

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

### Abstract

*A PID (proportional-integral-derivative) controller was used to control a heating plate to a set temperature while considering factors such as speed, accuracy, precision, and stability. A 120Vac wall outlet and a single pole-double throw relay powered the heating plate, while an Arduino UNO provided a timed signal to the relay. The final control system was able to accurately reach the desired temperature and could correct for any disturbances that it encountered. One of the ways that the PID controller was adjusted was by using potentiometers to change the PID gains. This allowed for very precise tuning and, as a result, a better system response.*

### Introduction

The goal of this lab was to create a control system which utilizes Proportional-Integral-Derivative, or PID, tuning. PID tuning is a useful tool in control systems for achieving a desired system response. The proportional (P) quantity is the current error in the desired value compared to the measured value. The integral (I) is the accumulated error over time. The derivative (D) is the rate of change for the error in the system. Depending on the system, some of these factors might be more important than others. For this reason, two gain values,  $K_p$ ,  $K_i$ , and  $K_d$ , were used. (Derivative control was unnecessary for this system, and thus the  $K_d$  gain was set to zero). By implementing potentiometers, these gains were user tunable and allowed for easy and precise weighting on each of the PID terms. By tuning these gain values manually or systematically using an algorithm, the desired possible response of any system with feedback can be achieved.

In this experiment, a user tunable PI system was developed to control the response of a crockpot. To achieve this, a TMP102 sensor was used to measure the current temperature of the crockpot. This current temperature was recorded in the Arduino software to then calculate proportional and integral error. Using the proportional and integral error, a system was developed to vary a PWM output which went to a single pole-double throw relay, later referred to as the relay. Once tested, 2 variable gain potentiometers were incorporated to provide immediate tuning of the system without having to recompile and upload the code. Once tuned, the percent overshoot (%OS) and damping ratio ( $\zeta$ ) were calculated using the measured data of the system.

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
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The %OS, “is the maximum peak value of the response curve measured from unity” [1] and the damping ratio is, “a dimensionless measure that describes how oscillations in a system decay after a disturbance” [2]. Both of these calculated values provide insight into the stability of the system and how it will react to outside disturbances, such as opening the lid of the crockpot.

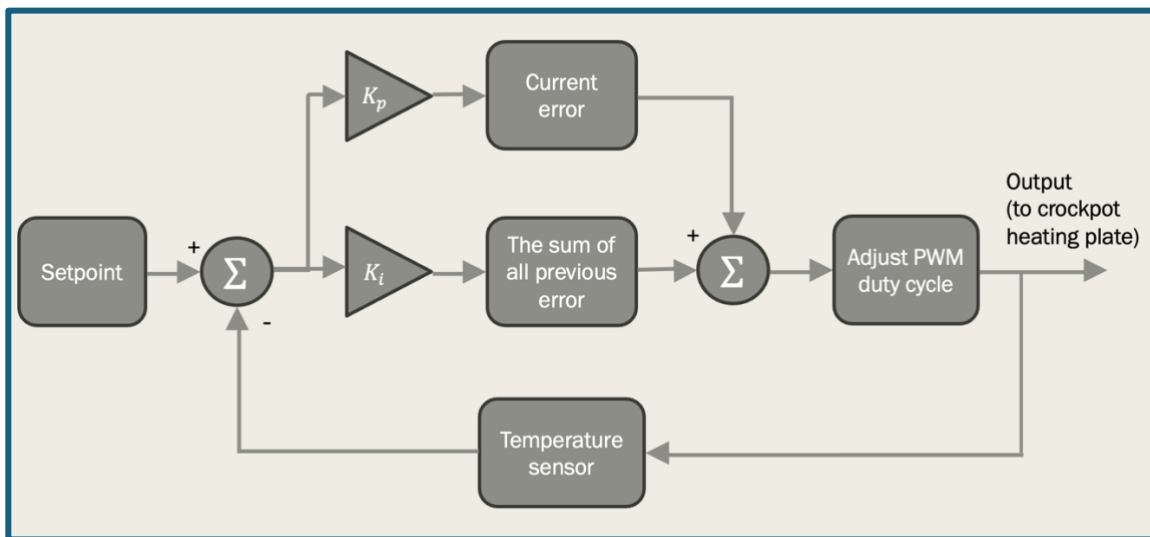


Figure 1: Block Diagram

To run the code, an Arduino UNO, later referred to as the Arduino, was used to run the program. The Arduino microcontroller is a writable system which once booted will continuously run the desired program. Though simple, the Arduino is a reliable controller for projects of smaller scaler. It provides an entry level into programmable logic using a higher language such as C.

### Equipment List

- 1) crockpot little dipper – a slow cooker with a heating plate. The crockpot also comes with a wall outlet plug to obtain power.

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

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Due: 5/12/25

- 2) Arduino UNO – a microcontroller that is inexpensive and can be easily interfaced using the Arduino IDE.
- 3) 3-25k Potentiometers – used to adjust the gains  $K_p$  and  $K_i$  for the PI controller and to easily change the setpoint temperature.
- 4) Nokia 5110 LCD – displays the current temperature, setpoint,  $K_p$  value, and  $K_i$  value.
- 5) Single Pole-Double Throw Relay - allows the motor to pull power from the outlet rather than the Arduino while still using the PWM from the Arduino.
- 6) 3-1k, 1-10k, 1-330  $\Omega$  Resistor - steps down voltage from Nokia LCD into Arduino

### Experimental Procedure

The first step of designing this control system was configuring all the hardware. In order to create a user-friendly system a Nokia LCD screen was chosen.. The completed LCD screen was programmed to display the set temperature, the current measured temperature, and the values of  $K_p$  and  $K_i$ . The powered-on screen can be seen in Figure 2.



Figure 2: Nokia LCD Screen

A voltage divider system was created in order to step down the voltage from the screen to the Arduino. Three potentiometers for analog user input were wired in with the sweep being used for input into the Arduino. The TMP102 temperature sensor was wired in using the I2C wiring protocol as specified by the datasheet. A complete wiring diagram can be seen in Figure 3.

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
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Due: 5/12/25

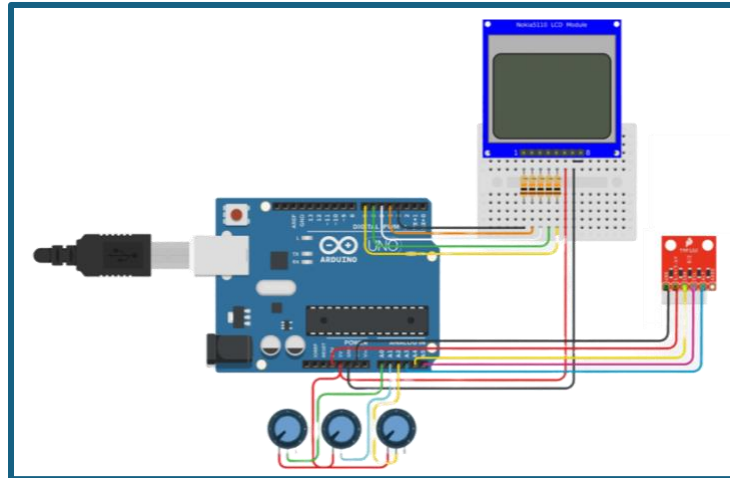


Figure 3: Wiring Diagram

Once constructed, the previous created code for PID motor control was used as a starting point. The code had to be re-written in order to measure temperature instead of RPM. In addition, the PWM signal had to be converted into a uniform time signal in order to be used with the mechanical relay. A 3D printed box was designed and printed using CAD software. The final design can be seen in Figure 4.

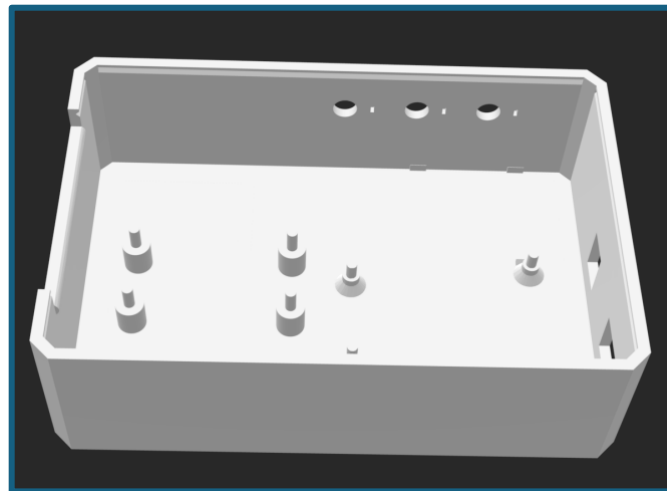


Figure 4: Final 3D Print Design for Box

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
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Due: 5/12/25

Once everything was set in the box, testing began with various values for  $K_p$  and  $K_i$ . Each test required various amounts of time due to the nature of the system.

$$P = \text{Setpoint} - \text{Current Temp} \quad \text{Eq. (2)}$$

$$I = \text{previous error} + \left( \frac{\text{SampleInterval}}{1000} \right) \quad \text{Eq. (3)}$$

### Experimental Data and Results

In the first test,  $K_p$  was set to 10 and  $K_i$  to 0, severely overdamping the system. The trial was aborted after 62.5 minutes due to water in the crockpot, simulating food. A water-tight bag held the temperature sensor, ensuring an accurate “food” temperature. The system was expected to reach 100.5 F in an additional 75 minutes. The results for this trial can be seen in Figure 5.

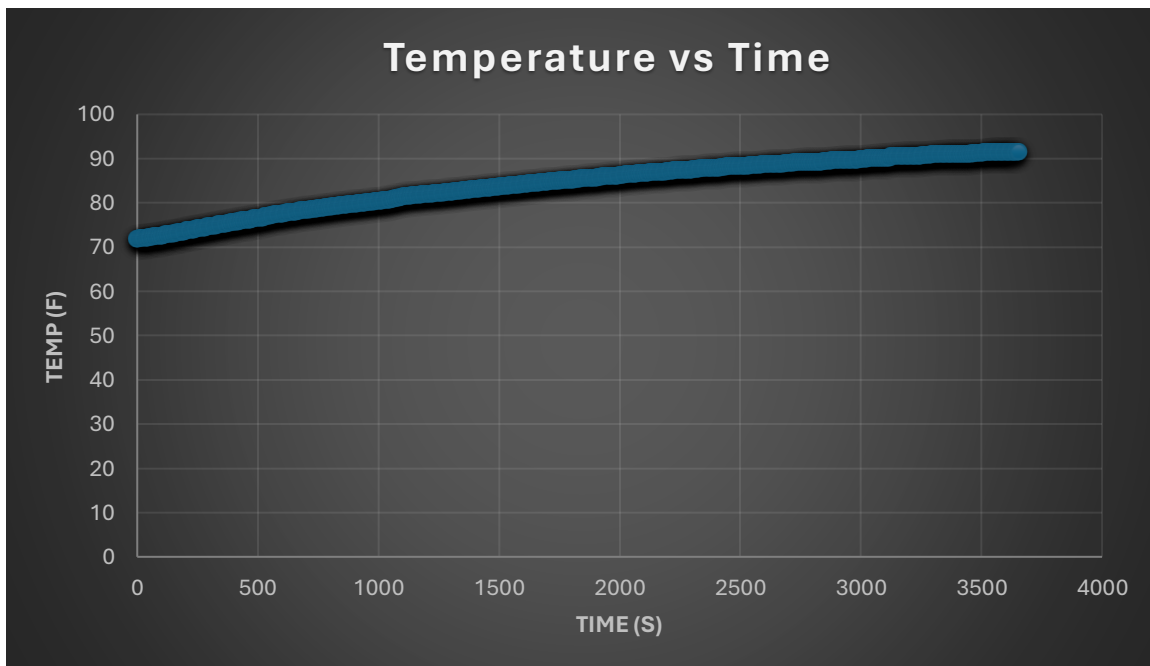


Figure 5: PI-Controller Test 1:  $K_p = 10$ ,  $K_i = 0$ , Desired Temperature = 100.5 F

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

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Due: 5/12/25

In the second trial,  $K_p$  was set to 8.53 and  $K_i$  was set to 0.021. The response was slightly underdamped and reached 113.11 F compared to the desired temperature of 110.1 F. The second trial ran for a total of 81 minutes as was stopped after one period. The results for this second trial can be seen in Figure 6.

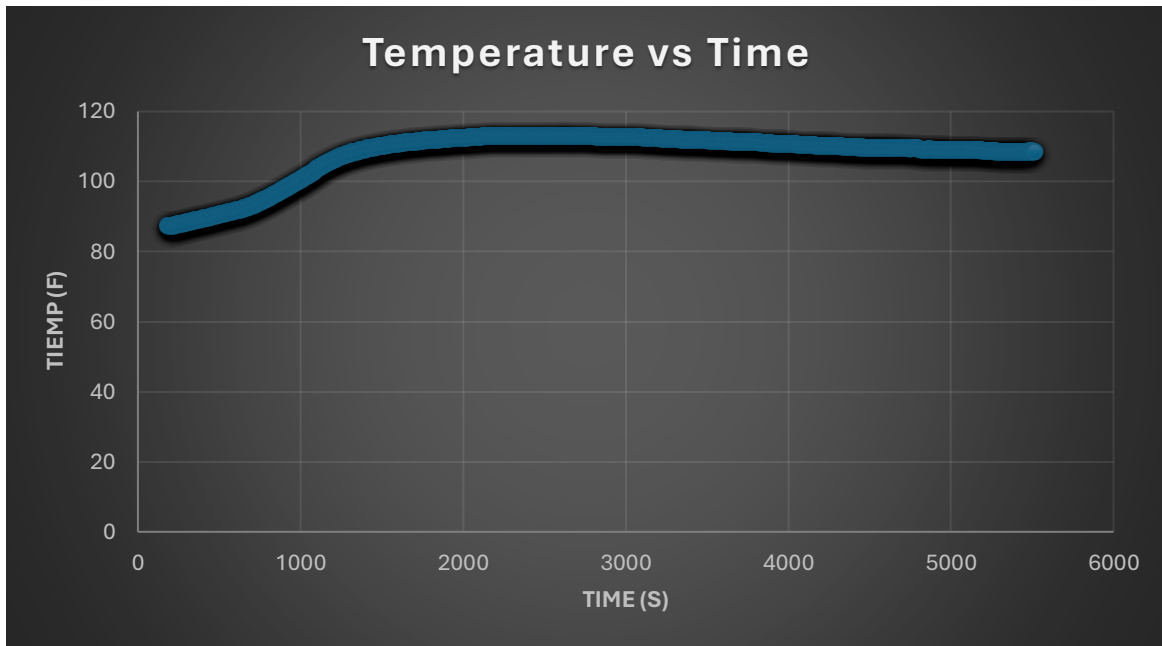


Figure 6: PI-Controller Test 2:  $K_p = 8.53$ ,  $K_i = 0.021$ , Desired Temperature = 110.1 F

$$\%OS = \frac{C_{max} - C_{final}}{C_{final}} * 100 \% \quad \text{Eq. (4)}$$

$$C_{max} = 113.11 \text{ F}$$

$$C_{final} = 110.1 \text{ F}$$

$$\%OS = 2.67\%$$

$$\zeta = \frac{-\ln(\% \frac{OS}{100})}{\sqrt{\pi^2 + \ln^2(\% \frac{OS}{100})}} \quad \text{Eq. (5)}$$

$$\zeta = 0.318$$

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EENG-4060  
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### Conclusion and Continuous Improvements

This project gave insight into carrying out a project to completion. The simple task of creating a control system with PI control was given, and the rest was up to the students to choose. Due to the simplicity of the project, a crockpot was chosen. In addition to creating a PI controlled crockpot, the overall system was targeted at being user friendly. This was done with the use of an LCD screen and a closed system box to prevent shock from the 120 AC voltage entering the open terminal relay.

