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ECE 153B

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Semi-Autonomous Temperature Regulator

Motivation:

Heating solutions produced nowadays typically come with a control mechanism that allows the temperature of a certain space to be regulated without having to manually tune the heater. However, certain older heating solutions do not have a built-in temperature regulation system and they only give users control of the intensity of the heating and the on-off state. The design being proposed aims to add a layer of semi-autonomous temperature regulation without having to modify the specific design of the heater.

Goal:

While the overall goal is to simply regulate temperature of a space, the goal of design can be broken down into: accurately recording the ambient temperature, establishing an idea of how often temperatures should be checked, determining how much the heater knob needs to be turned, and establishing a minimum temperature difference threshold to avoid unnecessary knob turns for small temperature differences.

If time permits, additional goals may include: a wireless temperature reporting network to ensure temperature of the entire space is taken into account, an external knob that allows users to manually and remotely control the heater, and additional configurations such as time of day where heater is on/off.

Design Procedure:

The feedback loop of the design can be summarized as such:

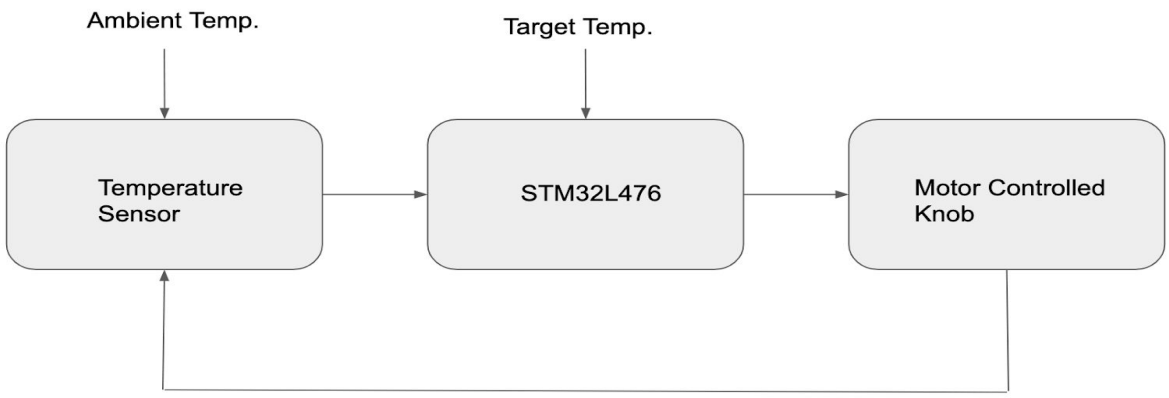

Figure 1: Design flow feedback loop

Initially, the user will set a target temperature for the space. The external temperature sensor will take the ambient temperature of the space and that temperature value will be compared against the user-defined target temperature. Once the comparison has been made, the microcontroller will generate a signal to control the knob controlled motor that will adjust the heater accordingly. The entire process will start again with the temperature sensor taking in ambient temperature values periodically, comparing values, and adjusting the heater accordingly.

The control logic can be summarized as such:

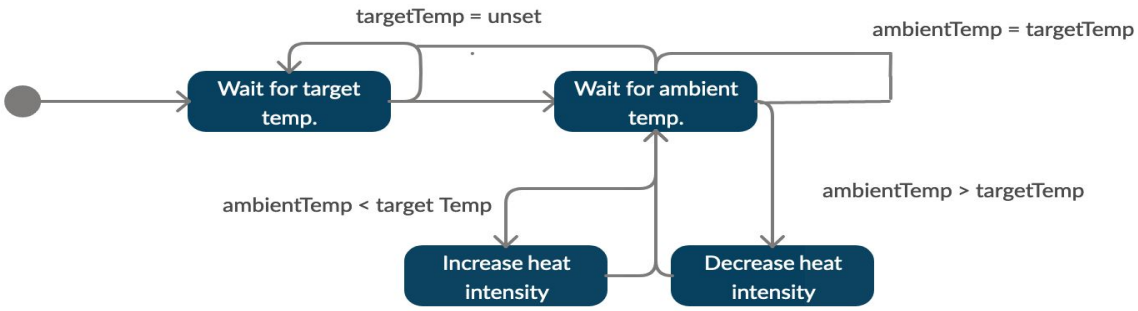

Figure 2: Microcontroller Temperature Control Logic

Peripherals and Parts:

DHT22 Digital Temperature and Humidity Sensor using I2C

Small Reduction Stepper Motor - 5VDC 32-Step 1/16 Gearing using SPI

Knob casing

Responsibilities:

Michael's Responsibilities

Michael will be in charge of setting up the temperature sensor and ensuring that the values are relatively accurate and also implementing the layout of the control logic in figure 2.

Oles' Responsibilities

Oles will be responsible for tuning the various parameters associated with the control logic and setting up the motor to properly turn the heater knob

Link to Project Site:

https://sites.google.com/view/ucsbece153bs-ahc