Controlling and Monitoring of Boiler Parameters using Scada

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Abstract

The control and monitoring of heater operation are covered in this paper. A boiler is a large component in an enterprise that heats water and produces steam. Steam can be utilised to run turbines or engines. In this project, the boiler's functioning is controlled by a PIC microcontroller, which regulates the boiler's temperature and pressure. This is due to the fact that PICs are highly adaptable, low-cost, space-efficient, and reduce complexity. The data from the microcontroller is received by SCADA and shown on the screen. The suggested boiler automation ensures that the boiler system, and thus the power production plant, runs safely, reliably, and continuously.Boilers are used in many industrial and commercial buildings to create hot water or steam for space or process heating. Boiler setup is made using LPG cylinder and heater is placed in the cylinder so that it acts as boiler. Pressure and temperature sensor is used to measure the both pressure and temperature in the boiler. To control temperature, pump is placed and when the temperature goes beyond the certain level pump automatically turns ON and the feedwater is supplied. When the pressure goes beyond the limit solenoid valve turns ON and steam released through the solenoid valve. LCD is placed to monitor the values from outside. This page discusses the many type of boilers are used to heat buildings, as well as fundamental boiler controls and factors that influence energy efficiency.

Keywords: *(Supervisory Control and Data Acquisition),PIC microcontroller, boiler, temperature and pressure.*

1. Introduction

Boiler was a closed vessel that heats water and produces water or steam by burning of fuel or the reaction of electrode or electrical resistance components. Several industrial and commercial buildings are using boiler to generate hot water for space or process heating. Boilers are large energy consumers, and anyone involved in the energy management of a facility needs to understand how they work and how their

performance can be maintained or improved. It's necessary to understand which boiler system parameters are the most important.The most essential metric of relevance in fuel burned boilers is combustion efficiency, which is largely managed by delivering the right amount of combustion air to combine with the fuel. As a result, knowing boiler control systems is critical. Steam and water boilers come in a variety of size, ranging from the apartment and house boilers to enormous commercial and industrial boilers. Water temperature and steam pressure are used to classify boilers. They are further classed based on the type of metal used in construction the type of fuel or heating element or the relationship between fire and water with the pipes (i.e., fire-pipe or water-pipe). Low-pressure boilers are one that can produce steam upto 15 pounds per square inch or hot water up to 250 degrees Fahrenheit at pressures up to 160 pounds per square inch. Medium and high-pressure boilers create steam with a pressure greater than 15 psig or hot water with a pressure greater than 160 psig or 250°F, or both Cast iron or welded steel are commonly used in the construction of boilers. Individually cast sections of cast iron boilers are joined to one another via screws, nuts, tie rods, or threaded rivets. To give a range of capacities, the number of sections can be adjusted.

2. Literature Survey

K. Gowri Shankar (2008) [1] there are numerous work phases needed in converting a manually operated boiler to a fully automatic boiler are outlined in this document. The demand for high-quality, more efficient, and automated machines has grown over time in this globalised world. The first section of the paper focuses on running the inputs into the boiler at a specific temperature in order to maintain a constant temperature in the boiler. This is made easier by the air preheater and the economizer. The study primarily focuses on the regulation of level, pressure, and flow in the various phases of the boiler. The temperature in the boiler is constantly monitored and raised to the power plant's prescribed level.

Ning Cai et. al., (2008) [2] given an overview of SCADA security's difficulty Control network security products and applications are discussed. In addition, current advancements in SCADA security will be discussed, particularly the trend in technical and theoretical investigations. Some critical SCADA security challenges are recognised and addressed, and this paper can serve as a roadmap for future work in this field. For several years, SCADA system security has been the focus of research, standardisation, and industrial practise. Due to the openness of SCADA network platforms, the improvement of hacking techniques, and the rising availability of hacking tools, attacks on SCADA systems are becoming increasingly widespread.

M. N. Lakhoua, (2010) [3], showed the uses of a SCADA systems are used in TPPs. In reality, a monitoring system must take into consideration the monitoring operator's physiological and cognitive qualities. On the one hand, the paper clearly describes the many processes of implementing a SCADA system and the challenges that come with it, and on the other, it offers three examples of SCADA system implementation at a TPP in Tunisia, as well as the instrumentation and measurements that were used. The first use is for a natural gas metering system, the second is for pump vibration monitoring, and the third is for monitoring heavy oil.

