Chapter 12
iTCLab Temperature Monitoring and Control System Based on PID and Internet of Things (IoT)

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ABSTRACT

The rapid increase in applications that combine modern concepts and innovations, due to the development of the internet of things (IoT) and cloud computing around the world, make all areas of life continue to move towards an advanced and intelligent society. This innovation continues to enter almost all fields, ranging from simple to complex innovations. In this chapter, IoT is used as a means for tuning PID parameters, when the error does not converge to zero. The experimental results show that the PID parameter tuning process can be done through IoT. And the results are quite encouraging, as an alternative way of tuning PID parameters.

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INTRODUCTION

Internet of things (IoT) is a developing region in which billions of keen objects are associated with one another utilizing the web to share information and assets (Rahmat, Moeljani, Widjajani, Sudiyarto, & Harianto, 2021). IoT innovation permits objects around us to be associated with the internet network. Where each object associated with the internet can be accessed anytime and anyplace. For illustration, able to remotely turn on and off machines at domestic (lights, TVs, stoves, radiators, etc.) as long as the equipment is associated with the IoT cloud and an online association is accessible. In general, the IoT architecture consists of an Application Layer, Middleware Layer, Network Layer, and Physical Layer (Rahmat et al., 2021, and Ravidas, Lekidis, Paci, & Zannone, 2019). The basic system of the IoT consists of 3 components, namely hardware or physical (things), internet connection, and cloud data center as a place to store or run the application (Rahmat et al., 2021). Some of the research on IoT and its application can be read in the following papers: Internet of things based attendance system design and development in a smart classroom (Eridani, Widianto, Windasari, Bawono, & Gunarto, 2021), Simplified automatic VAR/Power factor compensator using fuzzy logic based on internet of things (Luqman, Lestari, & Setiawan, 2019), Development of a smart parking system based on internet of things using object-oriented analysis and design method (Maulana, Adhy, Bahtiar, & Waspada, 2020), Smart Greetthings: Smart Greenhouse Based on Internet of Things for Environmental Engineering (Sofwan et al., 2020), Development of Controller for Internet of Things Based Anti Pollution Smart Toll Gate System (Syafei, Afiq, Wahyudi, & Hidayatno, 2020), LoRa Gateway as Internet of Things (IoT) Infrastructure Components on Undip Vocational School (Tadeus, Yuniarto, & Mangkusasmito, 2020), and lastly Door and light control prototype using Intel Galileo based Internet of Things (Windarto & Eridani, 2017).

In this paper, IoT is used as an alternative tuning of the proportional integral and derivative (PID) parameters of the internet-based temperature control lab (iTCLab) temperature control system. iTCLab is a temperature control kit for feedback control applications with an ESP32 Microcontroller, LED, two heaters, and two temperature sensors. The heater power output is adjusted to maintain the desired temperature set-point. Thermal energy from the heater is transferred by conduction, convection, and radiation to the temperature sensor. Heat is also transferred from the device to the environment.

This iTCLab kit is inspired by BYU (Brigham Young University) TCLab Products (BYU, 2018), one of the private campuses in Provo, Utah United States. This iTCLab kit is a miniature control system in a pocket that can be used as a practical IoT learning package, IoT programming, and IoT-based control system practice. This kit can also be used to learn system dynamics and control systems, Arduino

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