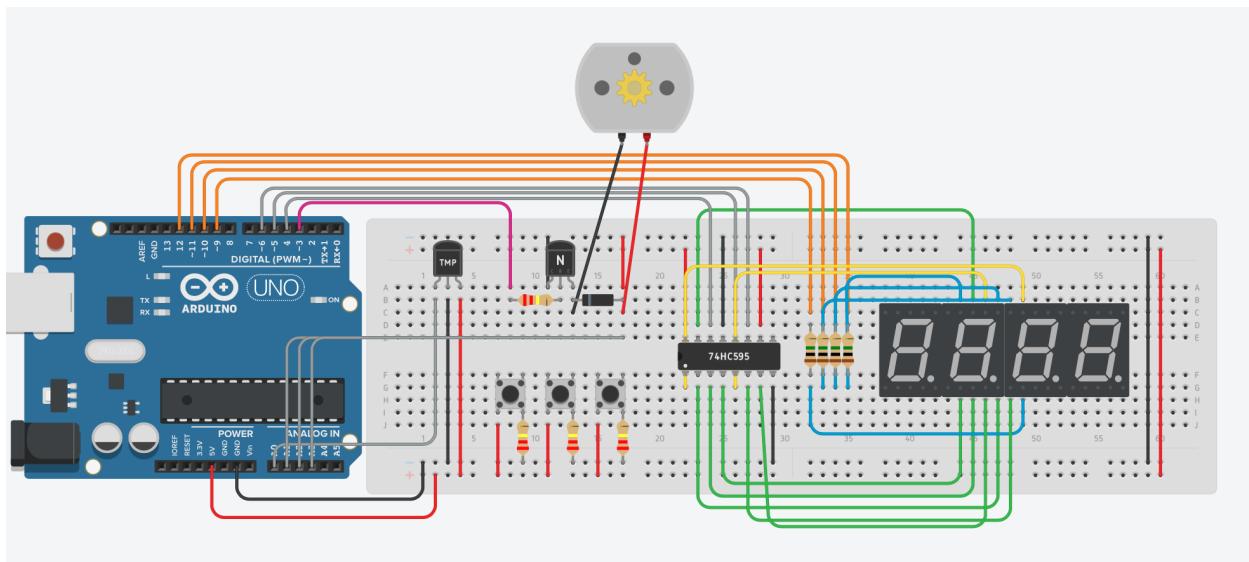
- DHT11 library - Used to take input from the DHT11 Temperature and Humidity Module. This library creates an object that the temperature module can store the current Celsius, Fahrenheit, and humidity readings.
- SevSegShift Library - Allowed the digits to be output on the 4-Digit 7-Segment Display. This library specifies things such as how bright the numbers will be, decimal places, which digit will be places where, and which type of hardware configuration you want to use.

Hardware Components:

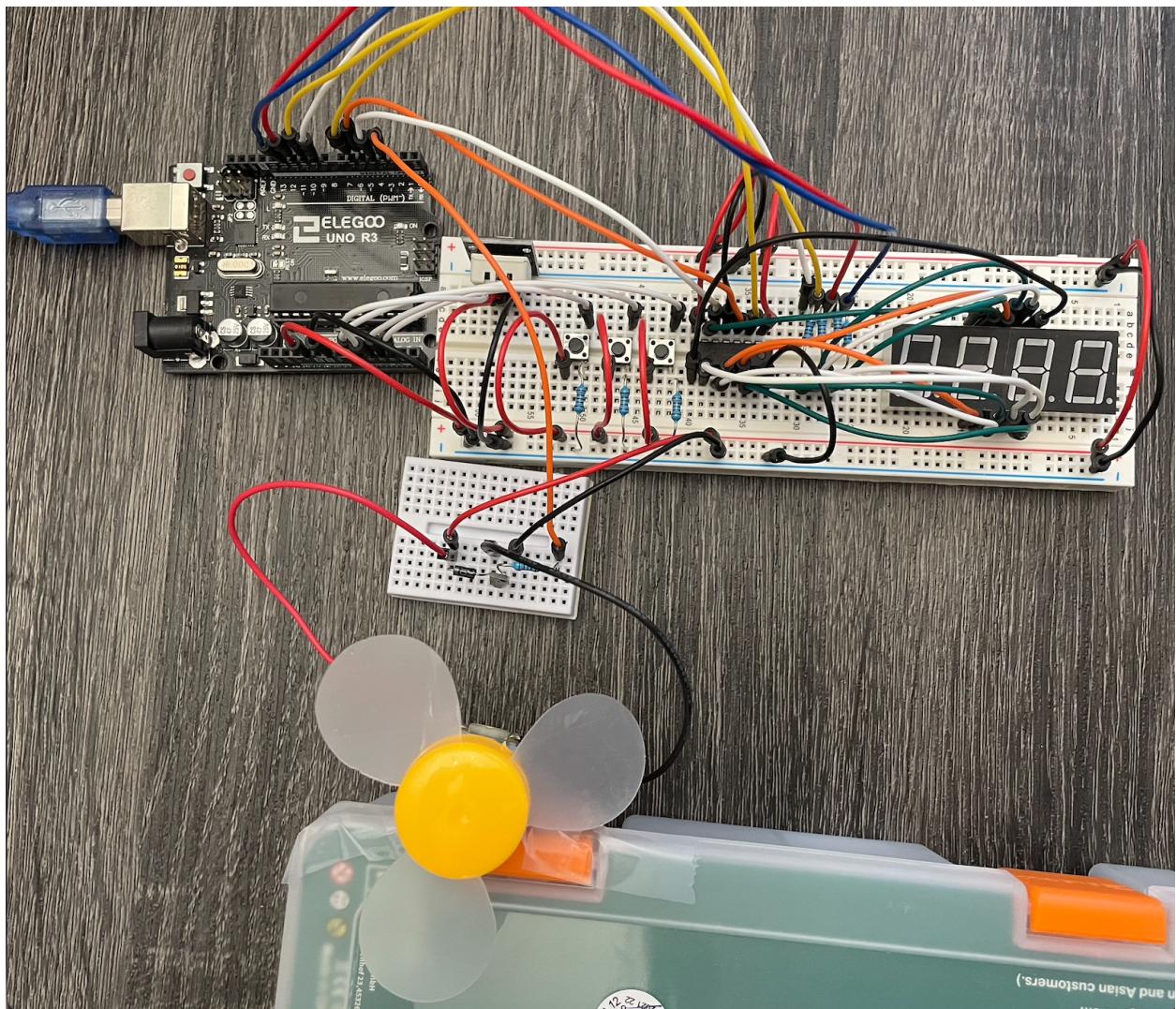
- Computing:
 - Elegoo UNO R3 Controller Board
- Inputs:
 - 3x buttons for mode changes
 - DHT11 Temperature and Humidity Module*
- Outputs:
 - 4 Digit 7-Segment Display
 - 74HC595 shift register*
 - Fan Blade and 3-6V DC Motor*
- Miscellaneous
 - Jumper wires
 - NPN Transistor PN2222
 - 1N4001 diode
 - 4x 1k Ω resistor
 - 4x 220 Ω resistor