S.Kalaivani, M.Jagadeeswari, (2015)[4] PLC, SCADA, and sensors were used to design and create a boiler automation system. A communication connection connects the PLC and the SCADA. The first part of the paper focuse on running the i/p into the boiler at a specific temperature in order to maintain a constant temperature of the boiler. With the help of numerous sensors, SCADA monitors boiler temperature, pressure, and water level, as

well as the output is sent to a PLC that controls boiler temperature, pressure, and water level. The entire system will be shut down if the temperature and pressure inside the boiler reach the predetermined value. Various automated non-return valves are utilised in the event of an emergency to release pressure and steam while also alerting the proper authority via an alarm. WPL software was used to create the boiler automation ladder diagram, while Intouch Wonderware created the SCADA design.

Olga V. Kolesnikova et. al. (2018) [5], For boilers with a three-stage steam cooling system, an automatic superheated temperature control system is considered. A force signal is used to correct temperature errors, and a cascade control mechanism is used to operate the system. The force signal represents the rate of change in vapour temperature following condensate injection. The author describes the mathematical model for boiler steam cooling. The model accounts for the non-linear character of a real boiler's isolation and control valves. Simulink (Matlab) was used to create the model, which was then tested using real data from a steam boiler. According to results, the boiler superheat steam temperature control method has acceptable quality features, implying effective control.

Sudip Phuyal et. al. (2020) [6], SCADA code was provided that was written in C# and successfully tested in the monitoring and control of industrial processes. The SCADA developed can remotely monitor, control, and monitor facilities, as well as log data to an IoT server. This strategy has proven to be effective in both technical and financial terms.

3. Components and its functions

3.1. DC motor

The DC motor is a device. In this device electrical energy is converted into mechanical energy. This paper uses a 3V DC motor for lawnmower movement.

3.2. Buck Converter

An isolated DC converter was referred to as a direct buck converter. Non-isolated converters are ideal for any circuit that requires local conversion at the board level.

3.3. Battery

It energizes the controller, motor driver of the robot. Since in this paper the proposed prototype is being small 9V battery was used. The battery size depends upon the size of the prototype and the controller.

3.5. Relay

Relay is used for controlling the various devices or other types of large current devices. The output of the relay is 250V and 10A in AC and 12V and 10A in DC. This relay module has many applications. Few examples are MCU, industrial field, PLC, and smart home control.

3.6. PIC16F877

The PIC16F877 is part of a family of RISC-based 8-bit microcontrollers. It has 8 KB of flash memory, which can be used to store a written application. This microcontroller is useful for device development since FLASH memory may be programmed and erased several times.

3.7. Solenoid valve

The function of a solenoid valve is to open or close an orifice in the valve body, allowing or obstructing flow through the valve. A piston opens or shuts the aperture by raising or lowering it within a sleeve tube after energising the coil. A solenoid valve is made comprised of a coil, a piston, and a sleeve.

3.8. Pressure sensor

Pressure sensors are widely used to determine a tank's level or the rate at which its level changes (as shown in the diagram to the right). The sensor is attached to the top of an open-ended tank-immersed tube. As the level rises,

the air above the pipe compresses, raising the pressure of the sensor.

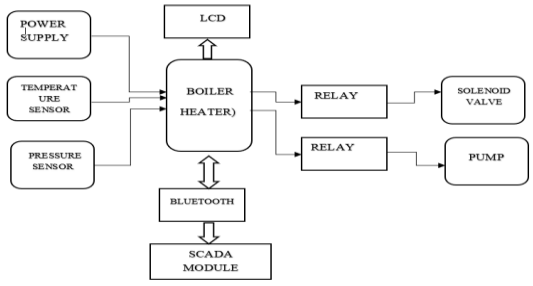
3.9. Temperature sensor

The LM35 was a precision integrated circuit temperature sensor with a proportional output (in oC). A sensor circuit is not subject to oxidation or other processes because it was sealed. The LM35 should be used to measure temperature more precisely than a thermistor. It also possessed a mild self-heating capability, creating a temperature rise of no more than 0.1oC in still air.

