IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 10, Issue 4, April 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.122

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 4, April 2021||

DOI:10.15662/IJAREEIE.2021.1004034

PLC SCADA Based Temperature Detection & Controlling System

Vaishnavi Patil, Maithilee Alave, Tejal Barhate, Rajashri Dandge, Prof. Veena Darala

UG Student, Dept. of EE, MGM College of Engineering & Technology, Kamothe, Navi Mumbai, India

AssistantProfessor, Dept. of EE, MGM College of Engineering & Technology, Kamothe, Navi Mumbai, India

ABSTRACT: Automation in the industrial workplace provides the advantages of improving productivity and quality while reducing errors and waste, increasing safety, and adding flexibility to the manufacturing process. Automation is capable of greatly improving the efficiency of manufacturing operations at the same time it reduced costs. It also allows one single facility to produce a variety of products and boost output (a machine capable of packing a large number of units per minute or hour can improve a company's bottom line). Targeting at the problem of slow response and low accuracy of the automatic temperature control system for material processing and boiler heating, a new design method is proposed to work with the PLC-based temperature control system, where the temperature control may be achieved through the fan and the heating plate. The hardware design and software design of the system are analysed in detail. In this paper, a combination of the temperature controller is taken as the control program to achieve the overall design of the control algorithm. Main concept of our paper is data acquisition & controlling by using SCADA and PLC.

KEYWORDS:PLC, Temperature Controller, SCADA, RTD

I. INTRODUCTION

The modern sensing technology and control methods are undergoing continuous innovation, where the real-time temperature control is demanding higher accuracy and faster response more than ever. Temperature control is widely used in production and industrial control processes in all aspects. For example, in the iron and steel smelting process, iron and steel to be baked requires heat treatment in order to achieve their performance indicators; plastic qualitative process also needs to maintain a certain temperature range. The fact is that the temperature control system is a complex process object involving large inertia and pure delay with multi-variable and time-varying parameters. At present, the PID control methodology is adopted in most cases. In this way, different PID parameters should be selected for different control objects, for which some practical experience is needed. As a language controller, the PID control is to imitate the way of human thinking and experience to achieve its control process that can more closely reflect the best control behaviour of the controller.

With strong robustness and control stability, it can be applied to different control objects. The combination of PID control and PLC, which is widely used in industrial control, is one of the hotspots in this research area. There are possibilities of errors in the measurements various stages involved with human workers. So advanced measurement and monitoring system is required to avoid failures, and are achieved by Programmable Logic Controller (PLC) and Supervisory Control and Data Acquisition system (SCADA). SCADA is used for continuous visual monitoring of tank temperature. The SCADA system is conceptualized and developed to generate reports and trends of the data recorders in the SCADA system.

The proposed system is capable of performing real-time measurement of industrial physical parameters data that can be efficiently transferred from PLC to a SCADA system. Temperature control has a very important role in industrial/home applications and is difficult to be implemented through ordinary control techniques. PID controllers are widely used in temperature control. PID Proportional, Integral Derivative Controller are in itself a separate controller, but when combined together gives optimized control for the system. Though the effect of individual parameter Proportion Gain (Kp), Integral Gain (Ki) Derivative Gain (Kd) are known, to demonstrate its effect, Automation plant consisting of PLC SCADA is developed.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 4, April 2021||

DOI:10.15662/IJAREEIE.2021.1004034

The purpose of the automation plant is to heat up a particular solution to a desired temperature with the mini-mum overshoot and in minimum time, in other word the optimum result. It is necessary to operate the system in closed loop to ensure the system temperature meets with the desired set-point. System is implemented using negative feedback principle where the controlled variable is increased when the process variable is smaller than the set-point and vice versa.

II. SYSTEM DESIGN

In this design, the temperature control system consists of hardware and software components. The sensor or measuring element measures information about the control variable and the information goes to controller where this value is compared with the desired value of the control variable that is set point and error signal generated, depending on this error signal the controller decides what action to be taken so that this control variable is driven to the desired value of control variable. So, controller takes decision it is work as a closed loop system figure 1.

