Ambient Temperature Control and Prevention of Tripping Circuit Breaker

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For this project I'd like to control the operation of a space heater. First, I want the space heater to turn on/off depending on the ambient temperature. In addition, I want to be able to operate a kettle (or other high current appliance) without tripping the circuit breaker. I would do this by automatically turning off the space heater when the kettle is on, and then turning it back on when I'm no longer using the kettle.

I. DESIGN

The following design relies on the second appliance having a light that indicates when it is on. This is the case for my kettle. The flowchart in Fig. 1 shows the idea behind the design.

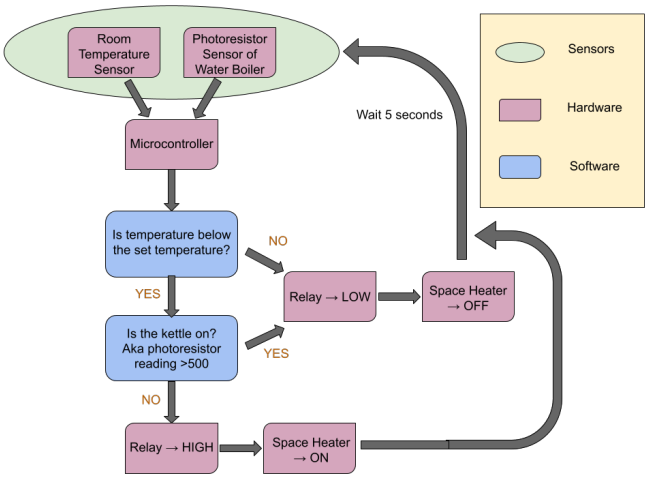

FIG. 1. Design Flowchart

There are two sensors in this design. The first is a temperature sensor which reads the temperature and sends it digitally to the microcontroller. The other sensor is a photoresistor which is a device that changes its resistance depending on the amount of light that it senses. The photoresistor will be attached to the light on the kettle and to an analog pin on the microcontroller. The microcontroller will read the resistance and be able to tell when the kettle is on. The last item attached to the microcontroller is a simple relay. The heater will be wired through the relay such that the heater is off when the switch open and on when the switch is closed. The switch of the relay will be controlled by a digital pin on the microcontroller. Using the sensor data, the microcontroller will decide whether to turn the relay on or off. Figure 2 shows an electronic schematic using a program called Scheme-It.

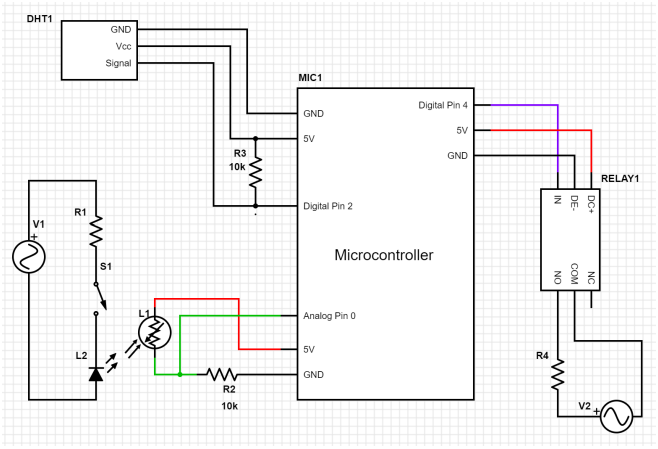

FIG. 2. Electronic Schematic

Lastly, Fig. 3 is a Tinkercad circuit, which describes the design more visually

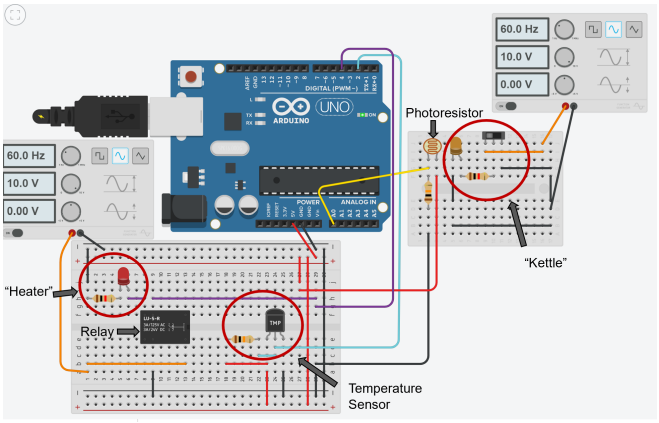

FIG. 3. Tinkercad Design

One aspect of the design which is not described above is a hysteresis cycle. This is part of the software that is updated to the microcontroller. Instead of one temperature T_{set} for the program to aim for, the program cycles between two temperatures. This prevents the heater from continuously turning on and off when the temperature is close to the set T_{set}

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II. LIST OF PARTS

- Microcontroller, I already have an Arduino UNO R3
- Space heater
- Water kettle (or other appliance with a light indicating it is on)
- Temperature sensor, the Arduino kit has one
- Photoresistor, also included in Arduino kit
- 5V relay module
- Extension cord
- Long Wires
- Dark tape (to insulate photoresistor from ambient light)
- Miscellaneous components which should be in my Arduino kit

III. PLAN OF IMPLEMENTATION

- Week 1: Figure out how to use the temperature sensor and relay and make sure I have (or order) correct versions of these.
- Week 2: Connect relay to appliances and make sure it works. Start coding and testing settings.
- Week 3: Combine temperature sensor and relay circuits and code their function.
- Week 4: Test functionality and make any changes. Try to make it aesthetically pleasing and easy to use.