4. Block diagram

The Block diagram of controlling and monitoring of SCADA were shown in below figure. Temperature sensor, pressure sensor, boiler, relay. pump, solenoid valve and LCD are the components involved in this project. The boiler setup is done using LPG cylinder and fitting a heater into the cylinder. Temperature sensor and pressure sensor is places on the cylinder. The sensed values are directly fed to SCADA software installed on the mobile phone through Bluetooth. Then, through controlling unit, the controlling process is done. The controlling unit includes relays, pump and solenoid valve. When the temperature exceeds the specified value, the pump turns ON and the feedwater is supplied. when the pressure reaches the specified value the solenoid valve turns ON and the steam escaped through it.

Fig.4 Block diagram of proposed work



5. Hardware and software implementation

Boiler setup is made using LPG cylinder and heater is placed inside the cylinder so that it acts as boiler. The pressure and temperature inside the boiler are measured using a pressure sensor and a temperature sensor, respectively.To control temperature, pump is placed and when the temperature goes beyond the certain level pump automatically turns ON and the feedwater is supplied. When the pressure goes beyond the limit solenoid valve turns ON and steam released through the solenoid valve. LCD is placed to monitor the values from outside. The software setup the prototype in installed in the form of app in mobile phone and is conncted through the Bluetooth.

6.Existing Method

In industries it is necessary to control the boiler parameters like temperature and pressure. Because in large industries boiler plays an important role.so it is important to monitor the parameters perodically. In existing method there is no automatic controller for regulating boiler parameters like temperature and pressure manually it has to monitored and controlled with the help of man power.

7. Proposed Method

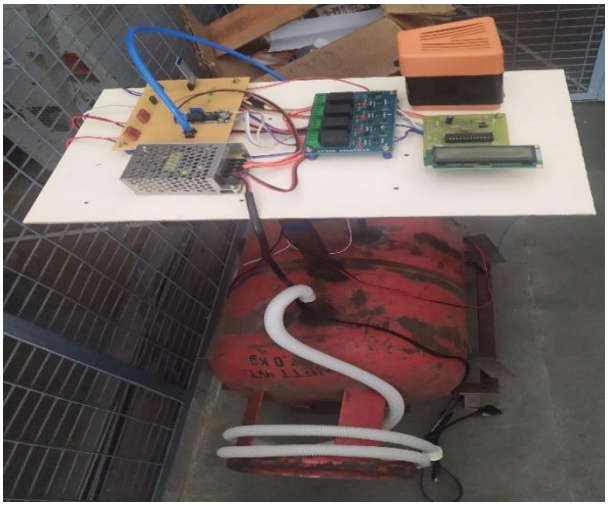
The proposed solution for this problem is to automate the process by using available technologies. The boiler parameters are (temperature and pressure) monitored using SCADA software. The SCADA software is installed in the mobile phone and through bluetooth the boiler parameters are monitored periodically. To control the temperature when it exceeds a specific limit pump is placed and feedwater is supplied. To control the pressure when it reaches a specified limit solenoid valve is placed and the steam escapes through it.

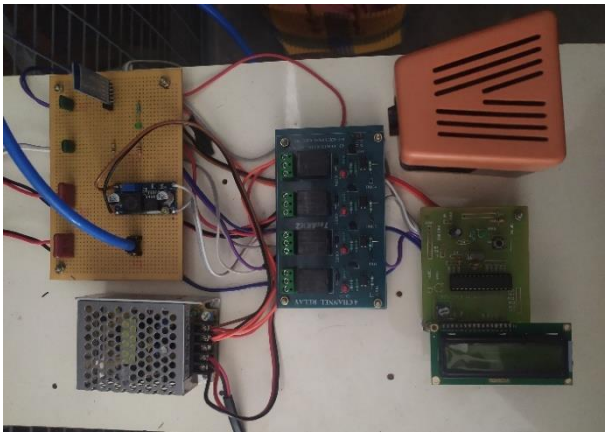
8. Result and Conclusion

The most energy-intensive machines are boilers. Understanding how a boiler works and

how to best operate it may save a lot of money on energy for residential, commercial, and industrial buildings. When the temperature increases beyond the specified limit the pump automatically turn ON and the feedwater is supplies and the temperature is controlled. Likewise, when the pressure of the boiler goes beyond the specified value the solenoid valve turned ON and the steam escapes through it.so, the expected output is obtained successfully.

Fig.6 Prototype of proposed work





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