Continuous improvements to the system would include the implementation of an auto-tuning PI algorithm. Due to the slow nature of the crockpots heating element, this auto tuning algorithm could continuously tune the PI variables for immediate feedback and system improvement. In addition, introducing derivative control would help with the overall system response. Finally, a temperature probe that can be inserted into the food would enhance the system's user-friendliness. Testing revealed that moisture buildup on the TMP102 sensors caused the system to short-circuit, halting cooking.

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EENG-4060  
Control Systems Lab  
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### References

- [1] Ogata, K., *Modern Control Engineering*, 5th ed., Upper Saddle River, NJ: Prentice Hall, 2010.
- [2] “Damping Ratio - (Intro to Electrical Engineering) - Vocab, Definition, Explanations Fiveable,” Fiveable.me, 2018. <https://library.fiveable.me/key-terms/introduction-electrical-systems-engineering-devices/damping-ratio> (accessed Apr. 24, 2025).
- [3] Tinkercad, “Tinkercad: 3D design, electronics, and coding,” Autodesk, [Online]. Available: <https://www.tinkercad.com> (accessed Apr. 24, 2025).
- [4] S. Zhuge, “Sentek Dynamics - World class provider of vibration test equipment, shakers, and environmental test chambers.” [https://www.sentekdynamics.com/sentek-dynamics-news/2020/8/24/pid-control-theory?gad\\_source=1&gbraid=0AAAAADm6T\\_KUkjk1yZQ5wtBkhITWuAxYh&gclid=CjwKCAjwwqfABhBcEiwAZJjC3nwxXcf-JLg5yyMjn81WMYhtYziCkl4VC9Fyg5hUpozA\\_AQFRFoh3RoC7pMQAvD\\_BwE](https://www.sentekdynamics.com/sentek-dynamics-news/2020/8/24/pid-control-theory?gad_source=1&gbraid=0AAAAADm6T_KUkjk1yZQ5wtBkhITWuAxYh&gclid=CjwKCAjwwqfABhBcEiwAZJjC3nwxXcf-JLg5yyMjn81WMYhtYziCkl4VC9Fyg5hUpozA_AQFRFoh3RoC7pMQAvD_BwE) (accessed Apr. 25, 2025).
- [5] Schuberg, Benjamin and Morris, John. “Lab 5: PID controller.” Benedictine College, Atchison, KS, USA, Rep. 5, 2025.
- [6] Alex the Giant. “TMP102 Digital temperature sensor hookup guide.” SparkFun. <https://learn.sparkfun.com/tutorials/tmp102-digital-temperature-sensor-hookup-guide/all> (accessed May 1, 2025).
- [7] Vernier Software & Technology, *Logger Pro 3*, Vernier Software & Technology, Beaverton, OR, USA.
- [8] Microcontrollers Lab. “Nokia5110 LCD Module.” <https://microcontrollerslab.com/nokia5110-lcd-pinout-arduino-interfacing-datasheet/> (accessed May 7, 2025).



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### Appendix A: Final Script

```
Final_Crockpot.ino
1 // Ben Schuberg and John Morris
2 // Crockpot PID
3
4 #include <Wire.h> // Used to establish serial communication on the I2C bus
5 #include <SparkFunTMP102.h> // Used to send and receive specific information from our sensor
6 #include <SPI.h>
7 #include <Adafruit_GFX.h>
8 #include <Adafruit_PCD8544.h>
9
10 #define RELAY_OUT 10
11 #define ENABLE 2
12 #define KP_POT A2 // Potentiometer for Kp
13 #define KI_POT A1 // Potentiometer for Ki
14 #define TEMP_SET_POT A0 // Potentiometer for setting desired temperature
15 #define SAMPLE_INTERVAL 3000 // sampling
16
17 // Variables
18 double Kp = 0.5; // Initial Proportional Gain
19 double Ki = 0.1; // Initial Integral Gain
20 const unsigned long CYCLE_PERIOD = 2000; // total period in milliseconds (mech. relay switch speed)
21 double Setpoint = 100; // Desired Temp (User Input)
22 double Input = 0; // Measured Temp
23 double Output = 0; // PID output (PWM duty cycle)
24 double lastError = 0; // Previous error
25 double integral = 0;
26 float temperature;
27 const int ALERT_PIN = A3;
28 TMP102 sensor0;
29
30 // Declare LCD object for software SPI
31 // Adafruit_PCD8544(CLK,DIN,D/C,CE,RST);
32 Adafruit_PCD8544 display = Adafruit_PCD8544(7, 6, 5, 4, 3);
33
34 void setup() {
35   pinMode(RELAY_OUT, OUTPUT); // output to the relay
36   pinMode(ENABLE, OUTPUT);
37   digitalWrite(ENABLE, HIGH);
38   // analogWrite(RELAY_OUT, 255 - dutyCycle);
39
40   Serial.begin(115200);
41   Serial.println("Enter Desired Temperature:");
42
43   // Configure TMP102 sensor
44   Serial.println("Testing the sensor now...");
45   Wire.begin(); // Join I2C Bus
46   pinMode(ALERT_PIN, INPUT); // Declare alertPin as an input
47
48   if (!sensor0.begin()) {
49     Serial.println("Cannot connect to TMP102.");
50     while (1); // Stuck here if connection fails
51   }
52
53   delay(5000);
54
55   Serial.println("Connected to TMP102!");
56   sensor0.setFault(0);
57   sensor0.setAlertPolarity(1);
58   sensor0.setAlertMode(0);
59   sensor0.setConversionRate(2);
60   sensor0.setExtendedMode(0);
61   sensor0.setHighTempF(82.0);
62   sensor0.setLowTempF(81.0);
63
64   // Initialize Display
65   display.begin();
66   display.setContrast(10);
67   display.clearDisplay();
68   display.setTextSize(0.75);
69   display.setTextColor(BLACK);
70   display.setCursor(0, 0);
71   display.println("Hello world!");
72   display.display();
73   delay(2000);
74 }
75
```