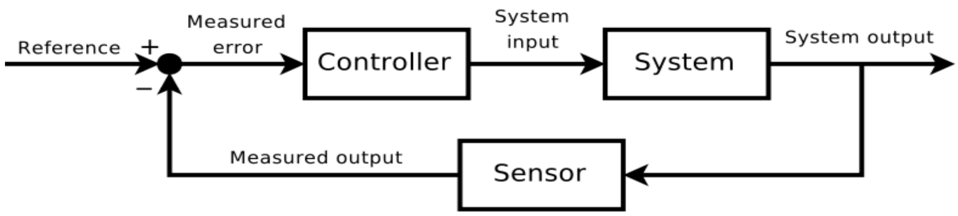


Fig.1 Block Diagram ofClosed-loopControlSystem

So, if measure the temperature the information goes to the controller and the controller decides the opening of the control valve. The information goes to controller the controllerdecides what is to be done and accordingly changes the opening of valve. So, every control give feedback & control system willhave at least one measuring sensor or measuring instrument. Feedback control system is widely used for control of temperature in process industry. Measurement is an essential activity in every branch of science andtechnology.

A. TEMPERATURE CONTROLLER

A temperature controller is a device that is used to control temperature. It does this by first measuring the temperature (process variable), it then compares it to the desired value (set value). The difference between these values is known as the error (Deviation). Temperature controllers use this error to decide how much heating or cooling is required to bring the process temperature back to the desired value. Once this calculation is complete the controller will produce an output signal that effects the change required. This output signal is known as the (manipulated value) and is normally connected to a heater, control valve, fan or some other "final control element" which actually injects or removes heat from the process.

Closed loop control is far more sophisticated than open loop. In a closed loop application, the output temperature is constantly measured and adjusted to maintain a constant output at the desired temperature. Closed loop control is always conscious of the output signal and will feed this back into the control process.

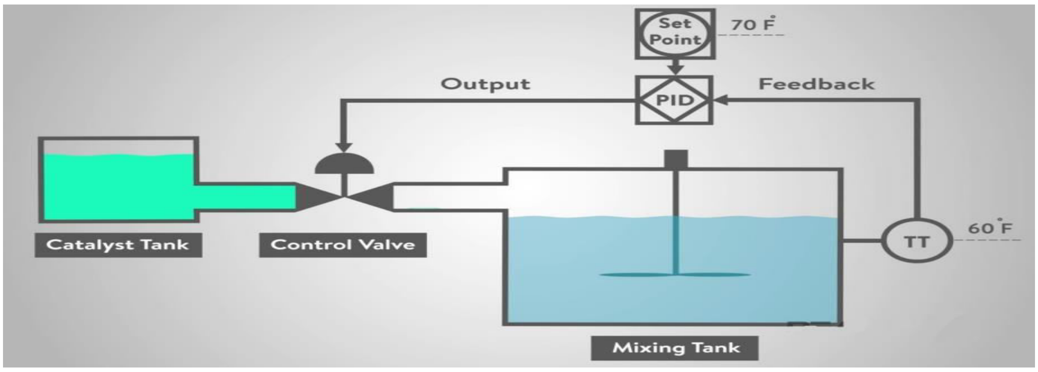


Fig.2 Overall Closed-loopControlSystem

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 4, April 2021||

DOI:10.15662/IJAREEIE.2021.1004034

B. PID

PID usually refers to a form of closed-loop control; named for the terms Proportional, Integral and Derivative. PID controllers are often used in temperature control. It's a fairly general term as it has been implemented in hundreds of different forms.

A PID loop can be implemented on a PLC. When not fully understand a system and the controlled object, or cannot be measured through effective means to obtain the system parameters, the most suitable PID control technology. PID controller is based on the error of the system, using a proportional, integral, differential, the calculated control amount is controlled.

In automation programming, we are often required to program a control loop for a given process to control temperature. This requires a target set-point with a controlled feedback process variable.A PID process loop controller is designed to generate an output that causes some corrective effort to be applied to a process so as to drive a measurable process variable towards the desired set-point value.

C. RTD

RTDs devices with resistance that changes with temperature changes in a linear way. This resistance value will change as temperature changes and by supplying a constant current, the measured voltage drop across the resistor can be used to determine the new resistance, and thus the temperature. RTDs come in a variety of types, with the most common type is a PT100. It’s made from platinum that has been calibrated to be 100 ohms at 0 degrees C. [2]

To measure material temperature of the tank, for that we use RTD sensor which will measure temperature of the tank and give signal to the temperature controller. Temperature controller will send signal in the form of voltage (0-10V DC). If RTD detect 0degree temperature, it will send 0V DC and if maximum temperature detected, it will send 10V DC to PLC. Temperature controller is directly connected to the PLC so PLC will read voltage. To measure material temperature of the tank by using RTD sensor. And also consider other components for control purpose. Assume Scaling range of temperature controller is 0-100°C=0 to 10V DC and according to this signal PLC consider 0 to 27648.