*complexity

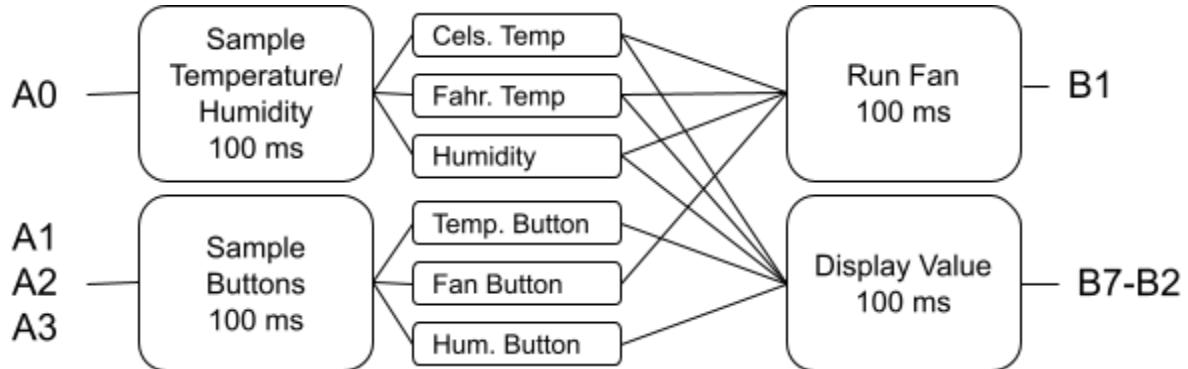
Wiring Diagram:



Physical Diagram:

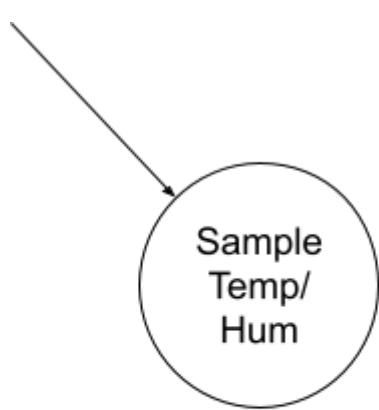


Task Diagram:



SynchSM Diagrams:

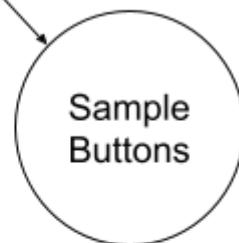
Sample Task:



```

CelsTemp = A0.temperature;
FTemp = (CelsTemp * 1.8) +
32;
Humidity = A0.humidity;
  
```

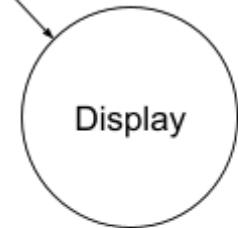
Sample Buttons



```

switch(state){
    case F:
        if(A1){state = C;}
        if(A2){state = H;}
    case C:
        if(A1){state = F;}
        if(A2){state = H;}
    case H:
        if(A1){state = F;}
        f(A2){state = H;}
    }
    if(A3){
        if(runFan){runFan = false;}
        else{runFan = true;}
    }
}
  
```

Display Task:



```
switch(state){  
    case F:  
        digitalWrite(display, FTemp);  
    case C:  
        digitalWrite(display, CelsTemp);  
    case H:  
        digitalWrite(display, Humidity);  
}
```

Fan Task:



```
switch(state){  
    case F:  
        if(FTemp > 80 && runFan)  
            {digitalWrite(motorPin, 70);}  
        else{digitalWrite(motorPin, 0);};  
    case C:  
        if(CelsTemp > 27 && runFan)  
            {digitalWrite(motorPin, 70);}  
        else{digitalWrite(motorPin, 0);};  
    case H:  
        if(Humidity > 40 && runFan)  
            {digitalWrite(motorPin, 70);}  
        else{digitalWrite(motorPin, 0);};  
}
```

Shared Variables:

```
int FTemp, CelsTemp, Humidity = 0;  
int motorPin = 3;  
bool runFan = true;
```