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
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```
76     display.clearDisplay();
77 }
78
79 void loop() {
80     // Read user-set temperature from potentiometer and map to 75-175°F
81     int potVal = analogRead(TEMP_SET_POT);
82     Setpoint = map(potVal, 0, 1023, 750, 1750) / 10.0; // Map and convert to float
83
84     // Read potentiometer values for Kp, Ki
85     Kp = analogRead(KP_POT) / 1023.0 * 10.0;
86     Ki = analogRead(KI_POT) / 1023.0 * 0.25;
87
88     // Measure Temp
89     boolean alertPinState, alertRegisterState;
90     sensor0.wakeup();
91     temperature = sensor0.readTempF();
92     alertPinState = digitalRead(ALERT_PIN);
93     alertRegisterState = sensor0.alert();
94     sensor0.sleep();
95
96     // PID Calculation
97     double error = Setpoint - temperature;
98     integral += error * (SAMPLE_INTERVAL / 1000.0);
99     Output = (Kp * error) + (Ki * integral);
100    Output = constrain(Output, 0, 255);
101
102    // Converting the PWM into something way slower, time based
103    double dutyCycle = Output / 255;
104    unsigned long onTime = dutyCycle * CYCLE_PERIOD;
105    unsigned long offTime = CYCLE_PERIOD - onTime;
106
107    // Run relay ON for onTime
108    if (onTime > 0) {
109        digitalWrite(RELAY_OUT, HIGH);
110        delay(onTime);
111    }
112
113    // Run relay OFF for offTime
114    if (offTime > 0) {
115        digitalWrite(RELAY_OUT, LOW);
116        delay(offTime);
117    }
118
119    // Serial Output
120    Serial.print("Setpoint: ");
121    Serial.print(Setpoint);
122    Serial.print(" | Temp: ");
123    Serial.print(temperature);
124    Serial.print(" | Duty Cycle % : ");
125    Serial.print(100*dutyCycle);
126    Serial.print(" | Kp: ");
127    Serial.print(Kp, 2);
128    Serial.print(" | Ki: ");
129    Serial.println(Ki, 3);
130
131    // LCD Output
132    display.clearDisplay(); // Clear screen buffer
133    display.setCursor(0, 0); // Reset text cursor
134    display.print("Desired Temp: ");
135    display.println(Setpoint, 1); // 1 decimal place
136    display.print("Current Temp: ");
137    display.println(temperature, 1); // 0 decimal place
138    display.print("Kp: ");
139    display.println(Kp, 1);
140    display.print("Ki: ");
141    display.println(Ki, 2);
142    display.display(); // Update screen
143
144    delay(SAMPLE_INTERVAL);
145
146 }
```

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
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### Appendix B: Experimental Data

13:54:36.614 -> Setpoint: 101.20   Temp: 113.79   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:54:41.688 -> Setpoint: 101.20   Temp: 113.79   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:54:46.792 -> Setpoint: 101.20   Temp: 113.90   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:54:51.871 -> Setpoint: 101.20   Temp: 113.90   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:54:56.937 -> Setpoint: 101.20   Temp: 114.01   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:02.008 -> Setpoint: 101.20   Temp: 114.01   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:07.085 -> Setpoint: 101.20   Temp: 114.12   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:12.163 -> Setpoint: 101.20   Temp: 114.12   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:17.272 -> Setpoint: 101.20   Temp: 114.12   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:22.351 -> Setpoint: 101.20   Temp: 114.24   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:27.427 -> Setpoint: 101.20   Temp: 114.24   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:32.502 -> Setpoint: 101.20   Temp: 114.24   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:37.584 -> Setpoint: 101.20   Temp: 114.24   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:42.658 -> Setpoint: 101.20   Temp: 113.22   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:47.736 -> Setpoint: 101.20   Temp: 111.65   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:52.818 -> Setpoint: 101.20   Temp: 109.85   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:55:57.894 -> Setpoint: 101.20   Temp: 107.94   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:02.970 -> Setpoint: 101.20   Temp: 106.02   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:08.048 -> Setpoint: 101.20   Temp: 104.34   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:13.128 -> Setpoint: 101.20   Temp: 102.76   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:18.208 -> Setpoint: 101.20   Temp: 101.30   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:23.316 -> Setpoint: 101.20   Temp: 99.84   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:28.392 -> Setpoint: 101.20   Temp: 98.49   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:33.467 -> Setpoint: 101.20   Temp: 97.14   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:38.542 -> Setpoint: 101.20   Temp: 95.68   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:43.609 -> Setpoint: 101.20   Temp: 93.65   Duty Cycle % : 0.00   Kp: 10.00   Ki: 0.122
13:56:48.687 -> Setpoint: 101.20   Temp: 92.07   Duty Cycle % : 5.68   Kp: 10.00   Ki: 0.122
13:56:53.791 -> Setpoint: 113.70   Temp: 90.72   Duty Cycle % : 63.29   Kp: 10.00   Ki: 0.122
13:56:58.871 -> Setpoint: 113.70   Temp: 89.82   Duty Cycle % : 70.25   Kp: 10.00   Ki: 0.122
13:57:03.953 -> Setpoint: 113.70   Temp: 89.26   Duty Cycle % : 86.54   Kp: 10.00   Ki: 0.057
13:57:09.029 -> Setpoint: 113.70   Temp: 88.81   Duty Cycle % : 80.55   Kp: 8.53   Ki: 0.021
13:57:14.106 -> Setpoint: 113.70   Temp: 88.47   Duty Cycle % : 82.32   Kp: 8.53   Ki: 0.020
13:57:19.189 -> Setpoint: 113.70   Temp: 88.14   Duty Cycle % : 84.04   Kp: 8.53   Ki: 0.021
13:57:24.271 -> Setpoint: 113.70   Temp: 87.91   Duty Cycle % : 85.42   Kp: 8.53   Ki: 0.020
13:57:29.350 -> Setpoint: 113.70   Temp: 87.80   Duty Cycle % : 86.42   Kp: 8.53   Ki: 0.020

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
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Due: 5/12/25

13:57:34.427 -> Setpoint: 113.70   Temp: 87.69   Duty Cycle % : 87.42   Kp: 8.53   Ki: 0.020
13:57:39.477 -> Setpoint: 113.70   Temp: 87.57   Duty Cycle % : 88.42   Kp: 8.53   Ki: 0.020
13:57:44.587 -> Setpoint: 113.70   Temp: 87.46   Duty Cycle % : 89.44   Kp: 8.53   Ki: 0.021
13:57:49.665 -> Setpoint: 113.70   Temp: 87.46   Duty Cycle % : 90.07   Kp: 8.53   Ki: 0.021
13:57:54.741 -> Setpoint: 113.70   Temp: 87.46   Duty Cycle % : 90.67   Kp: 8.53   Ki: 0.020
13:57:59.808 -> Setpoint: 113.70   Temp: 87.46   Duty Cycle % : 91.30   Kp: 8.53   Ki: 0.020
13:58:04.887 -> Setpoint: 113.70   Temp: 87.35   Duty Cycle % : 92.35   Kp: 8.53   Ki: 0.021
13:58:09.957 -> Setpoint: 113.70   Temp: 87.46   Duty Cycle % : 92.61   Kp: 8.53   Ki: 0.021
13:58:15.060 -> Setpoint: 106.60   Temp: 87.46   Duty Cycle % : 69.31   Kp: 8.53   Ki: 0.021
13:58:20.137 -> Setpoint: 109.40   Temp: 87.46   Duty Cycle % : 79.14   Kp: 8.53   Ki: 0.020
13:58:25.201 -> Setpoint: 109.40   Temp: 87.46   Duty Cycle % : 79.74   Kp: 8.53   Ki: 0.021
13:58:30.277 -> Setpoint: 109.40   Temp: 87.57   Duty Cycle % : 79.89   Kp: 8.53   Ki: 0.021
13:58:35.349 -> Setpoint: 109.40   Temp: 87.57   Duty Cycle % : 80.42   Kp: 8.53   Ki: 0.021
13:58:40.430 -> Setpoint: 110.00   Temp: 87.69   Duty Cycle % : 82.59   Kp: 8.53   Ki: 0.021
13:58:45.544 -> Setpoint: 110.00   Temp: 87.69   Duty Cycle % : 83.03   Kp: 8.53   Ki: 0.020
13:58:50.619 -> Setpoint: 110.00   Temp: 87.80   Duty Cycle % : 83.29   Kp: 8.53   Ki: 0.021
13:58:55.696 -> Setpoint: 110.00   Temp: 87.80   Duty Cycle % : 83.82   Kp: 8.53   Ki: 0.021
13:59:00.767 -> Setpoint: 110.00   Temp: 87.91   Duty Cycle % : 83.98   Kp: 8.53   Ki: 0.021
13:59:05.848 -> Setpoint: 110.00   Temp: 87.91   Duty Cycle % : 84.51   Kp: 8.53   Ki: 0.021
13:59:10.932 -> Setpoint: 110.00   Temp: 87.91   Duty Cycle % : 85.05   Kp: 8.53   Ki: 0.021
13:59:16.011 -> Setpoint: 110.00   Temp: 88.02   Duty Cycle % : 85.20   Kp: 8.53   Ki: 0.021
13:59:21.086 -> Setpoint: 110.00   Temp: 88.02   Duty Cycle % : 85.73   Kp: 8.53   Ki: 0.021
13:59:26.165 -> Setpoint: 110.00   Temp: 88.14   Duty Cycle % : 85.88   Kp: 8.53   Ki: 0.021
13:59:31.248 -> Setpoint: 110.00   Temp: 88.14   Duty Cycle % : 86.41   Kp: 8.53   Ki: 0.021
13:59:36.312 -> Setpoint: 110.00   Temp: 88.25   Duty Cycle % : 86.56   Kp: 8.53   Ki: 0.021
13:59:41.382 -> Setpoint: 110.00   Temp: 88.25   Duty Cycle % : 87.08   Kp: 8.53   Ki: 0.021
13:59:46.495 -> Setpoint: 110.00   Temp: 88.36   Duty Cycle % : 87.05   Kp: 8.53   Ki: 0.020
13:59:51.571 -> Setpoint: 110.00   Temp: 88.36   Duty Cycle % : 87.75   Kp: 8.53   Ki: 0.021
13:59:56.649 -> Setpoint: 110.00   Temp: 88.47   Duty Cycle % : 87.90   Kp: 8.53   Ki: 0.021
14:00:01.728 -> Setpoint: 110.00   Temp: 88.47   Duty Cycle % : 88.42   Kp: 8.53   Ki: 0.021
14:00:06.803 -> Setpoint: 110.00   Temp: 88.59   Duty Cycle % : 88.36   Kp: 8.53   Ki: 0.020
14:00:11.873 -> Setpoint: 110.00   Temp: 88.59   Duty Cycle % : 89.07   Kp: 8.53   Ki: 0.021
14:00:16.951 -> Setpoint: 110.00   Temp: 88.70   Duty Cycle % : 89.00   Kp: 8.53   Ki: 0.020
14:00:22.037 -> Setpoint: 110.00   Temp: 88.70   Duty Cycle % : 89.73   Kp: 8.53   Ki: 0.021
14:00:27.115 -> Setpoint: 110.00   Temp: 88.81   Duty Cycle % : 89.86   Kp: 8.53   Ki: 0.021
14:00:32.185 -> Setpoint: 110.00   Temp: 88.81   Duty Cycle % : 90.14   Kp: 8.53   Ki: 0.020
14:00:37.280 -> Setpoint: 110.00   Temp: 88.93   Duty Cycle % : 90.51   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:00:42.359 -> Setpoint: 110.00   Temp: 88.93   Duty Cycle % : 91.01   Kp: 8.53   Ki: 0.021
14:00:47.433 -> Setpoint: 110.00   Temp: 89.04   Duty Cycle % : 91.14   Kp: 8.53   Ki: 0.021
14:00:52.521 -> Setpoint: 110.00   Temp: 89.04   Duty Cycle % : 91.65   Kp: 8.53   Ki: 0.021
14:00:57.605 -> Setpoint: 110.00   Temp: 89.04   Duty Cycle % : 92.16   Kp: 8.53   Ki: 0.021
14:01:02.679 -> Setpoint: 110.00   Temp: 89.15   Duty Cycle % : 92.28   Kp: 8.53   Ki: 0.021
14:01:07.759 -> Setpoint: 110.00   Temp: 89.15   Duty Cycle % : 92.51   Kp: 8.53   Ki: 0.020
14:01:12.833 -> Setpoint: 110.00   Temp: 89.26   Duty Cycle % : 92.91   Kp: 8.53   Ki: 0.021
14:01:17.902 -> Setpoint: 110.00   Temp: 89.37   Duty Cycle % : 93.03   Kp: 8.53   Ki: 0.021
14:01:23.008 -> Setpoint: 110.00   Temp: 89.37   Duty Cycle % : 93.24   Kp: 8.53   Ki: 0.020
14:01:28.085 -> Setpoint: 110.00   Temp: 89.37   Duty Cycle % : 94.03   Kp: 8.53   Ki: 0.021
14:01:33.155 -> Setpoint: 110.00   Temp: 89.49   Duty Cycle % : 93.85   Kp: 8.53   Ki: 0.020
14:01:38.238 -> Setpoint: 110.00   Temp: 89.49   Duty Cycle % : 94.64   Kp: 8.53   Ki: 0.021
14:01:43.316 -> Setpoint: 110.00   Temp: 89.60   Duty Cycle % : 94.76   Kp: 8.53   Ki: 0.021
14:01:48.395 -> Setpoint: 110.00   Temp: 89.60   Duty Cycle % : 95.25   Kp: 8.53   Ki: 0.021
14:01:53.464 -> Setpoint: 110.00   Temp: 89.71   Duty Cycle % : 95.04   Kp: 8.53   Ki: 0.020
14:01:58.562 -> Setpoint: 110.00   Temp: 89.71   Duty Cycle % : 95.52   Kp: 8.53   Ki: 0.020
14:02:03.638 -> Setpoint: 110.00   Temp: 89.71   Duty Cycle % : 96.01   Kp: 8.53   Ki: 0.020
14:02:08.711 -> Setpoint: 110.00   Temp: 89.82   Duty Cycle % : 96.46   Kp: 8.53   Ki: 0.021
14:02:13.781 -> Setpoint: 110.00   Temp: 89.94   Duty Cycle % : 96.57   Kp: 8.53   Ki: 0.021
14:02:18.883 -> Setpoint: 110.00   Temp: 89.94   Duty Cycle % : 96.69   Kp: 8.53   Ki: 0.020
14:02:23.929 -> Setpoint: 110.00   Temp: 90.05   Duty Cycle % : 97.16   Kp: 8.53   Ki: 0.021
14:02:29.037 -> Setpoint: 110.00   Temp: 90.05   Duty Cycle % : 97.64   Kp: 8.53   Ki: 0.021
14:02:34.087 -> Setpoint: 110.00   Temp: 90.16   Duty Cycle % : 97.37   Kp: 8.53   Ki: 0.020
14:02:39.198 -> Setpoint: 110.00   Temp: 90.16   Duty Cycle % : 98.22   Kp: 8.53   Ki: 0.021
14:02:44.274 -> Setpoint: 110.00   Temp: 90.27   Duty Cycle % : 98.32   Kp: 8.53   Ki: 0.021
14:02:49.330 -> Setpoint: 110.00   Temp: 90.27   Duty Cycle % : 98.79   Kp: 8.53   Ki: 0.021
14:02:54.421 -> Setpoint: 110.00   Temp: 90.39   Duty Cycle % : 98.89   Kp: 8.53   Ki: 0.021
14:02:59.504 -> Setpoint: 110.00   Temp: 90.39   Duty Cycle % : 99.37   Kp: 8.53   Ki: 0.021
14:03:04.574 -> Setpoint: 110.00   Temp: 90.50   Duty Cycle % : 99.46   Kp: 8.53   Ki: 0.021
14:03:09.678 -> Setpoint: 110.00   Temp: 90.50   Duty Cycle % : 99.93   Kp: 8.53   Ki: 0.021
14:03:14.730 -> Setpoint: 110.00   Temp: 90.61   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:19.835 -> Setpoint: 110.00   Temp: 90.61   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:24.915 -> Setpoint: 110.00   Temp: 90.61   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:29.991 -> Setpoint: 110.00   Temp: 90.72   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:35.065 -> Setpoint: 110.00   Temp: 90.84   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:40.148 -> Setpoint: 110.00   Temp: 90.84   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:45.213 -> Setpoint: 110.00   Temp: 90.95   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:03:50.319 -> Setpoint: 110.00   Temp: 90.95   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:03:55.373 -> Setpoint: 110.00   Temp: 91.06   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:00.452 -> Setpoint: 110.00   Temp: 91.06   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:05.550 -> Setpoint: 110.00   Temp: 91.18   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:10.631 -> Setpoint: 110.00   Temp: 91.18   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:15.704 -> Setpoint: 110.00   Temp: 91.29   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:20.784 -> Setpoint: 110.00   Temp: 91.29   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:25.864 -> Setpoint: 110.00   Temp: 91.29   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:30.934 -> Setpoint: 110.00   Temp: 91.40   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:36.007 -> Setpoint: 110.00   Temp: 91.51   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:41.110 -> Setpoint: 110.00   Temp: 91.51   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:46.178 -> Setpoint: 110.00   Temp: 91.51   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:51.253 -> Setpoint: 110.00   Temp: 91.62   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:04:56.322 -> Setpoint: 110.00   Temp: 91.74   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:01.431 -> Setpoint: 110.00   Temp: 91.74   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:06.477 -> Setpoint: 110.00   Temp: 91.85   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:11.558 -> Setpoint: 110.00   Temp: 91.85   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:16.664 -> Setpoint: 110.00   Temp: 91.96   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:21.746 -> Setpoint: 110.00   Temp: 92.07   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:26.821 -> Setpoint: 110.00   Temp: 92.07   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:31.902 -> Setpoint: 110.00   Temp: 92.19   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:36.961 -> Setpoint: 110.00   Temp: 92.19   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:42.047 -> Setpoint: 110.00   Temp: 92.30   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:47.132 -> Setpoint: 110.00   Temp: 92.41   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:52.210 -> Setpoint: 110.00   Temp: 92.41   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:05:57.290 -> Setpoint: 110.00   Temp: 92.52   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:02.371 -> Setpoint: 110.00   Temp: 92.64   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:07.434 -> Setpoint: 110.00   Temp: 92.75   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:12.512 -> Setpoint: 110.00   Temp: 92.75   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:17.621 -> Setpoint: 110.00   Temp: 92.86   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:22.702 -> Setpoint: 110.00   Temp: 92.97   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:27.782 -> Setpoint: 110.00   Temp: 93.09   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:32.862 -> Setpoint: 110.00   Temp: 93.09   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:37.940 -> Setpoint: 110.00   Temp: 93.20   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:43.018 -> Setpoint: 110.00   Temp: 93.31   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:48.090 -> Setpoint: 110.00   Temp: 93.43   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:06:53.173 -> Setpoint: 110.00   Temp: 93.54   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:06:58.232 -> Setpoint: 110.00   Temp: 93.65   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:03.322 -> Setpoint: 110.00   Temp: 93.76   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:08.404 -> Setpoint: 110.00   Temp: 93.87   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:13.478 -> Setpoint: 110.00   Temp: 93.99   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:18.579 -> Setpoint: 110.00   Temp: 94.10   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:23.633 -> Setpoint: 110.00   Temp: 94.21   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:28.733 -> Setpoint: 110.00   Temp: 94.32   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:33.812 -> Setpoint: 110.00   Temp: 94.44   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:38.893 -> Setpoint: 110.00   Temp: 94.55   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:43.972 -> Setpoint: 110.00   Temp: 94.66   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:49.030 -> Setpoint: 110.00   Temp: 94.77   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:54.109 -> Setpoint: 110.00   Temp: 94.89   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:07:59.193 -> Setpoint: 110.00   Temp: 95.00   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:04.266 -> Setpoint: 110.00   Temp: 95.11   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:09.346 -> Setpoint: 110.00   Temp: 95.22   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:14.430 -> Setpoint: 110.00   Temp: 95.34   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:19.511 -> Setpoint: 110.00   Temp: 95.45   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:24.583 -> Setpoint: 110.00   Temp: 95.56   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:29.689 -> Setpoint: 110.00   Temp: 95.68   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:34.764 -> Setpoint: 110.00   Temp: 95.79   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:39.828 -> Setpoint: 110.00   Temp: 96.01   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:44.903 -> Setpoint: 110.00   Temp: 96.12   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:50.009 -> Setpoint: 110.00   Temp: 96.24   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:08:55.086 -> Setpoint: 110.00   Temp: 96.35   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:00.159 -> Setpoint: 110.00   Temp: 96.46   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:05.239 -> Setpoint: 110.00   Temp: 96.57   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:10.308 -> Setpoint: 110.00   Temp: 96.69   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:15.383 -> Setpoint: 110.00   Temp: 96.80   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:20.457 -> Setpoint: 110.00   Temp: 96.91   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:25.541 -> Setpoint: 110.00   Temp: 97.14   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:30.614 -> Setpoint: 110.00   Temp: 97.25   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:35.726 -> Setpoint: 110.00   Temp: 97.36   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:40.799 -> Setpoint: 110.00   Temp: 97.47   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:45.882 -> Setpoint: 110.00   Temp: 97.59   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:50.954 -> Setpoint: 110.00   Temp: 97.81   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:09:56.024 -> Setpoint: 110.00   Temp: 97.93   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:01.092 -> Setpoint: 110.00   Temp: 98.04   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:10:06.202 -> Setpoint: 110.00   Temp: 98.15   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:11.279 -> Setpoint: 110.00   Temp: 98.26   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:16.349 -> Setpoint: 110.00   Temp: 98.37   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:21.428 -> Setpoint: 110.00   Temp: 98.60   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:26.509 -> Setpoint: 110.00   Temp: 98.71   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:31.579 -> Setpoint: 110.00   Temp: 98.82   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:36.654 -> Setpoint: 110.00   Temp: 98.94   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:41.730 -> Setpoint: 110.00   Temp: 99.05   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:46.837 -> Setpoint: 110.00   Temp: 99.27   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:51.905 -> Setpoint: 110.00   Temp: 99.39   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:10:56.987 -> Setpoint: 110.00   Temp: 99.50   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:02.058 -> Setpoint: 110.00   Temp: 99.61   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:07.131 -> Setpoint: 110.00   Temp: 99.84   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:12.216 -> Setpoint: 110.00   Temp: 99.95   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:17.300 -> Setpoint: 110.00   Temp: 100.06   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:22.381 -> Setpoint: 110.00   Temp: 100.18   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:27.448 -> Setpoint: 110.00   Temp: 100.29   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:32.531 -> Setpoint: 110.00   Temp: 100.40   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:37.614 -> Setpoint: 110.00   Temp: 100.62   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:42.691 -> Setpoint: 110.00   Temp: 100.74   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:47.802 -> Setpoint: 110.00   Temp: 100.85   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:52.880 -> Setpoint: 110.00   Temp: 101.07   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:11:57.956 -> Setpoint: 110.00   Temp: 101.19   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:03.030 -> Setpoint: 110.00   Temp: 101.30   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:08.107 -> Setpoint: 110.00   Temp: 101.41   Duty Cycle % : 100.00   Kp: 8.52   Ki: 0.021
14:12:13.181 -> Setpoint: 110.00   Temp: 101.64   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:18.269 -> Setpoint: 110.00   Temp: 101.75   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:23.361 -> Setpoint: 110.00   Temp: 101.86   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:28.434 -> Setpoint: 110.00   Temp: 101.97   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:33.519 -> Setpoint: 110.00   Temp: 102.09   Duty Cycle % : 100.00   Kp: 8.53   Ki: 0.021
14:12:38.596 -> Setpoint: 110.00   Temp: 102.31   Duty Cycle % : 99.71   Kp: 8.53   Ki: 0.021
14:12:43.670 -> Setpoint: 110.00   Temp: 102.43   Duty Cycle % : 98.63   Kp: 8.53   Ki: 0.020
14:12:48.747 -> Setpoint: 110.00   Temp: 102.54   Duty Cycle % : 98.43   Kp: 8.53   Ki: 0.020
14:12:53.827 -> Setpoint: 110.00   Temp: 102.76   Duty Cycle % : 98.74   Kp: 8.53   Ki: 0.021
14:12:58.896 -> Setpoint: 110.00   Temp: 102.87   Duty Cycle % : 98.54   Kp: 8.53   Ki: 0.021
14:13:03.989 -> Setpoint: 110.00   Temp: 102.99   Duty Cycle % : 97.44   Kp: 8.53   Ki: 0.02
4:13:19.211 -> Setpoint: 110.00   Temp: 103.44   Duty Cycle % : 96.42   Kp: 8.53   Ki: 0.020



## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:13:24.298 -> Setpoint: 110.00   Temp: 103.55   Duty Cycle % : 97.09   Kp: 8.53   Ki: 0.021
14:13:29.405 -> Setpoint: 110.00   Temp: 103.66   Duty Cycle % : 96.87   Kp: 8.53   Ki: 0.021
14:13:34.453 -> Setpoint: 110.00   Temp: 103.77   Duty Cycle % : 95.74   Kp: 8.53   Ki: 0.020
14:13:39.531 -> Setpoint: 110.00   Temp: 103.89   Duty Cycle % : 96.41   Kp: 8.53   Ki: 0.021
14:13:44.613 -> Setpoint: 110.00   Temp: 104.11   Duty Cycle % : 94.90   Kp: 8.53   Ki: 0.020
14:13:49.725 -> Setpoint: 110.00   Temp: 104.22   Duty Cycle % : 95.57   Kp: 8.53   Ki: 0.021
14:13:54.799 -> Setpoint: 110.00   Temp: 104.34   Duty Cycle % : 95.33   Kp: 8.53   Ki: 0.021
14:13:59.884 -> Setpoint: 110.00   Temp: 104.45   Duty Cycle % : 95.08   Kp: 8.53   Ki: 0.021
14:14:04.967 -> Setpoint: 110.00   Temp: 104.56   Duty Cycle % : 93.93   Kp: 8.53   Ki: 0.020
14:14:10.047 -> Setpoint: 110.00   Temp: 104.68   Duty Cycle % : 94.59   Kp: 8.53   Ki: 0.021
14:14:15.124 -> Setpoint: 110.00   Temp: 104.90   Duty Cycle % : 93.96   Kp: 8.53   Ki: 0.021
14:14:20.200 -> Setpoint: 110.00   Temp: 105.01   Duty Cycle % : 92.79   Kp: 8.53   Ki: 0.020
14:14:25.280 -> Setpoint: 110.00   Temp: 105.12   Duty Cycle % : 93.45   Kp: 8.53   Ki: 0.021
14:14:30.359 -> Setpoint: 110.00   Temp: 105.24   Duty Cycle % : 93.18   Kp: 8.53   Ki: 0.021
14:14:35.447 -> Setpoint: 110.00   Temp: 105.35   Duty Cycle % : 92.92   Kp: 8.53   Ki: 0.021
14:14:40.524 -> Setpoint: 110.00   Temp: 105.46   Duty Cycle % : 92.65   Kp: 8.53   Ki: 0.021
14:14:45.600 -> Setpoint: 110.00   Temp: 105.57   Duty Cycle % : 91.46   Kp: 8.53   Ki: 0.020
14:14:50.677 -> Setpoint: 110.00   Temp: 105.69   Duty Cycle % : 92.11   Kp: 8.53   Ki: 0.021
14:14:55.776 -> Setpoint: 110.00   Temp: 105.80   Duty Cycle % : 91.84   Kp: 8.53   Ki: 0.021
14:15:00.850 -> Setpoint: 110.00   Temp: 105.91   Duty Cycle % : 91.56   Kp: 8.53   Ki: 0.021
14:15:05.926 -> Setpoint: 110.00   Temp: 106.02   Duty Cycle % : 91.28   Kp: 8.53   Ki: 0.021
14:15:11.013 -> Setpoint: 110.00   Temp: 106.25   Duty Cycle % : 90.62   Kp: 8.53   Ki: 0.021
14:15:16.093 -> Setpoint: 110.00   Temp: 106.25   Duty Cycle % : 90.71   Kp: 8.53   Ki: 0.021
14:15:21.166 -> Setpoint: 110.00   Temp: 106.36   Duty Cycle % : 89.49   Kp: 8.53   Ki: 0.020
14:15:26.247 -> Setpoint: 110.00   Temp: 106.47   Duty Cycle % : 90.13   Kp: 8.53   Ki: 0.021
14:15:31.323 -> Setpoint: 110.00   Temp: 106.59   Duty Cycle % : 89.83   Kp: 8.53   Ki: 0.021
14:15:36.396 -> Setpoint: 110.00   Temp: 106.70   Duty Cycle % : 89.54   Kp: 8.53   Ki: 0.021
14:15:41.472 -> Setpoint: 110.00   Temp: 106.81   Duty Cycle % : 88.30   Kp: 8.53   Ki: 0.020
14:15:46.579 -> Setpoint: 110.00   Temp: 106.93   Duty Cycle % : 88.93   Kp: 8.53   Ki: 0.021
14:15:51.660 -> Setpoint: 110.00   Temp: 107.04   Duty Cycle % : 88.63   Kp: 8.53   Ki: 0.021
14:15:56.740 -> Setpoint: 110.00   Temp: 107.15   Duty Cycle % : 88.32   Kp: 8.53   Ki: 0.021
14:16:01.813 -> Setpoint: 110.00   Temp: 107.15   Duty Cycle % : 88.39   Kp: 8.53   Ki: 0.021
14:16:06.890 -> Setpoint: 110.00   Temp: 107.26   Duty Cycle % : 88.08   Kp: 8.53   Ki: 0.021
14:16:11.974 -> Setpoint: 110.00   Temp: 107.37   Duty Cycle % : 87.77   Kp: 8.53   Ki: 0.021
14:16:17.052 -> Setpoint: 110.00   Temp: 107.49   Duty Cycle % : 86.51   Kp: 8.53   Ki: 0.020
14:16:22.130 -> Setpoint: 110.00   Temp: 107.60   Duty Cycle % : 87.13   Kp: 8.53   Ki: 0.021
14:16:27.221 -> Setpoint: 110.00   Temp: 107.60   Duty Cycle % : 87.19   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:16:32.300 -> Setpoint: 110.00   Temp: 107.71   Duty Cycle % : 85.93   Kp: 8.53   Ki: 0.020
14:16:37.379 -> Setpoint: 110.00   Temp: 107.82   Duty Cycle % : 86.54   Kp: 8.53   Ki: 0.021
14:16:42.458 -> Setpoint: 110.00   Temp: 107.82   Duty Cycle % : 86.60   Kp: 8.53   Ki: 0.021
14:16:47.526 -> Setpoint: 110.00   Temp: 107.94   Duty Cycle % : 86.27   Kp: 8.53   Ki: 0.021
14:16:52.604 -> Setpoint: 110.00   Temp: 108.05   Duty Cycle % : 85.00   Kp: 8.53   Ki: 0.020
14:16:57.680 -> Setpoint: 110.00   Temp: 108.05   Duty Cycle % : 85.99   Kp: 8.53   Ki: 0.021
14:17:02.757 -> Setpoint: 110.00   Temp: 108.16   Duty Cycle % : 85.66   Kp: 8.53   Ki: 0.021
14:17:07.845 -> Setpoint: 110.00   Temp: 108.27   Duty Cycle % : 85.32   Kp: 8.53   Ki: 0.021
14:17:12.924 -> Setpoint: 110.00   Temp: 108.27   Duty Cycle % : 85.36   Kp: 8.53   Ki: 0.021
14:17:18.008 -> Setpoint: 110.00   Temp: 108.39   Duty Cycle % : 85.03   Kp: 8.53   Ki: 0.021
14:17:23.086 -> Setpoint: 110.00   Temp: 108.39   Duty Cycle % : 85.06   Kp: 8.53   Ki: 0.021
14:17:28.155 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 83.78   Kp: 8.53   Ki: 0.020
14:17:33.239 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 84.76   Kp: 8.53   Ki: 0.021
14:17:38.343 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 83.47   Kp: 8.53   Ki: 0.020
14:17:43.424 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 83.50   Kp: 8.53   Ki: 0.020
14:17:48.475 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 84.11   Kp: 8.53   Ki: 0.021
14:17:53.582 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 82.81   Kp: 8.53   Ki: 0.020
14:17:58.657 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 83.78   Kp: 8.53   Ki: 0.021
14:18:03.735 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 83.43   Kp: 8.53   Ki: 0.021
14:18:08.814 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 83.46   Kp: 8.53   Ki: 0.021
14:18:13.897 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 83.11   Kp: 8.53   Ki: 0.021
14:18:18.975 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 82.18   Kp: 8.53   Ki: 0.020
14:18:24.058 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 81.82   Kp: 8.53   Ki: 0.020
14:18:29.130 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 82.79   Kp: 8.53   Ki: 0.021
14:18:34.213 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 81.48   Kp: 8.53   Ki: 0.020
14:18:39.294 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 82.45   Kp: 8.53   Ki: 0.021
14:18:44.372 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 82.09   Kp: 8.53   Ki: 0.021
14:18:49.452 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 82.10   Kp: 8.53   Ki: 0.021
14:18:54.533 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 80.78   Kp: 8.53   Ki: 0.020
14:18:59.611 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 81.75   Kp: 8.53   Ki: 0.021
14:19:04.693 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 81.76   Kp: 8.53   Ki: 0.021
14:19:09.775 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 81.39   Kp: 8.53   Ki: 0.021
14:19:14.855 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 81.02   Kp: 8.53   Ki: 0.021
14:19:19.929 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 81.03   Kp: 8.53   Ki: 0.021
14:19:25.012 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 81.04   Kp: 8.53   Ki: 0.021
14:19:30.083 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 80.66   Kp: 8.53   Ki: 0.021
14:19:35.161 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 80.67   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:19:40.242 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 80.67   Kp: 8.53   Ki: 0.021
14:19:45.318 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 80.29   Kp: 8.53   Ki: 0.021
14:19:50.398 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 80.30   Kp: 8.53   Ki: 0.021
14:19:55.512 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 79.92   Kp: 8.53   Ki: 0.021
14:20:00.558 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 79.92   Kp: 8.53   Ki: 0.021
14:20:05.638 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 79.91   Kp: 8.53   Ki: 0.021
14:20:10.718 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 79.53   Kp: 8.53   Ki: 0.021
14:20:15.829 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 78.57   Kp: 8.53   Ki: 0.020
14:20:20.910 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 79.52   Kp: 8.53   Ki: 0.021
14:20:25.960 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 79.14   Kp: 8.53   Ki: 0.021
14:20:31.058 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 79.13   Kp: 8.53   Ki: 0.021
14:20:36.147 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 79.12   Kp: 8.53   Ki: 0.021
14:20:41.217 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 78.74   Kp: 8.53   Ki: 0.021
14:20:46.283 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 78.73   Kp: 8.53   Ki: 0.021
14:20:51.363 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 78.72   Kp: 8.53   Ki: 0.021
14:20:56.440 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 78.33   Kp: 8.53   Ki: 0.021
14:21:01.546 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 78.32   Kp: 8.53   Ki: 0.021
14:21:06.627 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 78.30   Kp: 8.53   Ki: 0.021
14:21:11.705 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 77.91   Kp: 8.53   Ki: 0.021
14:21:16.785 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 77.90   Kp: 8.53   Ki: 0.021
14:21:21.859 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 76.93   Kp: 8.53   Ki: 0.020
14:21:26.926 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 77.49   Kp: 8.53   Ki: 0.021
14:21:32.004 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 77.47   Kp: 8.53   Ki: 0.021
14:21:37.109 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 77.45   Kp: 8.53   Ki: 0.021
14:21:42.159 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 77.43   Kp: 8.53   Ki: 0.021
14:21:47.239 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 77.04   Kp: 8.53   Ki: 0.021
14:21:52.347 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 77.01   Kp: 8.53   Ki: 0.021
14:21:57.424 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 76.99   Kp: 8.53   Ki: 0.021
14:22:02.503 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 76.02   Kp: 8.53   Ki: 0.020
14:22:07.575 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 75.62   Kp: 8.53   Ki: 0.020
14:22:12.648 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 76.55   Kp: 8.53   Ki: 0.021
14:22:17.723 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 76.53   Kp: 8.53   Ki: 0.021
14:22:22.831 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 76.50   Kp: 8.53   Ki: 0.021
14:22:27.906 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 76.10   Kp: 8.53   Ki: 0.021
14:22:32.982 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 75.12   Kp: 8.53   Ki: 0.020
14:22:38.060 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 75.10   Kp: 8.53   Ki: 0.020
14:22:43.135 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 75.64   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:22:48.215 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 75.61   Kp: 8.53   Ki: 0.021
14:22:53.288 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 75.58   Kp: 8.53   Ki: 0.021
14:22:58.367 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 75.55   Kp: 8.53   Ki: 0.021
14:23:03.441 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 75.53   Kp: 8.53   Ki: 0.021
14:23:08.548 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 75.50   Kp: 8.53   Ki: 0.021
14:23:13.625 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 75.09   Kp: 8.53   Ki: 0.021
14:23:18.699 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 74.11   Kp: 8.53   Ki: 0.020
14:23:23.775 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 75.02   Kp: 8.53   Ki: 0.021
14:23:28.851 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 74.99   Kp: 8.53   Ki: 0.021
14:23:33.926 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 74.58   Kp: 8.53   Ki: 0.021
14:23:39.001 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 73.60   Kp: 8.53   Ki: 0.020
14:23:44.077 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 74.51   Kp: 8.53   Ki: 0.021
14:23:49.152 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 74.48   Kp: 8.53   Ki: 0.021
14:23:54.264 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 74.44   Kp: 8.53   Ki: 0.021
14:23:59.345 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 74.03   Kp: 8.53   Ki: 0.021