D. PLC

A programmable logic controller (PLC) is a special form of microprocessor-based controller that uses programmable memory to store instructions and to implement functions such as logical, sequencing, timing, counting and arithmetic to control machine and processes. PLCs have rugged CPU, digital I/O, analog I/O and communication modules such that they can operate at industry environment conditions to control the various process parameters using the program written in accordance with the industrial process. They are programmed using application software on personal computers. The software allows users to create, edit, document, store and troubleshoot programs. The most commonly used programming language for PLC is ladder programming, which is easier for any operator to understand, operate, write and debug.[4]

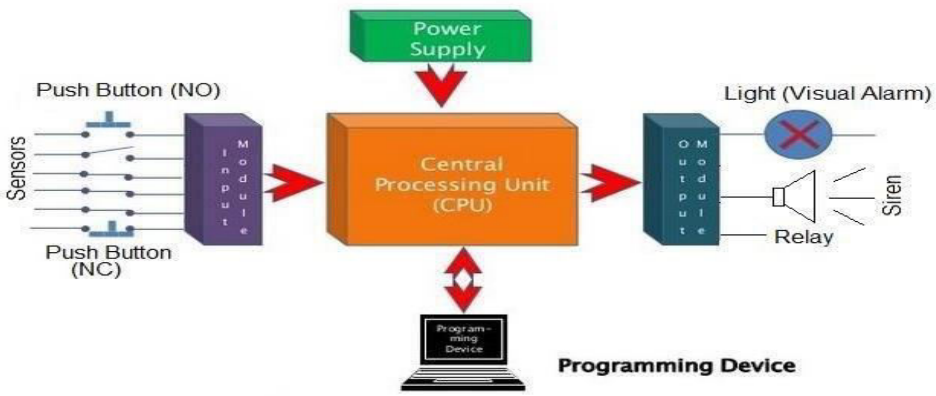


Fig.3BlockdiagramofPLCsystem

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE)

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 4, April 2021||

DOI:10.15662/IJAREEIE.2021.1004034

E. PLC LADDER LOGIC

In this system we will consider S7-1200 PLC and TIA portal software for configuration. For S7-1200 PLC we need TIA portal software for configuration of hardware.

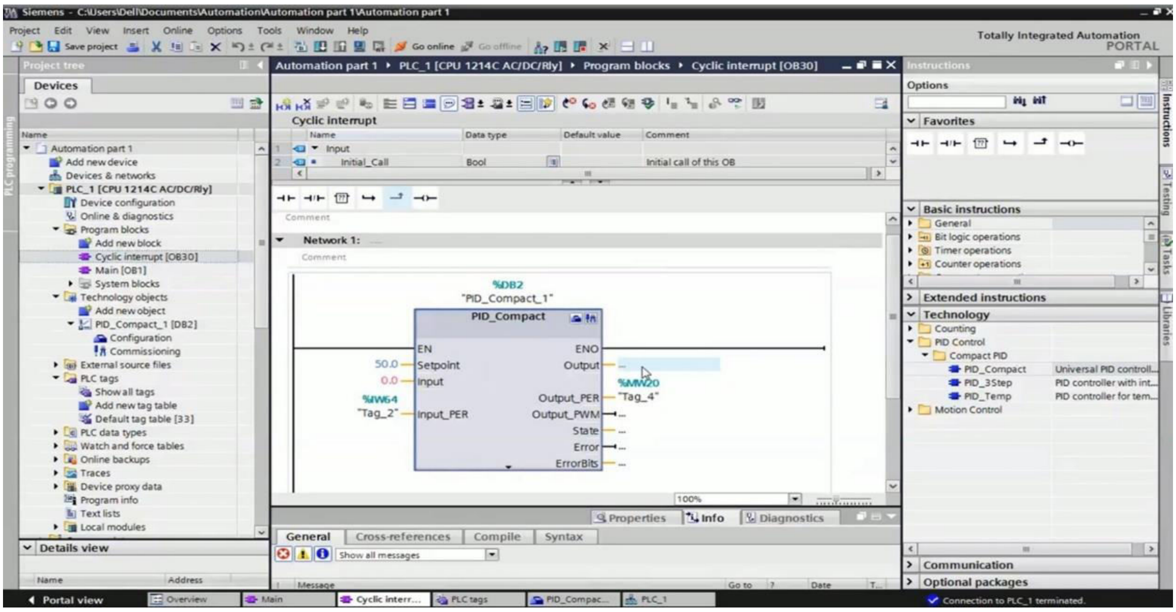


Fig.4 Ladder Logic (offline mode)

