International Journal of Innovative Research in Engineering & Management (IJIREM)
ISSN: 2350-0557, Volume-8, Issue-6, November 2021
https://doi.org/10.55524/ijirem.2021.8.6.117
www.ijirem.org

A System for Controlling Surface Temperature

Dr. Satish Saini
RIMT University, Mandi Gobindgarh,
Punjab, India
Email Id- satishsaini@rimt.ac.in

ABSTRACT
Temperature measurement using appropriate sensors and controls is critical not only for environmental and weather monitoring, but also for a variety of industrial processes. Temperature control refers to activities that aim to keep a certain region's temperature within a defined range or at a certain maximum/minimum level. Many temperature control systems have been created, however they all have certain drawbacks or flaws in terms of cost, accuracy, and control area. Researchers suggested this Surface temperature control technology to address these issues. The thermostat, peltier element, display screen, control unit, emergency button, and transducer with capacitor are all part of this system. This system is less expensive and has higher precision than other existing systems since it uses a transducer to provide electricity and only operates when the temperature is less or more than the specified value. These systems can be further customised by including new technologies that are now unavailable but will become popular in the coming years. As a result, the future of Surface temperature control systems seems promising.

KEYWORDS
Control System, Peltier, Temperature, Thermostat, Transducer.

1. INTRODUCTION
In the 18th century, the use of automatic temperature control systems began. The idea was created at the Norman School, Oklahoma, by Warren S. Johnson. In order to assess if it was too hot or too chilly, Janite had to attend each class room and then adjust the dampers in the cellar accordingly. Johnson was seeking a solution to stop or at least reduce the interruptions to the classroom of the pupils and to improve their comfort levels. This particular requirement was met by the Automatic Temperature Control System [1].

The usage of automated temperature control devices originated in the 18th century. Warren S. Johnson came up with the concept at the Norman School in Norman, Oklahoma. Janite had to visit each class room to determine if it was too hot or too cold, and then change the dampers in the cellar appropriately. Johnson was looking for a way to halt or at least lessen the number of disruptions in the classroom and to increase the students' comfort levels. The Automatic Temperature Control System addressed this specific demand [2-6].

A programmable thermostat is a computerised device that replaces the traditional (automatic) thermostat in older homes and flats. The thermostat senses the temperature of a room and turns on or off the heat/cooling unit to maintain the specified position on the thermostat. One drawback of the traditional thermostat is that it is frequently placed in an easily accessible position. This results in higher energy bills since the home is kept warmer than necessary when people go to bed or even go to work (when it is not needed) [7]. The present block diagram of the Temperature Control System is shown in Figure 1.

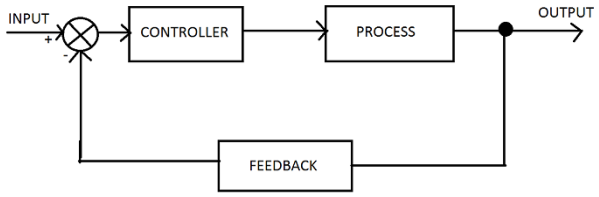

Figure 1: The above diagram shows the existing block diagram of Temperature control system

Researchers created a method to manage surface temperature in this study article. There has been no study done on temperature control systems utilising peltier elements as of yet. This peltier element has the ability to chill as well as heat. The thermostat is employed in this system to measure the temperature of the floor; if the temperature is higher or lower than the specified temperature, the peltier element responds to the condition and sends the data to the control unit, which displays it on the display screen. The energy is supplied to the entire system via a transducer.

2. LITERATURE REVIEW
Bhupesh Anuja et al. discussed about Temperature control and measurement [8]. Temperature measuring utilising appropriate sensors and controls is also critical for many industrial activities in environmental and weather monitoring. This article looks at PLCs, microcontrollers, and sensors to assist readers understand the differences between PLCs and microcontrollers in temperature control applications. In addition, three different types of intelligent temperature sensors are compared. To conduct a complete examination, smart sensors with computer assistance are utilised.

Emmanuel C. Ogu et al. discussed about Temperature control system [9]. The methods used to regulate the temperature within or within a given range in a specific location at a set maximum or lowest level are referred to as temperature control. This technique is used in almost every part of the world. With the emergence of the greenhouse effect, globalisation and industrialisation have necessitated greater uses for temperature management in many routine processes. Automatic temperature management has been proven to be the most successful technique in every application since the temperature is typically automatically adjusted during the operation (without the need for human intervention). The findings of a wide range of industrial applications, encompassing a wide range of sectors and schedules, show that In addition, this finding simplifies the job of a human being because you no longer

have to worry about other weather-related problems for I am trying to create a temperature control system that can automatically manage the environment by activating effector devices at the right moment, therefore altering temperature relative to set point.