14:24:04.413 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 73.99   Kp: 8.53   Ki: 0.021
14:24:09.472 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 73.96   Kp: 8.53   Ki: 0.021
14:24:14.574 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 73.54   Kp: 8.53   Ki: 0.021
14:24:19.639 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 72.56   Kp: 8.53   Ki: 0.020
14:24:24.734 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 73.46   Kp: 8.53   Ki: 0.021
14:24:29.800 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 73.42   Kp: 8.53   Ki: 0.021
14:24:34.874 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 73.38   Kp: 8.53   Ki: 0.021
14:24:39.982 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 73.34   Kp: 8.53   Ki: 0.021
14:24:45.056 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 72.92   Kp: 8.53   Ki: 0.021
14:24:50.130 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 71.94   Kp: 8.53   Ki: 0.020
14:24:55.192 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 72.84   Kp: 8.53   Ki: 0.021
14:25:00.298 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 72.79   Kp: 8.53   Ki: 0.021
14:25:05.363 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 72.75   Kp: 8.53   Ki: 0.021
14:25:10.444 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 72.71   Kp: 8.53   Ki: 0.021
14:25:15.516 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 72.29   Kp: 8.53   Ki: 0.021
14:25:20.596 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 71.31   Kp: 8.53   Ki: 0.020
14:25:25.672 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 71.26   Kp: 8.53   Ki: 0.020
14:25:30.750 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 72.15   Kp: 8.53   Ki: 0.021
14:25:35.858 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 72.11   Kp: 8.53   Ki: 0.021
14:25:40.909 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 72.06   Kp: 8.53   Ki: 0.021
14:25:46.018 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.64   Kp: 8.53   Ki: 0.021
14:25:51.099 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.59   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:25:56.169 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.54   Kp: 8.53   Ki: 0.021
14:26:01.242 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.49   Kp: 8.53   Ki: 0.021
14:26:06.319 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.44   Kp: 8.53   Ki: 0.021
14:26:11.420 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.40   Kp: 8.53   Ki: 0.021
14:26:16.487 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 71.35   Kp: 8.53   Ki: 0.021
14:26:21.578 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 70.92   Kp: 8.53   Ki: 0.021
14:26:26.644 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 70.87   Kp: 8.53   Ki: 0.021
14:26:31.718 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 70.82   Kp: 8.53   Ki: 0.021
14:26:36.798 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 70.77   Kp: 8.53   Ki: 0.021
14:26:41.899 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 70.72   Kp: 8.53   Ki: 0.021
14:26:46.944 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 70.67   Kp: 8.53   Ki: 0.021
14:26:52.057 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 70.24   Kp: 8.53   Ki: 0.021
14:26:57.135 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 69.26   Kp: 8.53   Ki: 0.020
14:27:02.219 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 70.13   Kp: 8.53   Ki: 0.021
14:27:07.291 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 70.08   Kp: 8.53   Ki: 0.021
14:27:12.369 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 70.02   Kp: 8.53   Ki: 0.021
14:27:17.450 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 69.97   Kp: 8.53   Ki: 0.021
14:27:22.523 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 69.92   Kp: 8.53   Ki: 0.021
14:27:27.597 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 69.48   Kp: 8.53   Ki: 0.021
14:27:32.671 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 69.43   Kp: 8.53   Ki: 0.021
14:27:37.780 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 69.37   Kp: 8.53   Ki: 0.021
14:27:42.827 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 68.40   Kp: 8.53   Ki: 0.020
14:27:47.938 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 69.26   Kp: 8.53   Ki: 0.021
14:27:53.016 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 68.29   Kp: 8.53   Ki: 0.020
14:27:58.069 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 69.15   Kp: 8.53   Ki: 0.021
14:28:03.148 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.71   Kp: 8.53   Ki: 0.021
14:28:08.255 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.65   Kp: 8.53   Ki: 0.021
14:28:13.329 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.59   Kp: 8.53   Ki: 0.021
14:28:18.406 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.54   Kp: 8.53   Ki: 0.021
14:28:23.487 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.48   Kp: 8.53   Ki: 0.021
14:28:28.565 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.42   Kp: 8.53   Ki: 0.021
14:28:33.638 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 67.45   Kp: 8.53   Ki: 0.020
14:28:38.720 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.30   Kp: 8.53   Ki: 0.021
14:28:43.791 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 67.86   Kp: 8.53   Ki: 0.021
14:28:48.871 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 68.18   Kp: 8.53   Ki: 0.021
14:28:53.950 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 67.74   Kp: 8.53   Ki: 0.021
14:28:59.024 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 67.68   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:29:04.134 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 67.62   Kp: 8.53   Ki: 0.021
14:29:09.218 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 66.65   Kp: 8.53   Ki: 0.020
14:29:14.297 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 67.50   Kp: 8.53   Ki: 0.021
14:29:19.368 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 66.15   Kp: 8.53   Ki: 0.020
14:29:24.444 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 66.99   Kp: 8.53   Ki: 0.021
14:29:29.520 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 66.93   Kp: 8.53   Ki: 0.021
14:29:34.599 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 66.86   Kp: 8.53   Ki: 0.021
14:29:39.680 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 66.80   Kp: 8.53   Ki: 0.021
14:29:44.756 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 66.73   Kp: 8.53   Ki: 0.021
14:29:49.829 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 66.29   Kp: 8.53   Ki: 0.021
14:29:54.907 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 66.22   Kp: 8.53   Ki: 0.021
14:30:00.010 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 66.16   Kp: 8.53   Ki: 0.021
14:30:05.088 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.19   Kp: 8.53   Ki: 0.020
14:30:10.174 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 66.02   Kp: 8.53   Ki: 0.021
14:30:15.237 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.95   Kp: 8.53   Ki: 0.021
14:30:20.314 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.89   Kp: 8.53   Ki: 0.021
14:30:25.385 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.82   Kp: 8.53   Ki: 0.021
14:30:30.496 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.75   Kp: 8.53   Ki: 0.021
14:30:35.562 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.69   Kp: 8.53   Ki: 0.021
14:30:40.639 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 65.62   Kp: 8.53   Ki: 0.021
14:30:45.721 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 65.17   Kp: 8.53   Ki: 0.021
14:30:50.806 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.21   Kp: 8.53   Ki: 0.020
14:30:55.881 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 65.03   Kp: 8.53   Ki: 0.021
14:31:00.956 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.96   Kp: 8.53   Ki: 0.021
14:31:06.038 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.89   Kp: 8.53   Ki: 0.021
14:31:11.112 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.82   Kp: 8.53   Ki: 0.021
14:31:16.189 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.75   Kp: 8.53   Ki: 0.021
14:31:21.261 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.80   Kp: 8.53   Ki: 0.020
14:31:26.370 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.62   Kp: 8.53   Ki: 0.021
14:31:31.445 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.55   Kp: 8.53   Ki: 0.021
14:31:36.515 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.48   Kp: 8.53   Ki: 0.021
14:31:41.594 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.41   Kp: 8.53   Ki: 0.021
14:31:46.672 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.34   Kp: 8.53   Ki: 0.021
14:31:51.777 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.27   Kp: 8.53   Ki: 0.021
14:31:56.851 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.32   Kp: 8.53   Ki: 0.020
14:32:01.931 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 64.13   Kp: 8.53   Ki: 0.021
14:32:07.007 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.18   Kp: 8.53   Ki: 0.020

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:32:12.081 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.99   Kp: 8.53   Ki: 0.021
14:32:17.160 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.92   Kp: 8.53   Ki: 0.021
14:32:22.246 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.85   Kp: 8.53   Ki: 0.021
14:32:27.320 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.78   Kp: 8.53   Ki: 0.021
14:32:32.394 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 62.84   Kp: 8.53   Ki: 0.020
14:32:37.475 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.64   Kp: 8.53   Ki: 0.021
14:32:42.556 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.57   Kp: 8.53   Ki: 0.021
14:32:47.631 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 62.63   Kp: 8.53   Ki: 0.020
14:32:52.708 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.43   Kp: 8.53   Ki: 0.021
14:32:57.788 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.36   Kp: 8.53   Ki: 0.021
14:33:02.890 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.29   Kp: 8.53   Ki: 0.021
14:33:07.976 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.22   Kp: 8.53   Ki: 0.021
14:33:13.050 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.15   Kp: 8.53   Ki: 0.021
14:33:18.103 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.08   Kp: 8.53   Ki: 0.021
14:33:23.211 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 63.01   Kp: 8.53   Ki: 0.021
14:33:28.275 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 62.08   Kp: 8.53   Ki: 0.020
14:33:33.353 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 62.87   Kp: 8.53   Ki: 0.021
14:33:38.440 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 62.80   Kp: 8.53   Ki: 0.021
14:33:43.510 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 61.87   Kp: 8.53   Ki: 0.020
14:33:48.595 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 62.28   Kp: 8.53   Ki: 0.021
14:33:53.676 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 62.21   Kp: 8.53   Ki: 0.021
14:33:58.745 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 62.14   Kp: 8.53   Ki: 0.021
14:34:03.820 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 62.07   Kp: 8.53   Ki: 0.021
14:34:08.930 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.99   Kp: 8.53   Ki: 0.021
14:34:13.980 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.92   Kp: 8.53   Ki: 0.021
14:34:19.059 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.85   Kp: 8.53   Ki: 0.021
14:34:24.138 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.78   Kp: 8.53   Ki: 0.021
14:34:29.248 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.85   Kp: 8.53   Ki: 0.020
14:34:34.329 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.63   Kp: 8.53   Ki: 0.021
14:34:39.409 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.71   Kp: 8.53   Ki: 0.020
14:34:44.480 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.49   Kp: 8.53   Ki: 0.021
14:34:49.561 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.41   Kp: 8.53   Ki: 0.021
14:34:54.638 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.34   Kp: 8.53   Ki: 0.021
14:34:59.714 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.42   Kp: 8.53   Ki: 0.020
14:35:04.795 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.20   Kp: 8.53   Ki: 0.021
14:35:09.873 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.12   Kp: 8.53   Ki: 0.021
14:35:14.950 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 61.05   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:35:20.018 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.98   Kp: 8.53   Ki: 0.021
14:35:25.099 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.91   Kp: 8.53   Ki: 0.021
14:35:30.208 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.83   Kp: 8.53   Ki: 0.021
14:35:35.288 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.76   Kp: 8.53   Ki: 0.021
14:35:40.364 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.69   Kp: 8.53   Ki: 0.021
14:35:45.442 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.62   Kp: 8.53   Ki: 0.021
14:35:50.524 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.70   Kp: 8.53   Ki: 0.020
14:35:55.602 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.47   Kp: 8.53   Ki: 0.021
14:36:00.669 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.56   Kp: 8.53   Ki: 0.020
14:36:05.741 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.33   Kp: 8.53   Ki: 0.021
14:36:10.818 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.26   Kp: 8.53   Ki: 0.021
14:36:15.925 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.18   Kp: 8.53   Ki: 0.021
14:36:20.980 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.11   Kp: 8.53   Ki: 0.021
14:36:26.081 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 60.04   Kp: 8.53   Ki: 0.021
14:36:31.155 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.97   Kp: 8.53   Ki: 0.021
14:36:36.218 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.89   Kp: 8.53   Ki: 0.021
14:36:41.324 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.82   Kp: 8.53   Ki: 0.021
14:36:46.399 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.75   Kp: 8.53   Ki: 0.021
14:36:51.470 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.85   Kp: 8.53   Ki: 0.020
14:36:56.549 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.60   Kp: 8.53   Ki: 0.021
14:37:01.615 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.70   Kp: 8.53   Ki: 0.020
14:37:06.722 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.46   Kp: 8.53   Ki: 0.021
14:37:11.794 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.39   Kp: 8.53   Ki: 0.021
14:37:16.861 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.31   Kp: 8.53   Ki: 0.021
14:37:21.964 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.24   Kp: 8.53   Ki: 0.021
14:37:27.031 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.17   Kp: 8.53   Ki: 0.021
14:37:32.111 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.10   Kp: 8.53   Ki: 0.021
14:37:37.201 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 59.02   Kp: 8.53   Ki: 0.021
14:37:42.274 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.95   Kp: 8.53   Ki: 0.021
14:37:47.361 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.88   Kp: 8.53   Ki: 0.021
14:37:52.437 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.81   Kp: 8.53   Ki: 0.021
14:37:57.512 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.73   Kp: 8.53   Ki: 0.021
14:38:02.584 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.66   Kp: 8.53   Ki: 0.021
14:38:07.690 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.77   Kp: 8.53   Ki: 0.020
14:38:12.757 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.52   Kp: 8.53   Ki: 0.021
14:38:17.826 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.44   Kp: 8.53   Ki: 0.021
14:38:22.899 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.37   Kp: 8.53   Ki: 0.021



## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:38:27.982 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.30   Kp: 8.53   Ki: 0.021
14:38:33.068 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 58.23   Kp: 8.53   Ki: 0.021
14:38:38.144 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.34   Kp: 8.53   Ki: 0.020
14:38:43.251 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.70   Kp: 8.53   Ki: 0.021
14:38:48.326 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.63   Kp: 8.53   Ki: 0.021
14:38:53.397 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.55   Kp: 8.53   Ki: 0.021
14:38:58.481 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.48   Kp: 8.53   Ki: 0.021
14:39:03.558 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.97   Kp: 8.53   Ki: 0.020
14:39:08.630 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.71   Kp: 8.53   Ki: 0.021
14:39:13.703 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.26   Kp: 8.53   Ki: 0.021
14:39:18.803 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.56   Kp: 8.53   Ki: 0.021
14:39:23.868 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.11   Kp: 8.53   Ki: 0.021
14:39:28.955 -> Setpoint: 110.00   Temp: 113.11   Duty Cycle % : 57.03   Kp: 8.53   Ki: 0.021
14:39:34.055 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.34   Kp: 8.53   Ki: 0.021
14:39:39.124 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.27   Kp: 8.53   Ki: 0.021
14:39:44.196 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.19   Kp: 8.53   Ki: 0.021
14:39:49.276 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 57.12   Kp: 8.53   Ki: 0.021
14:39:54.357 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.25   Kp: 8.53   Ki: 0.020
14:39:59.431 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.18   Kp: 8.53   Ki: 0.020
