Analysis of a Microcontroller-Based PID Controller

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ABSTRACT

The PID algorithm permits the high temperature measurement system and greatly controls accuracy. The circuit is a simple and clear structure and is easy to use and understand. The administrator / administrator generates the result based on error signals and removes the system in achieving zero error. The response of the PID controller is due to a sequence / number of codes indicated on the microcontroller. The validation results are presented graphically. A way to test this type of system is to develop a cost-effective system and propel it to a scientific community of future application.

Keywords: Controls, Temperature, PID, Microcontroller

INTRODUCTION

There are a number of processes and locations where different temperatures are required throughout the processes. The physical & chemical reactions are very sensitive to environmental changes and can disturb their physical and chemical properties and can affect the reaction. Regulators must control the temperature to maintain the temperature to a set point as required during the reaction [1]–[3]. This can be enabled through the use of digital computers and also has features in terms of program suitability and capability. The output in the voltage detector is upgraded to a binary format with the microcontroller connected to the system [4]. Temperature tracker is set to generate sensor output / sensitivity in frequency & time by O.I.Mohammad.et.al.

This journal / paper reports on a microcontroller-based temperature controller developed using LM-35 as a sensor. This scheme benefits from simple and understandable hardware that is developed using microcontroller and relay for conversion process. Since this browser is LM-35, this test device has a range from 55to155 degrees Celsius.

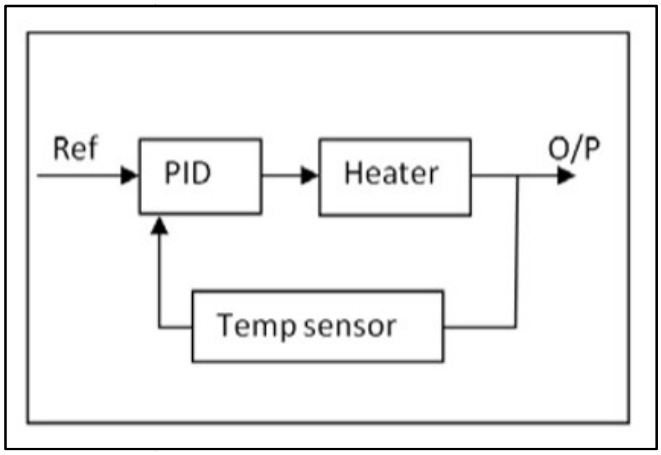

Figure 1. Block diagram/figure of the anticipated setup

Software Design

The language used for programming is 'Embedded C'. The 'C' program is a very easy and extended set of codes by using this programming language the programs can be more easily interpreted, understood and followed. 14 (fourteen) pins are introduced / digital output and 6 (six) input points / analog pins at the microcontroller. It has got a clock speed of 16MHz. The controller is receiving a TTL (5V) UART serial / series communication present on pin 0 and pin 1. This microcontroller has also supported the 12C (TWI) & SPI communication.

MATHEMATICAL EQUATION OF HEAT TRANSFER SYSTEM

If you think that there is not any heat source in the system and water with real temperatures, the equation has been developed.

Equation 1. Formula of the Heat flow

$$Q = C\left(\frac{d\theta_0}{dt}\right) + \theta_0/R \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Wherever Q = level of heat flax flow from the heating element.

θ_0 *is the* Water temperature.

R = thermal sustainability [5].

With reference to *Equation 1* it may be said that the time constant for the process is RC. So in the case implemented for test values, the heating machine (heater) has 700W operating power. So, resistance of heater (heating device is said to 46Ω according to the calculation.

The scenario that has been executed is that the heater first be examined/observed in routine situations & no control system will be employed during this part of the experiment. The heater takes 4 minutes 15 seconds to heat water at 50ºC in room temperature condition.

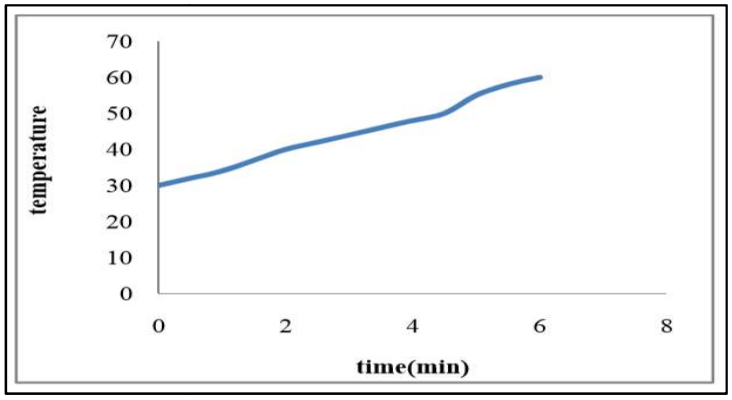

Figure 2. Time response/reaction of the heater with no control system applied. (Open loop system)

PID Controller

The Joint Partner Regulator is a combination of all the current errors, past errors & an estimation of future problems/errors. All the errors that are finally verified will mean that the system is performing in an error free condition[6].

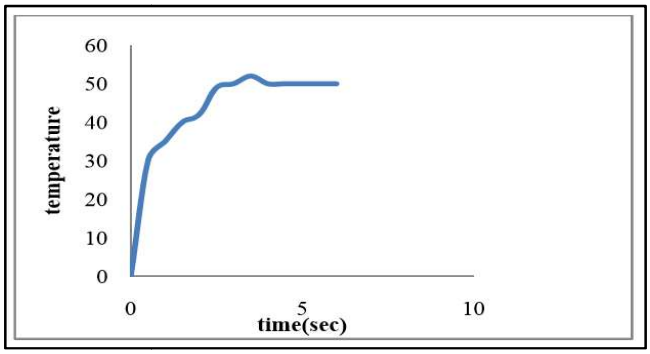

Figure 3. Time Response of PID controller

Conclusion

- The performance of the electrical heater was audited and the PID control limits are available.
- Controlling the system manually provides the parameters required for the improvement of system by employing the feedback response.
- The P, PI, PID Controllers will provide the phased corrections in increasing the outcomes as required.
- The PID Governor/controller may suggest the system to estimate the error and control the system input that prevents and delays the system and wastage simultaneously.
- The boundaries are defined as P, I & D set for a specific system. They can be different for different systems.
- It is felt that PID will be a good solution for any system to be sustainable and that the boundaries that offer a perfect solution are a significant step forward on a several of occasions.

REFERENCE

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