Vincent Miralles et al. discussed a review on applications and techniques of Temperature and Heating control in microfluidic systems [10]. It gives an overview of the numerous techniques to temperature regulation in microfluidic systems that have been developed during the past decade [11-15]. From external heating sources to microwaves and lasers, there have been many ways. Temperature rates ranging from 0.1 to 2,000 °C/s are covered, as are steady gradients from 6 to 40 °C/mm. We cover a variety of modern approaches for applications such as digital microfluidics, in which the integration of a heating source to produce a temperature gradient allows for the management of a crucial parameter without the requirement for high precision. The focus of a temperature gradient, on the other hand, need highly fine charge concentration and separation control.

Charlie J. Tomlinson et al. discussed a review on Remote sensing land surface temperature for meteorology and climatology [16]. Remotely sensed data volumes and availability have risen dramatically during the past decade. Satellites, sensors, and research linked to surface terrain evaluation in the meteorological and climatological areas are examined in this paper. These measurements may be used for many purposes, such as urban heat island studies, by utilising the electromagnetic thermal infrarot component.

Research Question

- What instruments are used in Surface temperature Control system?
- How this Surface Temperature control system is better than the existing one?

3. METHODOLOGY

The main purpose of this research is to maintain the temperature of the surface to normal temperature at any time using the implementation of electronic devices such as sensors, Arduino (Control Unit), transducers, peltier, thermostat etc.

3.1 Design

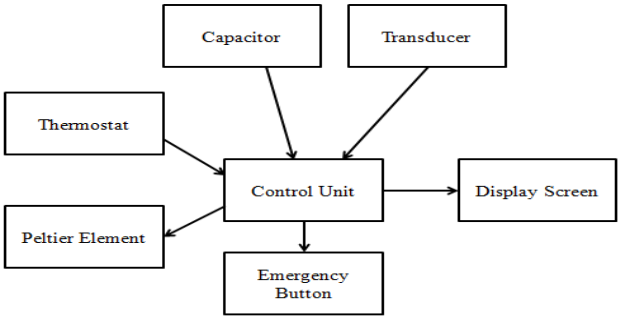

Figure 2: Illustrates the block diagram of Surface temperature control system

The Surface Temperature Control System is depicted in Figure 2 as a block diagram. Thermostat, control unit, emergency button, display screen, Peltier element, and transducer with capacitor make up this system. Transducers supply power to all circuits, and transducers may convert any force/pressure into electrical energy, which is then stored in a capacitor. If an issue happens, an emergency button is given. The temperature of the floor, the quantity of power generated at any one time, and the oxygen level in the room will all be displayed on the display screen [17].

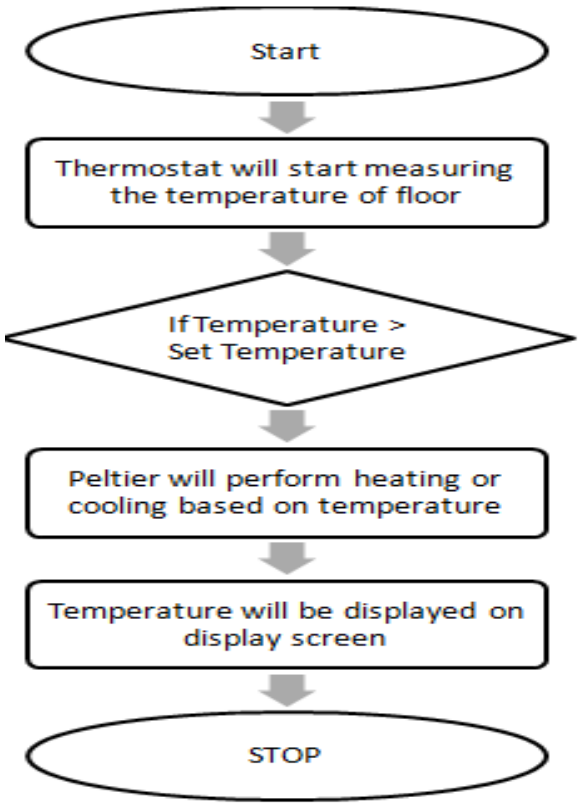

Figure 3: Illustrates the flowchart of working of thermostat and peltier together in this circuit

The thermostat and peltier flow diagram is shown in Figure 3. To determine if the floor temperature is above or below a preset degree, a thermostat is employed. The thermostat notifies the control unit, which then notifies peltier element to conduct heating or cooling, depending on the temperature.