14:40:04.511 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.90   Kp: 8.53   Ki: 0.021
14:40:09.606 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.83   Kp: 8.53   Ki: 0.021
14:40:14.655 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 55.96   Kp: 8.53   Ki: 0.020
14:40:19.762 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.69   Kp: 8.53   Ki: 0.021
14:40:24.817 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.61   Kp: 8.53   Ki: 0.021
14:40:29.907 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.54   Kp: 8.53   Ki: 0.021
14:40:35.002 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.47   Kp: 8.53   Ki: 0.021
14:40:40.065 -> Setpoint: 110.00   Temp: 113.00   Duty Cycle % : 56.40   Kp: 8.53   Ki: 0.021
14:40:45.141 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.70   Kp: 8.53   Ki: 0.021
14:40:50.243 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.63   Kp: 8.53   Ki: 0.021
14:40:55.295 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.77   Kp: 8.53   Ki: 0.020
14:41:00.371 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.71   Kp: 8.53   Ki: 0.020
14:41:05.482 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.42   Kp: 8.53   Ki: 0.021
14:41:10.556 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.35   Kp: 8.53   Ki: 0.021
14:41:15.631 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.28   Kp: 8.53   Ki: 0.021
14:41:20.711 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.21   Kp: 8.53   Ki: 0.021
14:41:25.781 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.15   Kp: 8.53   Ki: 0.021
14:41:30.857 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.08   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:41:35.965 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 56.01   Kp: 8.53   Ki: 0.021
14:41:41.041 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.94   Kp: 8.53   Ki: 0.021
14:41:46.116 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.87   Kp: 8.53   Ki: 0.021
14:41:51.192 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.80   Kp: 8.53   Ki: 0.021
14:41:56.269 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.73   Kp: 8.53   Ki: 0.021
14:42:01.350 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.66   Kp: 8.53   Ki: 0.021
14:42:06.427 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.59   Kp: 8.53   Ki: 0.021
14:42:11.506 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.52   Kp: 8.53   Ki: 0.021
14:42:16.588 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.45   Kp: 8.53   Ki: 0.021
14:42:21.666 -> Setpoint: 110.00   Temp: 112.89   Duty Cycle % : 55.38   Kp: 8.53   Ki: 0.021
14:42:26.740 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.69   Kp: 8.53   Ki: 0.021
14:42:31.818 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.62   Kp: 8.53   Ki: 0.021
14:42:36.887 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.55   Kp: 8.53   Ki: 0.021
14:42:41.956 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.49   Kp: 8.53   Ki: 0.021
14:42:47.032 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.65   Kp: 8.53   Ki: 0.020
14:42:52.106 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.35   Kp: 8.53   Ki: 0.021
14:42:57.180 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.29   Kp: 8.53   Ki: 0.021
14:43:02.255 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.22   Kp: 8.53   Ki: 0.021
14:43:07.365 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.38   Kp: 8.53   Ki: 0.020
14:43:12.439 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.08   Kp: 8.53   Ki: 0.021
14:43:17.512 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 55.02   Kp: 8.53   Ki: 0.021
14:43:22.585 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 55.33   Kp: 8.53   Ki: 0.021
14:43:27.672 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.12   Kp: 8.53   Ki: 0.020
14:43:32.740 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.82   Kp: 8.53   Ki: 0.021
14:43:37.815 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 55.13   Kp: 8.53   Ki: 0.021
14:43:42.924 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 54.31   Kp: 8.53   Ki: 0.020
14:43:47.974 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 55.00   Kp: 8.53   Ki: 0.021
14:43:53.081 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 54.18   Kp: 8.53   Ki: 0.020
14:43:58.152 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 54.87   Kp: 8.53   Ki: 0.021
14:44:03.224 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.67   Kp: 8.53   Ki: 0.020
14:44:08.306 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.36   Kp: 8.53   Ki: 0.021
14:44:13.388 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.30   Kp: 8.53   Ki: 0.021
14:44:18.473 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.47   Kp: 8.53   Ki: 0.020
14:44:23.544 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.16   Kp: 8.53   Ki: 0.021
14:44:28.622 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 54.10   Kp: 8.53   Ki: 0.021
14:44:33.695 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 54.41   Kp: 8.53   Ki: 0.021
14:44:38.769 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.96   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:44:43.851 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.90   Kp: 8.53   Ki: 0.021
14:44:48.955 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.83   Kp: 8.53   Ki: 0.021
14:44:54.030 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.76   Kp: 8.53   Ki: 0.021
14:44:59.104 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.95   Kp: 8.53   Ki: 0.020
14:45:04.185 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.63   Kp: 8.53   Ki: 0.021
14:45:09.271 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.56   Kp: 8.53   Ki: 0.021
14:45:14.347 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.49   Kp: 8.53   Ki: 0.021
14:45:19.422 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.43   Kp: 8.53   Ki: 0.021
14:45:24.496 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.36   Kp: 8.53   Ki: 0.021
14:45:29.571 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.29   Kp: 8.53   Ki: 0.021
14:45:34.649 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.23   Kp: 8.53   Ki: 0.021
14:45:39.751 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.16   Kp: 8.53   Ki: 0.021
14:45:44.832 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.09   Kp: 8.53   Ki: 0.021
14:45:49.906 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 53.03   Kp: 8.53   Ki: 0.021
14:45:54.987 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.22   Kp: 8.53   Ki: 0.020
14:46:00.067 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.89   Kp: 8.53   Ki: 0.021
14:46:05.139 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.09   Kp: 8.53   Ki: 0.020
14:46:10.226 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.76   Kp: 8.53   Ki: 0.021
14:46:15.303 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 51.95   Kp: 8.53   Ki: 0.020
14:46:20.392 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.62   Kp: 8.53   Ki: 0.021
14:46:25.465 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 51.82   Kp: 8.53   Ki: 0.020
14:46:30.540 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.49   Kp: 8.53   Ki: 0.021
14:46:35.613 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.42   Kp: 8.53   Ki: 0.021
14:46:40.717 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.36   Kp: 8.53   Ki: 0.021
14:46:45.786 -> Setpoint: 110.00   Temp: 112.77   Duty Cycle % : 52.29   Kp: 8.53   Ki: 0.021
14:46:50.861 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 51.87   Kp: 8.53   Ki: 0.020
14:46:55.939 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 52.54   Kp: 8.53   Ki: 0.021
14:47:01.009 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 51.74   Kp: 8.53   Ki: 0.020
14:47:06.086 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 52.41   Kp: 8.53   Ki: 0.021
14:47:11.197 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 52.34   Kp: 8.53   Ki: 0.021
14:47:16.278 -> Setpoint: 110.00   Temp: 112.66   Duty Cycle % : 52.28   Kp: 8.53   Ki: 0.021
14:47:21.327 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 52.59   Kp: 8.53   Ki: 0.021
14:47:26.403 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 52.53   Kp: 8.53   Ki: 0.021
14:47:31.484 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 52.47   Kp: 8.53   Ki: 0.021
14:47:36.591 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 52.41   Kp: 8.53   Ki: 0.021
14:47:41.662 -> Setpoint: 110.00   Temp: 112.55   Duty Cycle % : 52.35   Kp: 8.53   Ki: 0.021
14:47:46.737 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.67   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:47:51.811 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.61   Kp: 8.53   Ki: 0.021
14:47:56.909 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.55   Kp: 8.53   Ki: 0.021
14:48:01.990 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.49   Kp: 8.53   Ki: 0.021
14:48:07.062 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.43   Kp: 8.53   Ki: 0.021
14:48:12.138 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.37   Kp: 8.53   Ki: 0.021
14:48:17.213 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.31   Kp: 8.53   Ki: 0.021
14:48:22.291 -> Setpoint: 110.00   Temp: 112.44   Duty Cycle % : 52.25   Kp: 8.53   Ki: 0.021
14:48:27.367 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.57   Kp: 8.53   Ki: 0.021
14:48:32.438 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.52   Kp: 8.53   Ki: 0.021
14:48:37.545 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.46   Kp: 8.53   Ki: 0.021
14:48:42.621 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 51.69   Kp: 8.53   Ki: 0.020
14:48:47.700 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.35   Kp: 8.53   Ki: 0.021
14:48:52.779 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.29   Kp: 8.53   Ki: 0.021
14:48:57.855 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.24   Kp: 8.53   Ki: 0.021
14:49:02.934 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.18   Kp: 8.53   Ki: 0.021
14:49:08.010 -> Setpoint: 110.00   Temp: 112.32   Duty Cycle % : 52.12   Kp: 8.53   Ki: 0.021
14:49:13.085 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.45   Kp: 8.53   Ki: 0.021
14:49:18.193 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 51.68   Kp: 8.53   Ki: 0.020
14:49:23.269 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.34   Kp: 8.53   Ki: 0.021
14:49:28.318 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.29   Kp: 8.53   Ki: 0.021
14:49:33.423 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.23   Kp: 8.53   Ki: 0.021
14:49:38.504 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.18   Kp: 8.53   Ki: 0.021
14:49:43.584 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.13   Kp: 8.53   Ki: 0.021
14:49:48.666 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.07   Kp: 8.53   Ki: 0.021
14:49:53.728 -> Setpoint: 110.00   Temp: 112.21   Duty Cycle % : 52.02   Kp: 8.53   Ki: 0.021
14:49:58.814 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.35   Kp: 8.53   Ki: 0.021
14:50:03.878 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.30   Kp: 8.53   Ki: 0.021
14:50:08.990 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.24   Kp: 8.53   Ki: 0.021
14:50:14.062 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.19   Kp: 8.53   Ki: 0.021
14:50:19.141 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.14   Kp: 8.53   Ki: 0.021
14:50:24.224 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.09   Kp: 8.53   Ki: 0.021
14:50:29.300 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 52.04   Kp: 8.53   Ki: 0.021
14:50:34.375 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.99   Kp: 8.53   Ki: 0.021
14:50:39.457 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.24   Kp: 8.53   Ki: 0.020
14:50:44.537 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.89   Kp: 8.53   Ki: 0.021
14:50:49.613 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.84   Kp: 8.53   Ki: 0.021
14:50:54.690 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.09   Kp: 8.53   Ki: 0.020

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:50:59.771 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.04   Kp: 8.53   Ki: 0.020
14:51:04.845 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.69   Kp: 8.53   Ki: 0.021
14:51:09.925 -> Setpoint: 110.00   Temp: 112.10   Duty Cycle % : 51.64   Kp: 8.53   Ki: 0.021
14:51:14.997 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.96   Kp: 8.53   Ki: 0.021
14:51:20.105 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.22   Kp: 8.53   Ki: 0.020
14:51:25.174 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.87   Kp: 8.53   Ki: 0.021
14:51:30.237 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.82   Kp: 8.53   Ki: 0.021
14:51:35.344 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.77   Kp: 8.53   Ki: 0.021
14:51:40.419 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.72   Kp: 8.53   Ki: 0.021
14:51:45.501 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 50.98   Kp: 8.53   Ki: 0.020
14:51:50.584 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 50.93   Kp: 8.53   Ki: 0.020
14:51:55.665 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.58   Kp: 8.53   Ki: 0.021
14:52:00.711 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 50.84   Kp: 8.53   Ki: 0.020
14:52:05.794 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.48   Kp: 8.53   Ki: 0.021
14:52:10.880 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.44   Kp: 8.53   Ki: 0.021
14:52:15.961 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.39   Kp: 8.53   Ki: 0.021
14:52:21.038 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.34   Kp: 8.53   Ki: 0.021
14:52:26.117 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 50.60   Kp: 8.53   Ki: 0.020
14:52:31.195 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.24   Kp: 8.53   Ki: 0.021
14:52:36.298 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.20   Kp: 8.53   Ki: 0.021
14:52:41.372 -> Setpoint: 110.00   Temp: 111.99   Duty Cycle % : 51.15   Kp: 8.53   Ki: 0.021
14:52:46.455 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 51.48   Kp: 8.53   Ki: 0.021
14:52:51.533 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 50.75   Kp: 8.53   Ki: 0.020
14:52:56.616 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 51.39   Kp: 8.53   Ki: 0.021
14:53:01.694 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 51.34   Kp: 8.53   Ki: 0.021
14:53:06.776 -> Setpoint: 110.00   Temp: 111.87   Duty Cycle % : 51.30   Kp: 8.53   Ki: 0.021
14:53:11.855 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.63   Kp: 8.53   Ki: 0.021
14:53:16.936 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.59   Kp: 8.53   Ki: 0.021
14:53:22.018 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.55   Kp: 8.53   Ki: 0.021
14:53:27.096 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.50   Kp: 8.53   Ki: 0.021
14:53:32.176 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 50.78   Kp: 8.53   Ki: 0.020
14:53:37.256 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.42   Kp: 8.53   Ki: 0.021
14:53:42.335 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.38   Kp: 8.53   Ki: 0.021
14:53:47.409 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.33   Kp: 8.53   Ki: 0.021
14:53:52.490 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.29   Kp: 8.53   Ki: 0.021
14:53:57.566 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.25   Kp: 8.53   Ki: 0.021
14:54:02.648 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.21   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:54:07.723 -> Setpoint: 110.00   Temp: 111.76   Duty Cycle % : 51.16   Kp: 8.53   Ki: 0.021
14:54:12.805 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.50   Kp: 8.53   Ki: 0.021
14:54:17.878 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 50.78   Kp: 8.53   Ki: 0.020
14:54:22.959 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.42   Kp: 8.53   Ki: 0.021
14:54:28.034 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.38   Kp: 8.53   Ki: 0.021
14:54:33.119 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.34   Kp: 8.53   Ki: 0.021
14:54:38.200 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.30   Kp: 8.53   Ki: 0.021
14:54:43.279 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.26   Kp: 8.53   Ki: 0.021
14:54:48.349 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.22   Kp: 8.53   Ki: 0.021
14:54:53.449 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.18   Kp: 8.53   Ki: 0.021
14:54:58.520 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 51.14   Kp: 8.53   Ki: 0.021
14:55:03.602 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 50.43   Kp: 8.53   Ki: 0.020
14:55:08.680 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.44   Kp: 8.53   Ki: 0.021
14:55:13.755 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.73   Kp: 8.53   Ki: 0.020
14:55:18.837 -> Setpoint: 110.00   Temp: 111.65   Duty Cycle % : 50.99   Kp: 8.53   Ki: 0.021
14:55:23.916 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.33   Kp: 8.53   Ki: 0.021
14:55:28.990 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.62   Kp: 8.53   Ki: 0.020
14:55:34.064 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.58   Kp: 8.53   Ki: 0.020
14:55:39.144 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.22   Kp: 8.53   Ki: 0.021
14:55:44.250 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.18   Kp: 8.53   Ki: 0.021
14:55:49.327 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.14   Kp: 8.53   Ki: 0.021
14:55:54.406 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.44   Kp: 8.53   Ki: 0.020
14:55:59.477 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.07   Kp: 8.53   Ki: 0.021
14:56:04.555 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 51.03   Kp: 8.53   Ki: 0.021