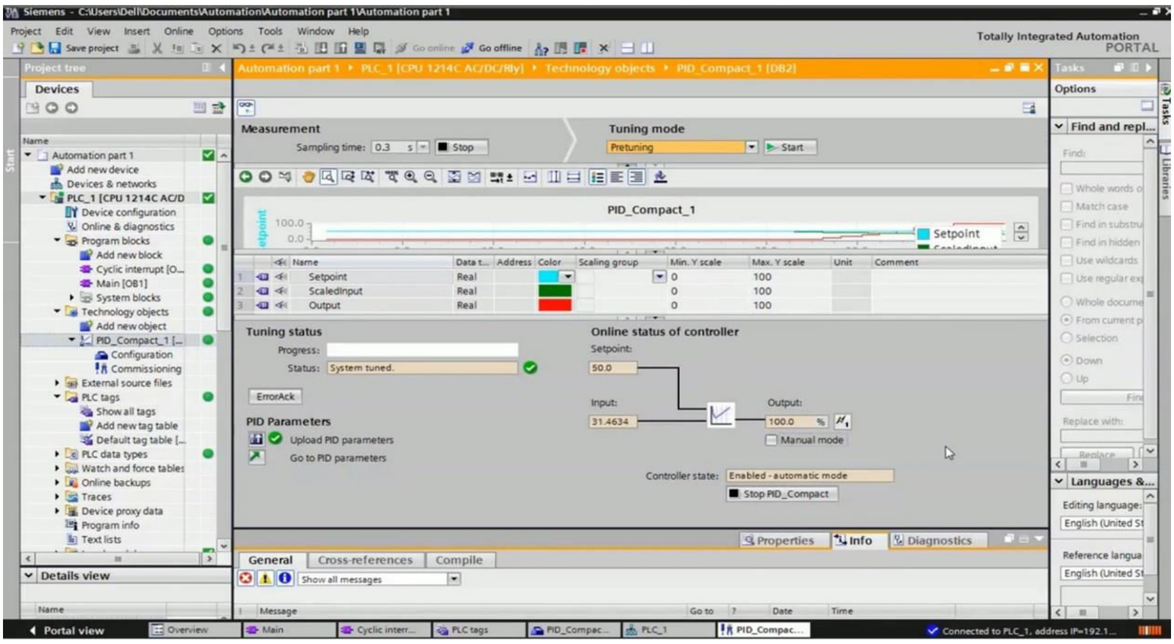


Fig.5 Ladder Logic (run mode)

Output:

1) If the temperature greater than 60°C, then the Fan ON.

2) If the temperature greater than 70°C, then the Alarm ON.

3) If the temperature greater than 73°C, then the Cooling system ON.

4) If the temperature greater than 75°C, then the whole system gets shut down.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 4, April 2021||

DOI:10.15662/IJAREEIE.2021.1004034

F. SCADA

Supervisory control and data acquisition (SCADA) are a control system architecture that uses computers, networked data communications and graphical user interface for high level process supervisory management. The SCADA concept was developed as a universal means of remote access to a variety of local control modules. It is one of the most commonly used types of industrial control systems. Data Acquisition and Control Systems have gained much larger importance in the Industrial field because of the rapid Technological advancement and Security reasons.

To interface PLC with SCADA first we have to establish a proper communication channel. The monitoring PC's communications or network port link is connected with the cable (usually) that connects to the PLC. The next step is to ensure that both the systems can communicate with each other. At last you need to set up the SCADA server to collect information from the PLC system across the network. Typically, this is done by having names or addresses in the SCADA chart of usually similar names. After completing these steps, PLC SCADA system is now able to communicate with each other. The details vary greatly from manufacturer to manufacturer.

G. SCADA DESIGN

For monitoring the system, we used the SCADA application. The software used for designing of SCADA is Wonderware Intouch.