3.2 Instruments

- Peltier Element: Peltier cooler, heater, or thermoelectric thermal pump is an active solid-state heat pump that transfers heat from one side of the device to another and, depending on the current direction, consumes electricity. Compared to vapor-compression refrigeration, this method is far less popular in refrigeration. Compared to vapour compression refrigerators, Peltier coolers have the following advantages: no moving components or circulating liquid, extremely long life, invulnerability to leaks, compact size and flexible shape. Some of its major drawbacks are a high price for a given cooling capacity, and (a low COP). It is the goal of many academics and corporations to produce low-cost, high-efficiency Peltier. It may also be used to heat or cool as a temperature controller as shown in Figure 4.

International Journal of Innovative Research in Engineering & Management (IJIREM)
ISSN: 2350-0557, Volume-8, Issue-6, November 2021
https://doi.org/10.55524/ijirem.2021.8.6.117
www.ijirem.org

Figure 4: Illustrates the peltier element that performs both heating and cooling operations [18]

- Thermostat: Thermostat, an instrument that detects variations in temperature in order to keep the temperature of an enclosed area generally consistent is shown in Figure 5. The thermostat generates signals, often electric when the temperature exceeds or falls beneath the intended value, for a system containing relays, valves, switches etc.

Figure 5: Illustrates the thermostat used for measuring temperature of any surface[19]

- Control Unit: A control unit is circuitry that directs operations within a computer's processor[20]. In this system, Control unit play an important role as all the data was sent to it and it will display it on display screen.
- Emergency Button: Emergency button is provided in this system if any incident occurs.
- Capacitor: As the name suggests, a capacitor is a device used to store electrical energy. It's a two-terminal passive electrical component. Capacitance is the term used to describe a capacitor's when electrical conductors are close enough to each other in a circuit, there is some capacitance between them. A capacitor, however, is a component that has been built with the Formerly known as condenser, or a capacitor, the capacitor has evolved over time
- Transducer: A transducer receives electric high-voltage sequences called echo-sounder pulses. The transducer works as a microphone when the sound wave bounces back. It receives and transforms the sound wave into electric energy during the interval between each transmitting pulse. The block diagram of Transducer is shown in Figure 6.

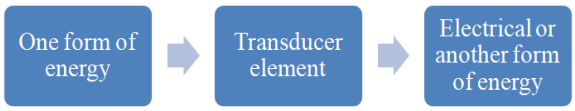

Figure 6: Illustrates the block diagram of Transducer

4. RESULTS & DISCUSSION

As previously stated, a surface temperature control system is one that is used to regulate the temperature of any surface, such as a floor or a room. Different temperature sensors and components are used to construct a variety of temperature control systems. However, no invention based on the Peltier element has ever been made. As a result, researchers suggested this method based on the Peltier element. The thermostat, peltier element, display screen, control unit, emergency button, and transducer with capacitor are all part of this system. The transducer, which transforms one type of energy into another and generates electrical energy, provides energy to the entire system. As a result, the system is low-cost and simple to maintain. This system performs better than the prior innovation because it automatically turns on when the temperature is higher or lower than the specified setting, normalises it, and then returns to sleep mode. This system has a promising future since it can be further improved utilising new technologies like machine learning and artificial intelligence[21-25].

5. CONCLUSION

The applications for temperature management are diverse, and they focus on physical, chemical, and biological concerns. All temperature control systems have distinct benefits and disadvantages in terms of ease of integration, cost, control area, and control precision, among other things. Researchers suggested this surface temperature control method utilising a peltier element to address these issues. The thermostat, peltier element, display screen, control unit, emergency button, and transducer with capacitor are all part of this system. Because power production is based on a transducer, and it operates automatically when the surface temperature is higher or less than the specified temperature, this system solves the problems of cost, precision, and control area. As a result, this system's accuracy is superior than that of previous systems. Temperature management systems have a promising future since they can be further customised utilising emerging technologies such as machine learning.

REFERENCES

[1]. Qin Q, Liu Z, Yang Q, Gong Q, Wang Y. Research on intelligent temperature control system based on WSN routing optimization. Pap Asia. 2018;
[2]. Goel S, Malhotra A, Agarwal A, Chandak S, Kumar A, Khan A. Comparative Efficacy of Ultrasonography and Acoustic Radiation Force Impulse (ARFI) Elastography in Prediction of Malignancy in Thyroid Nodules. J Diagnostic Med Sonogr. 2020;
[3]. Huda N, ul Islam MS, Kumar H, Pant A, Bishnoi S. Proximal Fibular Osteotomy for Medial Compartment Knee Osteoarthritis: Is It Worth? Indian J Orthop. 2020;
[4]. Khan M, Vishal, Kumar A, Khaitan T, Sinha DK, Kumar C. Comparative Evaluation of 3d Locking Versus Non-Locking Titanium Miniplates in the Treatment of Mandibular Fracture. Indian J Otolaryngol Head Neck Surg. 2020;

[5]. Ramos Meza CS, Bashir S, Jain V, Aziz S, Raza Shah SA, Shabbir MS, et al. The Economic Consequences of the Loan Guarantees and Firm's Performance: A Moderate Role of Corporate Social Responsibility. Glob Bus Rev. 2021;
[6]. Hatim M, Siddiqui F, Kumar R. Addressing challenges and demands of intelligent seasonal rainfall forecasting using artificial intelligence approach. In: Proceedings of International Conference on Computation, Automation and Knowledge Management, ICCAKM 2020. 2020.
[7]. Ikhlef A, Kihel M, Boukhezzar B, Guerroudj A, Mansouri N. Online temperature control system. Int J Interact Mob Technol. 2015;
[8]. Bhupesh Anuja, Shashank Singh UC. Review of temperature measurement. Rev Sci Instrum. 2000;71(8):2959–78.
[9]. Emmanuel C. Ogu OO. Temperature control system. 2017 IEEE Cent Am Panama Student Conf CONESCAPAN 2017. 2018;2018-Janua(February):1–7.
[10]. Miralles V, Huerre A, Malloggi F, Jullien M-C. A Review of Heating and Temperature Control in Microfluidic Systems: Techniques and Applications. Vol. 3, Diagnostics. 2013. 33–67 p.
[11]. Jain V, Arya S, Gupta R. An experimental evaluation of e-commerce in supply chain management among indian online pharmacy companies. Int J Recent Technol Eng. 2019;
[12]. Dhingra V, Mudgal RK, Dhingra M. Safe and Healthy Work Environment: A Study of Artisans of Indian Metalware Handicraft Industry. Manag Labour Stud. 2017;
[13]. Akhtar M, Mittal RK. Enterprise performance management and flexibility: Factors of effectiveness in upstream oil industry in india. Glob J Flex Syst Manag. 2010;
[14]. Singh BK, Singh AK, Singh VK. Exposure assessment of traffic-related air pollution on human health - a case study of a metropolitan city. Environ Eng Manag J. 2018;
[15]. Tyagi S, Dwivedi RK, Saxena AK. A novel data hiding tool based on pvd: Steganopixtrans. Int J Sci Technol Res. 2019;
[16]. Tomlinson CJ, Chapman L, Thornes JE, Baker C. Remote sensing land surface temperature for meteorology and climatology: A review. Meteorol Appl. 2011;18(3):296–306.
[17]. Christenson J. Sensors and transducers. In: Handbook of Biomechatronics. 2018.
[18]. TEC1-12706-Peltier-Cooler-800x600.
[19]. Thermostat-Page.
[20]. Real Time Based Temperature Control Using Arduino. Int J Innov Eng Technol. 2017;
[21]. Nkomo SM. The Emperor Has No Clothes: Rewriting "Race in Organizations." Acad Manag Rev. 1992;17(3):487–513.
[22]. III CAO, Caldwell DF, Barnett WP. Work Group Demography, Social Integration, and Turnover. Adm Sci Q. 1989;34(1):21.
[23]. Rotter NG, O'Connell AN. The relationships among sex-role orientation, cognitive complexity, and tolerance for ambiguity. Sex Roles. 1982;8(12):1209–20.
[24]. Adler NJ. International dimensions of organizational behavior. Int Exec. 1986;28(1):31–2.
[25]. Cox TH, Lobel SA, McLeod PL. Effects of Ethnic Group Cultural Differences on Cooperative and Competitive Behavior On a Group Task. Acad Manag J. 1991;34(4):827–47.