14:56:09.632 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.32   Kp: 8.53   Ki: 0.020
14:56:14.708 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.34   Kp: 8.53   Ki: 0.021
14:56:19.787 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.25   Kp: 8.53   Ki: 0.020
14:56:24.863 -> Setpoint: 110.00   Temp: 111.54   Duty Cycle % : 50.88   Kp: 8.53   Ki: 0.021
14:56:29.938 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.23   Kp: 8.53   Ki: 0.021
14:56:35.019 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.19   Kp: 8.53   Ki: 0.021
14:56:40.127 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.16   Kp: 8.53   Ki: 0.021
14:56:45.198 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.12   Kp: 8.53   Ki: 0.021
14:56:50.280 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.09   Kp: 8.53   Ki: 0.021
14:56:55.356 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 51.05   Kp: 8.53   Ki: 0.021
14:57:00.423 -> Setpoint: 110.00   Temp: 111.43   Duty Cycle % : 50.36   Kp: 8.53   Ki: 0.020
14:57:05.498 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.70   Kp: 8.53   Ki: 0.020
14:57:10.572 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.33   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

14:57:15.683 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.64   Kp: 8.53   Ki: 0.020
14:57:20.759 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.27   Kp: 8.53   Ki: 0.021
14:57:25.843 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.58   Kp: 8.53   Ki: 0.020
14:57:30.924 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.54   Kp: 8.53   Ki: 0.020
14:57:36.001 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.17   Kp: 8.53   Ki: 0.021
14:57:41.064 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.14   Kp: 8.53   Ki: 0.021
14:57:46.153 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.11   Kp: 8.53   Ki: 0.021
14:57:51.226 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.08   Kp: 8.53   Ki: 0.021
14:57:56.295 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 51.05   Kp: 8.53   Ki: 0.021
14:58:01.379 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.36   Kp: 8.53   Ki: 0.020
14:58:06.453 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.98   Kp: 8.53   Ki: 0.021
14:58:11.558 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.95   Kp: 8.53   Ki: 0.021
14:58:16.639 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.92   Kp: 8.53   Ki: 0.021
14:58:21.711 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.23   Kp: 8.53   Ki: 0.020
14:58:26.787 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.86   Kp: 8.53   Ki: 0.021
14:58:31.867 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.21   Kp: 8.53   Ki: 0.021
14:58:36.946 -> Setpoint: 110.00   Temp: 111.31   Duty Cycle % : 50.80   Kp: 8.53   Ki: 0.021
14:58:42.026 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.14   Kp: 8.53   Ki: 0.021
14:58:47.100 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.12   Kp: 8.53   Ki: 0.021
14:58:52.179 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.09   Kp: 8.53   Ki: 0.021
14:58:57.249 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.06   Kp: 8.53   Ki: 0.021
14:59:02.329 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.03   Kp: 8.53   Ki: 0.021
14:59:07.434 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 51.00   Kp: 8.53   Ki: 0.021
14:59:12.510 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 50.32   Kp: 8.53   Ki: 0.020
14:59:17.592 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 50.94   Kp: 8.53   Ki: 0.021
14:59:22.671 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 50.26   Kp: 8.53   Ki: 0.020
14:59:27.753 -> Setpoint: 110.00   Temp: 111.20   Duty Cycle % : 50.88   Kp: 8.53   Ki: 0.021
14:59:32.803 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 50.58   Kp: 8.53   Ki: 0.020
14:59:37.915 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 51.21   Kp: 8.53   Ki: 0.021
14:59:42.992 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 50.53   Kp: 8.53   Ki: 0.020
14:59:48.068 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 51.16   Kp: 8.53   Ki: 0.021
14:59:53.146 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 51.13   Kp: 8.53   Ki: 0.021
14:59:58.214 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 51.10   Kp: 8.53   Ki: 0.021
15:00:03.295 -> Setpoint: 110.00   Temp: 111.09   Duty Cycle % : 51.08   Kp: 8.53   Ki: 0.021
15:00:08.377 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 51.43   Kp: 8.53   Ki: 0.021
15:00:13.455 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 51.41   Kp: 8.53   Ki: 0.021
15:00:18.536 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 51.38   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:00:23.615 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 51.36   Kp: 8.53   Ki: 0.021
15:00:28.685 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 50.69   Kp: 8.53   Ki: 0.020
15:00:33.763 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 51.31   Kp: 8.53   Ki: 0.021
15:00:38.840 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.67   Kp: 8.53   Ki: 0.021
15:00:43.947 -> Setpoint: 110.00   Temp: 110.97   Duty Cycle % : 50.62   Kp: 8.53   Ki: 0.020
15:00:49.007 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.62   Kp: 8.53   Ki: 0.021
15:00:54.091 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.60   Kp: 8.53   Ki: 0.021
15:00:59.168 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.58   Kp: 8.53   Ki: 0.021
15:01:04.250 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.56   Kp: 8.53   Ki: 0.021
15:01:09.324 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.54   Kp: 8.53   Ki: 0.021
15:01:14.408 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 50.87   Kp: 8.53   Ki: 0.020
15:01:19.487 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.50   Kp: 8.53   Ki: 0.021
15:01:24.567 -> Setpoint: 110.00   Temp: 110.86   Duty Cycle % : 51.48   Kp: 8.53   Ki: 0.021
15:01:29.642 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.19   Kp: 8.53   Ki: 0.020
15:01:34.731 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.17   Kp: 8.53   Ki: 0.020
15:01:39.804 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.80   Kp: 8.53   Ki: 0.021
15:01:44.905 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.78   Kp: 8.53   Ki: 0.021
15:01:49.981 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.76   Kp: 8.53   Ki: 0.021
15:01:55.063 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.74   Kp: 8.53   Ki: 0.021
15:02:00.140 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.73   Kp: 8.53   Ki: 0.021
15:02:05.214 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.71   Kp: 8.53   Ki: 0.021
15:02:10.292 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.69   Kp: 8.53   Ki: 0.021
15:02:15.378 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.03   Kp: 8.53   Ki: 0.020
15:02:20.459 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.65   Kp: 8.53   Ki: 0.021
15:02:25.524 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.64   Kp: 8.53   Ki: 0.021
15:02:30.606 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 52.00   Kp: 8.53   Ki: 0.021
15:02:35.682 -> Setpoint: 110.00   Temp: 110.75   Duty Cycle % : 51.60   Kp: 8.53   Ki: 0.021
15:02:40.757 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.96   Kp: 8.53   Ki: 0.021
15:02:45.840 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.95   Kp: 8.53   Ki: 0.021
15:02:50.923 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.93   Kp: 8.53   Ki: 0.021
15:02:55.999 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.92   Kp: 8.53   Ki: 0.021
15:03:01.077 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.90   Kp: 8.53   Ki: 0.021
15:03:06.241 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.89   Kp: 8.53   Ki: 0.021
15:03:11.233 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.87   Kp: 8.53   Ki: 0.021
15:03:16.339 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.86   Kp: 8.53   Ki: 0.021
15:03:21.425 -> Setpoint: 110.00   Temp: 110.64   Duty Cycle % : 51.84   Kp: 8.53   Ki: 0.021
15:03:26.503 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.20   Kp: 8.53   Ki: 0.021



## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:03:31.585 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.19   Kp: 8.53   Ki: 0.021
15:03:36.665 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.18   Kp: 8.53   Ki: 0.021
15:03:41.740 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.17   Kp: 8.53   Ki: 0.021
15:03:46.818 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.15   Kp: 8.53   Ki: 0.021
15:03:51.895 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 51.50   Kp: 8.53   Ki: 0.020
15:03:56.979 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.13   Kp: 8.53   Ki: 0.021
15:04:02.052 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.12   Kp: 8.53   Ki: 0.021
15:04:07.129 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.10   Kp: 8.53   Ki: 0.021
15:04:12.211 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.09   Kp: 8.53   Ki: 0.021
15:04:17.294 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 52.08   Kp: 8.53   Ki: 0.021
15:04:22.376 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 51.42   Kp: 8.53   Ki: 0.020
15:04:27.455 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 51.41   Kp: 8.53   Ki: 0.020
15:04:32.533 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 52.42   Kp: 8.53   Ki: 0.021
15:04:37.615 -> Setpoint: 110.00   Temp: 110.52   Duty Cycle % : 51.39   Kp: 8.53   Ki: 0.020
15:04:42.695 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 51.76   Kp: 8.53   Ki: 0.020
15:04:47.775 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 52.39   Kp: 8.53   Ki: 0.021
15:04:52.850 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 52.38   Kp: 8.53   Ki: 0.021
15:04:57.926 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 52.37   Kp: 8.53   Ki: 0.021
15:05:03.004 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 52.36   Kp: 8.53   Ki: 0.021
15:05:08.073 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 51.71   Kp: 8.53   Ki: 0.020
15:05:13.184 -> Setpoint: 110.00   Temp: 110.41   Duty Cycle % : 52.34   Kp: 8.53   Ki: 0.021
15:05:18.262 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.71   Kp: 8.53   Ki: 0.021
15:05:23.337 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.06   Kp: 8.53   Ki: 0.020
15:05:28.420 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.69   Kp: 8.53   Ki: 0.021
15:05:33.472 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.68   Kp: 8.53   Ki: 0.021
15:05:38.558 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.68   Kp: 8.53   Ki: 0.021
15:05:43.638 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.67   Kp: 8.53   Ki: 0.021
15:05:48.711 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.66   Kp: 8.53   Ki: 0.021
15:05:53.820 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.65   Kp: 8.53   Ki: 0.021
15:05:58.898 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.65   Kp: 8.53   Ki: 0.021
15:06:03.980 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.64   Kp: 8.53   Ki: 0.021
15:06:09.058 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.63   Kp: 8.53   Ki: 0.021
15:06:14.137 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 51.99   Kp: 8.53   Ki: 0.020
15:06:19.216 -> Setpoint: 110.00   Temp: 110.30   Duty Cycle % : 52.62   Kp: 8.53   Ki: 0.021
15:06:24.300 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.99   Kp: 8.53   Ki: 0.021
15:06:29.370 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.99   Kp: 8.53   Ki: 0.021
15:06:34.448 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.98   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:06:39.540 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.34   Kp: 8.53   Ki: 0.020
15:06:44.612 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.97   Kp: 8.53   Ki: 0.021
15:06:49.689 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.33   Kp: 8.53   Ki: 0.020
15:06:54.774 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.96   Kp: 8.53   Ki: 0.021
15:06:59.843 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.96   Kp: 8.53   Ki: 0.021
15:07:04.917 -> Setpoint: 110.00   Temp: 110.19   Duty Cycle % : 52.95   Kp: 8.53   Ki: 0.021
15:07:09.991 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.33   Kp: 8.53   Ki: 0.021
15:07:15.071 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.33   Kp: 8.53   Ki: 0.021
15:07:20.148 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.33   Kp: 8.53   Ki: 0.021
15:07:25.229 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.32   Kp: 8.53   Ki: 0.021
15:07:30.338 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.32   Kp: 8.53   Ki: 0.021
15:07:35.412 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.32   Kp: 8.53   Ki: 0.021
15:07:40.489 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.32   Kp: 8.53   Ki: 0.021
15:07:45.567 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.32   Kp: 8.53   Ki: 0.021
15:07:50.647 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.31   Kp: 8.53   Ki: 0.021
15:07:55.726 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 53.31   Kp: 8.53   Ki: 0.021
15:08:00.802 -> Setpoint: 110.00   Temp: 110.07   Duty Cycle % : 52.67   Kp: 8.53   Ki: 0.020
15:08:05.877 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 53.69   Kp: 8.53   Ki: 0.021
15:08:10.952 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 53.69   Kp: 8.53   Ki: 0.021
15:08:16.058 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 53.69   Kp: 8.53   Ki: 0.021
15:08:21.136 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 53.69   Kp: 8.53   Ki: 0.021
15:08:26.209 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 53.69   Kp: 8.53   Ki: 0.021
15:08:31.285 -> Setpoint: 110.00   Temp: 109.96   Duty Cycle % : 53.69   Kp: 8.53   Ki: 0.021
15:08:36.361 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.07   Kp: 8.53   Ki: 0.021
15:08:41.448 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.08   Kp: 8.53   Ki: 0.021
15:08:46.511 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.08   Kp: 8.53   Ki: 0.021
15:08:51.606 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.08   Kp: 8.53   Ki: 0.021
15:08:56.678 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.09   Kp: 8.53   Ki: 0.021
15:09:01.773 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.09   Kp: 8.53   Ki: 0.021
15:09:06.847 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.09   Kp: 8.53   Ki: 0.021
15:09:11.927 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.10   Kp: 8.53   Ki: 0.021
15:09:17.008 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.10   Kp: 8.53   Ki: 0.021
15:09:22.096 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.11   Kp: 8.53   Ki: 0.021
15:09:27.177 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 53.47   Kp: 8.53   Ki: 0.020
15:09:32.252 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.11   Kp: 8.53   Ki: 0.021
15:09:37.330 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.12   Kp: 8.53   Ki: 0.021
15:09:42.418 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.12   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:09:47.466 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 53.49   Kp: 8.53   Ki: 0.020
15:09:52.577 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.51   Kp: 8.53   Ki: 0.021
15:09:57.653 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.51   Kp: 8.53   Ki: 0.021
15:10:02.731 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.52   Kp: 8.53   Ki: 0.021
15:10:07.809 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.53   Kp: 8.53   Ki: 0.021
15:10:12.886 -> Setpoint: 110.00   Temp: 109.85   Duty Cycle % : 54.15   Kp: 8.53   Ki: 0.021
15:10:17.960 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 53.90   Kp: 8.53   Ki: 0.020
15:10:23.040 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.54   Kp: 8.53   Ki: 0.021
15:10:28.116 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.55   Kp: 8.53   Ki: 0.021
15:10:33.189 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.55   Kp: 8.53   Ki: 0.021
15:10:38.297 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.56   Kp: 8.53   Ki: 0.021
15:10:43.349 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.57   Kp: 8.53   Ki: 0.021
15:10:48.432 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.57   Kp: 8.53   Ki: 0.021
15:10:53.508 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.58   Kp: 8.53   Ki: 0.021
15:10:58.586 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.59   Kp: 8.53   Ki: 0.021
15:11:03.668 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.59   Kp: 8.53   Ki: 0.021
15:11:08.745 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.60   Kp: 8.53   Ki: 0.021
15:11:13.827 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.61   Kp: 8.53   Ki: 0.021
15:11:18.908 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.61   Kp: 8.53   Ki: 0.021
15:11:24.014 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.00   Kp: 8.53   Ki: 0.021
15:11:29.096 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.01   Kp: 8.53   Ki: 0.021
15:11:34.173 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.64   Kp: 8.53   Ki: 0.021
15:11:39.266 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.00   Kp: 8.53   Ki: 0.020
15:11:44.348 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.65   Kp: 8.53   Ki: 0.021
15:11:49.433 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.01   Kp: 8.53   Ki: 0.020
15:11:54.509 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.66   Kp: 8.53   Ki: 0.021
15:11:59.584 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.67   Kp: 8.53   Ki: 0.021
15:12:04.661 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.67   Kp: 8.53   Ki: 0.021
15:12:09.740 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.68   Kp: 8.53   Ki: 0.021
15:12:14.813 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.69   Kp: 8.53   Ki: 0.021
15:12:19.897 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.05   Kp: 8.53   Ki: 0.020
15:12:24.974 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.70   Kp: 8.53   Ki: 0.021
15:12:30.053 -> Setpoint: 110.00   Temp: 109.74   Duty Cycle % : 54.71   Kp: 8.53   Ki: 0.021
15:12:35.131 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 54.45   Kp: 8.53   Ki: 0.020
15:12:40.236 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.10   Kp: 8.53   Ki: 0.021
15:12:45.313 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 54.47   Kp: 8.53   Ki: 0.020
15:12:50.395 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.12   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:12:55.476 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 54.87   Kp: 8.53   Ki: 0.020
15:13:00.546 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.14   Kp: 8.53   Ki: 0.021
15:13:05.624 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.15   Kp: 8.53   Ki: 0.021
15:13:10.699 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.54   Kp: 8.53   Ki: 0.021
15:13:15.779 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.55   Kp: 8.53   Ki: 0.021
15:13:20.888 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 54.92   Kp: 8.53   Ki: 0.020
15:13:25.932 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.19   Kp: 8.53   Ki: 0.021
15:13:31.011 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 54.56   Kp: 8.53   Ki: 0.020
15:13:36.089 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.21   Kp: 8.53   Ki: 0.021
15:13:41.200 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.22   Kp: 8.53   Ki: 0.021
15:13:46.277 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.23   Kp: 8.53   Ki: 0.021
15:13:51.356 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.24   Kp: 8.53   Ki: 0.021
15:13:56.437 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.25   Kp: 8.53   Ki: 0.021
15:14:01.517 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.64   Kp: 8.53   Ki: 0.021
15:14:06.599 -> Setpoint: 110.00   Temp: 109.62   Duty Cycle % : 55.27   Kp: 8.53   Ki: 0.021
15:14:11.679 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.01   Kp: 8.53   Ki: 0.020
15:14:16.757 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.67   Kp: 8.53   Ki: 0.021
15:14:21.835 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.68   Kp: 8.53   Ki: 0.021
15:14:26.914 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.05   Kp: 8.53   Ki: 0.020
15:14:31.993 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.08   Kp: 8.53   Ki: 0.021
15:14:37.073 -> Setpoint: 110.00   Temp: 109.51   Duty Cycle % : 55.07   Kp: 8.53   Ki: 0.020
15:14:42.133 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.11   Kp: 8.53   Ki: 0.021
15:14:47.244 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.12   Kp: 8.53   Ki: 0.021
15:14:52.293 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 55.49   Kp: 8.53   Ki: 0.020
15:14:57.399 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.15   Kp: 8.53   Ki: 0.021
15:15:02.473 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.17   Kp: 8.53   Ki: 0.021
15:15:07.553 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 55.54   Kp: 8.53   Ki: 0.020
15:15:12.634 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.58   Kp: 8.53   Ki: 0.021
15:15:17.716 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.59   Kp: 8.53   Ki: 0.021
15:15:22.787 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.23   Kp: 8.53   Ki: 0.021
15:15:27.866 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.24   Kp: 8.53   Ki: 0.021
15:15:32.938 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.26   Kp: 8.53   Ki: 0.021
15:15:38.014 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 55.63   Kp: 8.53   Ki: 0.020
15:15:43.126 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.29   Kp: 8.53   Ki: 0.021
15:15:48.176 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.30   Kp: 8.53   Ki: 0.021
15:15:53.252 -> Setpoint: 110.00   Temp: 109.40   Duty Cycle % : 56.32   Kp: 8.53   Ki: 0.021
15:15:58.362 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.71   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:16:03.440 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.73   Kp: 8.53   Ki: 0.021
15:16:08.510 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.75   Kp: 8.53   Ki: 0.021
15:16:13.587 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.76   Kp: 8.53   Ki: 0.021
15:16:18.669 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.16   Kp: 8.53   Ki: 0.021
15:16:23.745 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.18   Kp: 8.53   Ki: 0.021
15:16:28.822 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.20   Kp: 8.53   Ki: 0.021
15:16:33.901 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 56.57   Kp: 8.53   Ki: 0.020
15:16:38.979 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 56.59   Kp: 8.53   Ki: 0.020
15:16:44.080 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.26   Kp: 8.53   Ki: 0.021
15:16:49.151 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.28   Kp: 8.53   Ki: 0.021
15:16:54.238 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 56.65   Kp: 8.53   Ki: 0.020
15:16:59.297 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.32   Kp: 8.53   Ki: 0.021
15:17:04.372 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.34   Kp: 8.53   Ki: 0.021
15:17:09.463 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 56.98   Kp: 8.53   Ki: 0.021
15:17:14.537 -> Setpoint: 110.00   Temp: 109.29   Duty Cycle % : 57.00   Kp: 8.53   Ki: 0.021
15:17:19.624 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.39   Kp: 8.53   Ki: 0.021
5:17:24.702 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 56.76   Kp: 8.53   Ki: 0.020
15:17:29.803 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.43   Kp: 8.53   Ki: 0.021
15:17:34.882 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 56.80   Kp: 8.53   Ki: 0.020
15:17:39.959 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 56.82   Kp: 8.53   Ki: 0.020
15:17:45.037 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.49   Kp: 8.53   Ki: 0.021
15:17:50.117 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.51   Kp: 8.53   Ki: 0.021
15:17:55.196 -> Setpoint: 110.00   Temp: 109.18   Duty Cycle % : 57.53   Kp: 8.53   Ki: 0.021
15:18:00.272 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 57.93   Kp: 8.53   Ki: 0.021
15:18:05.352 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 57.95   Kp: 8.53   Ki: 0.021
15:18:10.429 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 57.98   Kp: 8.53   Ki: 0.021
15:18:15.511 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.00   Kp: 8.53   Ki: 0.021
15:18:20.590 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.02   Kp: 8.53   Ki: 0.021
15:18:25.667 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.04   Kp: 8.53   Ki: 0.021
15:18:30.736 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.07   Kp: 8.53   Ki: 0.021
15:18:35.815 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.09   Kp: 8.53   Ki: 0.021
15:18:40.897 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.11   Kp: 8.53   Ki: 0.021
15:18:45.972 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.13   Kp: 8.53   Ki: 0.021
15:18:51.082 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 58.16   Kp: 8.53   Ki: 0.021
15:18:56.157 -> Setpoint: 110.00   Temp: 109.06   Duty Cycle % : 57.52   Kp: 8.53   Ki: 0.020
15:19:01.240 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.58   Kp: 8.53   Ki: 0.021
15:19:06.318 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.61   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:19:11.396 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.63   Kp: 8.53   Ki: 0.021
15:19:16.472 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.66   Kp: 8.53   Ki: 0.021
15:19:21.548 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.03   Kp: 8.53   Ki: 0.020
15:19:26.626 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.71   Kp: 8.53   Ki: 0.021
15:19:31.704 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.73   Kp: 8.53   Ki: 0.021
15:19:36.784 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.76   Kp: 8.53   Ki: 0.021
15:19:41.856 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.78   Kp: 8.53   Ki: 0.021
15:19:46.967 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.81   Kp: 8.53   Ki: 0.021
15:19:52.039 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.84   Kp: 8.53   Ki: 0.021
15:19:57.110 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.86   Kp: 8.53   Ki: 0.021
15:20:02.187 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.89   Kp: 8.53   Ki: 0.021
15:20:07.271 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.91   Kp: 8.53   Ki: 0.021
15:20:12.342 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.94   Kp: 8.53   Ki: 0.021
15:20:17.666 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.96   Kp: 8.53   Ki: 0.021
15:20:22.531 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.99   Kp: 8.53   Ki: 0.021
15:20:27.583 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.01   Kp: 8.53   Ki: 0.021
15:20:32.665 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.04   Kp: 8.53   Ki: 0.021
15:20:37.740 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.44   Kp: 8.53   Ki: 0.021
15:20:42.847 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.09   Kp: 8.53   Ki: 0.021
15:20:47.929 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.12   Kp: 8.53   Ki: 0.021
15:20:53.009 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.14   Kp: 8.53   Ki: 0.021
15:20:58.087 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.17   Kp: 8.53   Ki: 0.021
15:21:03.166 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.19   Kp: 8.53   Ki: 0.021
15:21:08.246 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 58.93   Kp: 8.53   Ki: 0.020
15:21:13.324 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.58   Kp: 8.53   Ki: 0.020
15:21:18.408 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.27   Kp: 8.53   Ki: 0.021
15:21:23.490 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.63   Kp: 8.53   Ki: 0.020
15:21:28.573 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.66   Kp: 8.53   Ki: 0.020
15:21:33.634 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 58.68   Kp: 8.53   Ki: 0.020
15:21:38.719 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.37   Kp: 8.53   Ki: 0.021
15:21:43.796 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.40   Kp: 8.53   Ki: 0.021
15:21:48.865 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.42   Kp: 8.53   Ki: 0.021
15:21:53.949 -> Setpoint: 110.00   Temp: 108.95   Duty Cycle % : 59.45   Kp: 8.53   Ki: 0.021
15:21:59.022 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.85   Kp: 8.53   Ki: 0.021
15:22:04.126 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.88   Kp: 8.53   Ki: 0.021
15:22:09.207 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.91   Kp: 8.53   Ki: 0.021
15:22:14.277 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.94   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:22:19.359 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.97   Kp: 8.53   Ki: 0.021
15:22:24.434 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 59.99   Kp: 8.53   Ki: 0.021
15:22:29.528 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 60.02   Kp: 8.53   Ki: 0.021
15:22:34.651 -> Setpoint: 110.00   Temp: 108.84   Duty Cycle % : 60.05   Kp: 8.53   Ki: 0.021
15:22:39.696 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.46   Kp: 8.53   Ki: 0.021
15:22:44.763 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.49   Kp: 8.53   Ki: 0.021
15:22:49.837 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.52   Kp: 8.53   Ki: 0.021
15:22:54.921 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.55   Kp: 8.53   Ki: 0.021
15:22:59.983 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.58   Kp: 8.53   Ki: 0.021
15:23:05.087 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.61   Kp: 8.53   Ki: 0.021
15:23:10.170 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.64   Kp: 8.53   Ki: 0.021
15:23:15.252 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.67   Kp: 8.53   Ki: 0.021
15:23:20.330 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.70   Kp: 8.53   Ki: 0.021
15:23:25.413 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.06   Kp: 8.53   Ki: 0.020
15:23:30.487 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.77   Kp: 8.53   Ki: 0.021
15:23:35.560 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.80   Kp: 8.53   Ki: 0.021
15:23:40.643 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.15   Kp: 8.53   Ki: 0.020
15:23:45.721 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.86   Kp: 8.53   Ki: 0.021
15:23:50.810 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.89   Kp: 8.53   Ki: 0.021
15:23:55.880 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.92   Kp: 8.53   Ki: 0.021
15:24:00.950 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.33   Kp: 8.53   Ki: 0.021
15:24:06.021 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 60.98   Kp: 8.53   Ki: 0.021
15:24:11.131 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.39   Kp: 8.53   Ki: 0.021
15:24:16.181 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.43   Kp: 8.53   Ki: 0.021
15:24:21.288 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.46   Kp: 8.53   Ki: 0.021
15:24:26.367 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.49   Kp: 8.53   Ki: 0.021
15:24:31.439 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 60.85   Kp: 8.53   Ki: 0.020
15:24:36.514 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.56   Kp: 8.53   Ki: 0.021
15:24:41.596 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.60   Kp: 8.53   Ki: 0.021
15:24:46.670 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.63   Kp: 8.53   Ki: 0.021
15:24:51.743 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.66   Kp: 8.53   Ki: 0.021
15:24:56.821 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.70   Kp: 8.53   Ki: 0.021
15:25:01.926 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.73   Kp: 8.53   Ki: 0.021
15:25:07.006 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.76   Kp: 8.53   Ki: 0.021
15:25:12.083 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.80   Kp: 8.53   Ki: 0.021
15:25:17.157 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.83   Kp: 8.53   Ki: 0.021
15:25:22.233 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.86   Kp: 8.53   Ki: 0.021

## Lab 6: PI-Controlled Crock Pot

EENG-4060  
Control Systems Lab  
Assigned: 4/24/25

Benjamin Schuberg  
John Morris  
Due: 5/12/25

15:25:27.310 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.90   Kp: 8.53   Ki: 0.021	
15:25:32.412 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.93   Kp: 8.53   Ki: 0.021	
15:25:37.463 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 61.96   Kp: 8.53   Ki: 0.021	
15:25:42.543 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.38   Kp: 8.53   Ki: 0.021	
15:25:47.653 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.41   Kp: 8.53   Ki: 0.021	
15:25:52.734 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.07   Kp: 8.53   Ki: 0.021	
15:25:57.807 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.48   Kp: 8.53   Ki: 0.021	
15:26:02.890 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.52   Kp: 8.53   Ki: 0.021	
15:26:07.961 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.18   Kp: 8.53   Ki: 0.021	
15:26:13.039 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.21   Kp: 8.53   Ki: 0.021	
15:26:18.119 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.62   Kp: 8.53   Ki: 0.021	
15:26:23.198 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.66   Kp: 8.53   Ki: 0.021	
15:26:28.282 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.69   Kp: 8.53   Ki: 0.021	
15:26:33.351 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.73   Kp: 8.53   Ki: 0.021	
15:26:38.456 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.77   Kp: 8.53   Ki: 0.021	
15:26:43.536 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.80   Kp: 8.53   Ki: 0.021	
15:26:48.614 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.84   Kp: 8.53   Ki: 0.021	
15:26:53.694 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.88   Kp: 8.53   Ki: 0.021	
15:26:58.769 -> Setpoint: 110.00   Temp: 108.50   Duty Cycle % : 62.91   Kp: 8.53   Ki: 0.021	
15:27:03.840 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.57   Kp: 8.53   Ki: 0.021	
15:27:08.923 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.60   Kp: 8.53   Ki: 0.021	
15:27:13.998 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.64   Kp: 8.53   Ki: 0.021	
15:27:19.075 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.67   Kp: 8.53   Ki: 0.021	
15:27:24.154 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.70   Kp: 8.53   Ki: 0.021	
15:27:29.228 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.74   Kp: 8.53   Ki: 0.021	
15:27:34.308 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.77   Kp: 8.53   Ki: 0.021	
15:27:39.385 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.80   Kp: 8.53   Ki: 0.021	
15:27:44.468 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 62.46   Kp: 8.53   Ki: 0.021	
15:27:49.550 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.17   Kp: 8.53   Ki: 0.020	
15:27:54.630 -> Setpoint: 110.00   Temp: 108.72   Duty Cycle % : 61.83   Kp: 8.53   Ki: 0.020	
15:27:59.737 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.93   Kp: 8.53   Ki: 0.021	
15:28:04.785 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 62.97   Kp: 8.53   Ki: 0.021	
15:28:09.869 -> Setpoint: 110.00   Temp: 108.61   Duty Cycle % : 63.00   Kp: 8.53   Ki: 0.021	