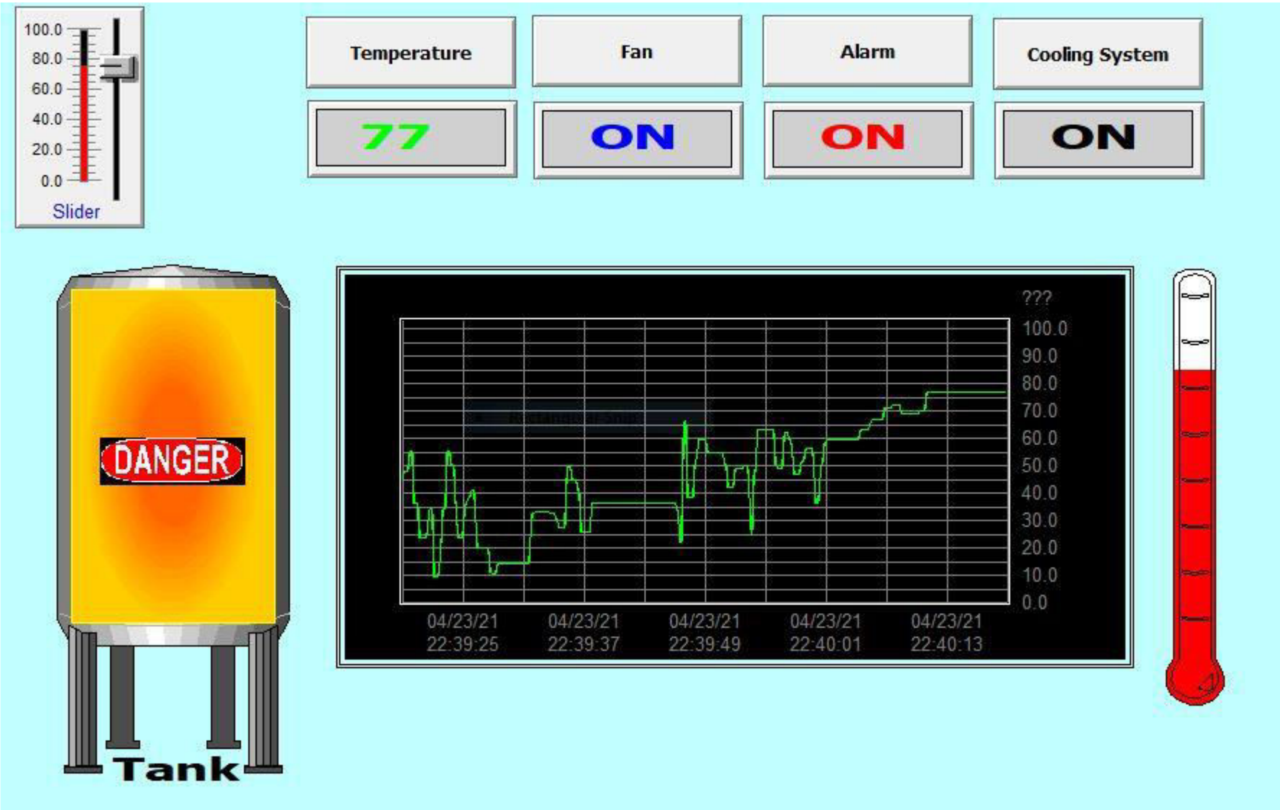


Fig.6 SCADA Design

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 10, Issue 4, April 2021||

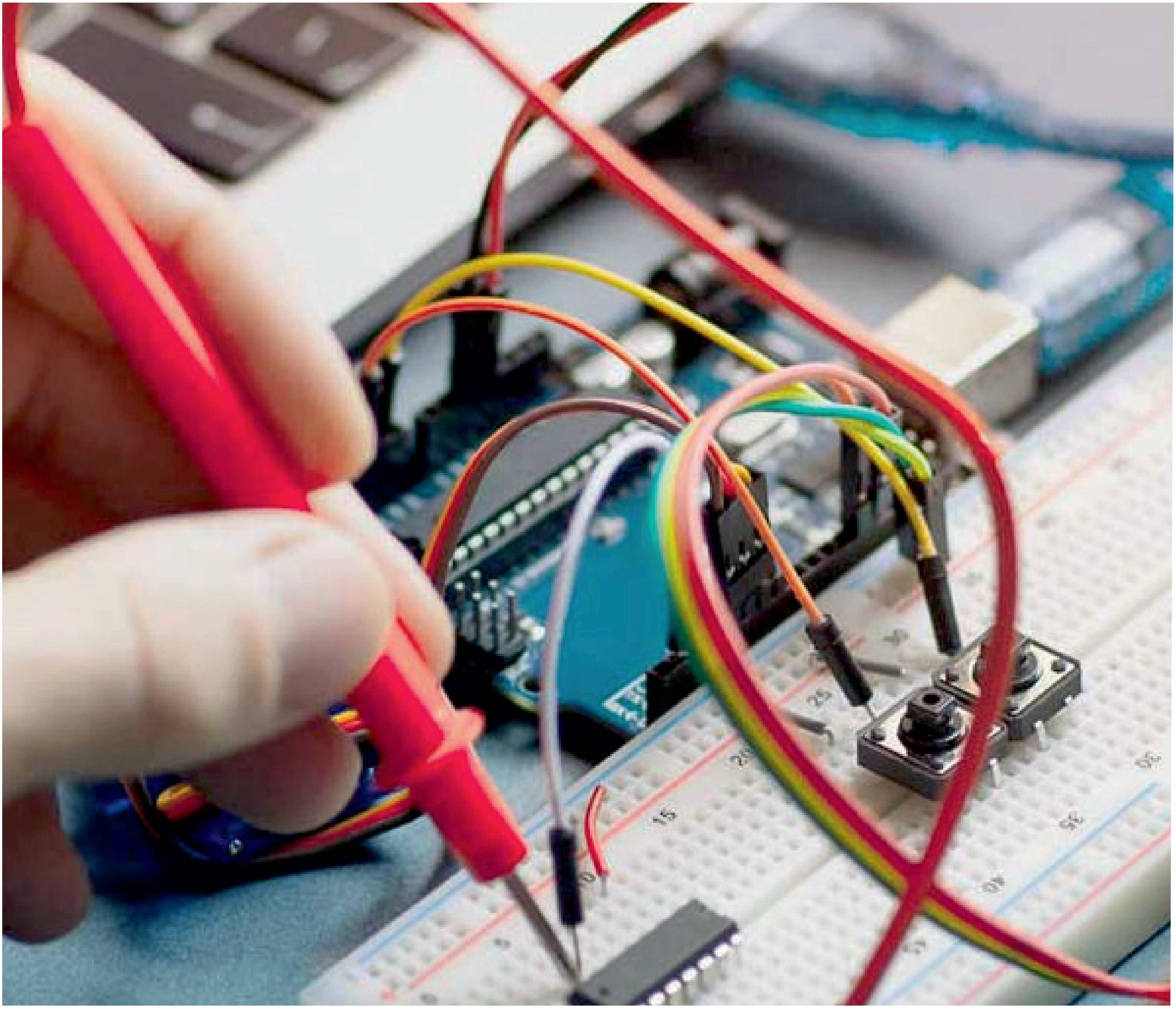
DOI:10.15662/IJAREEIE.2021.1004034

III. CONCLUSION

In this paper, Temperature Detection & Controlling System using PLC and SCADA was designed. Resistance Temperature Detector is used to measure the temperature. If the system temperature greater than 60°C, then the Fan ON.If the temperature greater than 70°C,then the Alarm ON.If the temperature greater than 73°C,then the Cooling system ON.If the temperature greater than 75°C, then the whole system gets shut down. SCADA is used to monitor the parameters and PLC used to control the operation. The programmable controller has strong anti-interference ability and programming is simple, easy to learn and use by the project operator, like in the industrial field. This article is designed temperature monitoring system based on SIEMENS PLC. RTD allows the temperature reaches the set value, and the system compares the current temperature and set temperature, temperature control; beyond the set value, the system will alarm. The system has good stability, high reliability, and broad application prospects.

REFERENCES

1. TIDA-0095 RTD Temperature Transmitter for 2-Wire, 4 to 20-mA Current Loop Systems, TIDU182 Application Report
2. https://www.te.com/
3. TI Precision Designs: 0-1A, Single-Supply, Low-Side, Current Sensing Solution, TIDU040
4. https://www.electronicsforu.com/market-verticals/automation/industrial-automation-scada-hmi-plc
5. TI Precision Designs: Ratiometric 3-Wire RTD Acquisition System, 0 °C – 100 °C, 0.005% FSR, SLAU520
6. Example Temperature Measurement Applications Using the ADS1247 and ADS1248, Application Report SBAA180
7. Signal Conditioning and Linearization of RTD Sensors, 2011 Texas Instruments Technology Day Presentation, Collin Wells
8. http://www.omega.com
9. https://www.wikipedia.org
10. http://paper.ijcsns.org/07_book/201108/20110821.pdf



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 7.122

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर
NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering