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Pressure Reduced De-Superheated Steam System Using Microcontroller in Thermal Power Station

M.Gowri Shankar[1], B.Manikandan[2], N.Manjunath[2]

Assistant Professor, Department of EIE, Adhiyamaan College of Engineering, Hosur, Tamil Nadu, India[1]

UG Student, Department of EIE, Adhiyamaan College of Engineering, Hosur, Tamil Nadu, India[2]

ABSTRACT: In Thermal Power Plant, auxiliary steam plays an important role. The auxiliary steam is tapped from the main steam. The pressure requirement of auxiliary steam is different from that of main steam. To control and to maintain the requirements of the auxiliary steam pressure reduction and de-superheating(PRDS) system is used in Mettur Thermal Power Station-2. The PRDS system includes 30 modules of analog units to give control signal to the respective drives. The complexities and failure due to the discrete components are more.The proposed paper" REDUCED DE-SUPERHEATED SYSTEM BY USING MICROCONTROLLER "is aimed to reduced the complexities while controlling and maintaining the system parameters.In this paper a microcontroller has been used to provide control signals.The accuracy and speed of control system increased the cost of system and reduces consequently. The controller in addition can provide control over leakage of steam in worst cases.

KEYWORDS: Pressure reducing valve, nozzles, HFO atomizing.

I.INTRODUCTION

The Steam PRDS is used for Steam Conditioning Services for reduction of pressure and temperature of steam. It is a combination of Control Valve for the pressure reduction purpose and atomizing nozzles through which water is sprayed into steam for reducing the temperature. Typical applications are in Boiler steam, Turbine by-pass, HRS (Heat recovery steam Generation), and typical Process application where steam temperature and Pressure are critical. Normally steam will be produced in the Boiler with high pressure and temperature and depending on the process requirement, pressure and temperature will be reduced at the consumption point at the plant. This will help to reduce the energy losses during the transmission. PRDS systems are designed to reduce the steam pressure to operating pressure and also bring the outlet steam temperature closer to that of saturation. Suitably designed pressure reducing valve installed on superheated steam line, reduces steam pressure to desired operating pressure. During this process the steam temperature also reduces following superheated steam curve, however the degree of superheat remains unaltered. The steam temperature is reduced close to saturation by injecting water into high velocity steam by controlled water flow through water control valve. Spray water quantity required for the temperature reduction of International Journal of Latest Trends in Engineering and Technology (IJLTET). The steam is controlled by separate spray water valve. The spray water is injected into the steam where steam velocity and turbulence are at their highest, which gives quick and efficient cooling. For PRDS control system, there will be one Pressure loop and one temperature loop.Existing System: In this paper,the pressure reduced and valves are controlled using integrated circuits manually[1].The pressure reduction and de-superheating system is used for the control and the maintenance of the auxiliary steam parameters.There are two control loops to achieve the requirements steam pressure control,spray water injection control(temperature). The steam pressure at the main steam line is 130Kg/sq.cm.The pressure value is reduced to meet the requirements of the auxiliary steam.This is done by the pneumatic valve control action.The pressure after the pressure control valve is sensed and transmitted as 4-20mA current signal by pressure transmitter.The set signal from the control board is given as another input to the PI controller.When the pressure is higher than the requirement valve opening is reduced, when it is low the valve opening is increased to maintain a pressure of 15Kg/sq.cm. The "Self PRDS" system where steam is cut off from the main line into a common bus that can be utilized by the other units is subjected to various losses such as valve

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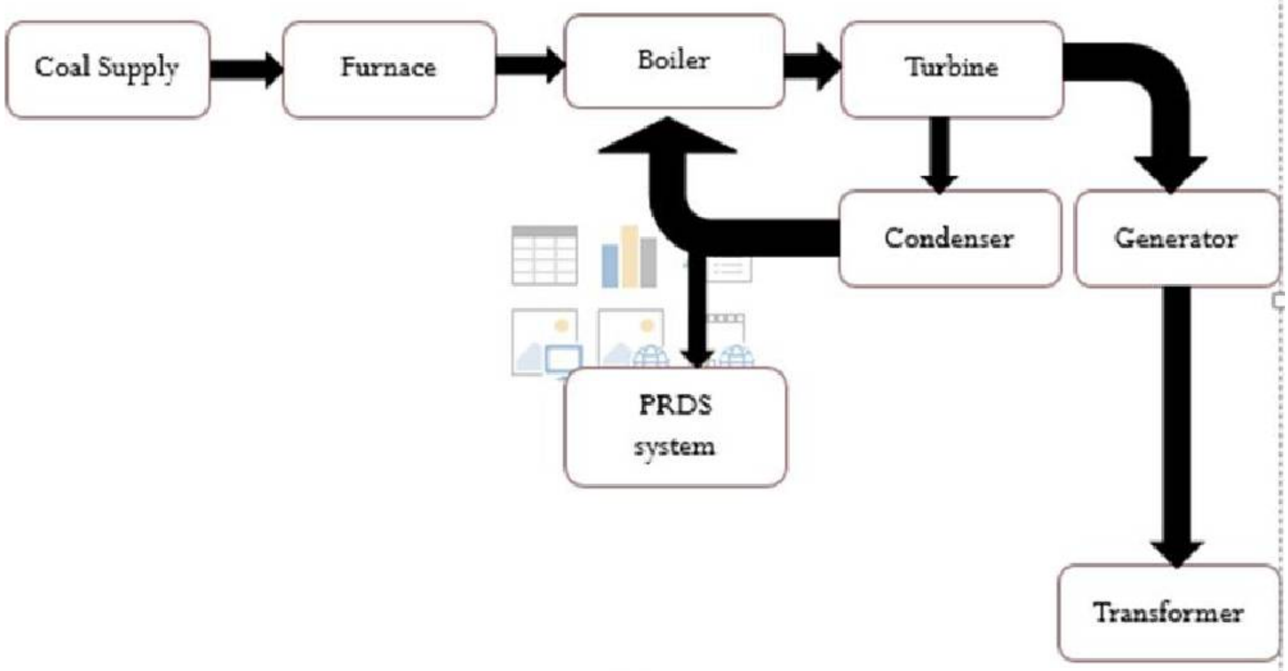
leakage, gland leakage, turbulence and vibration. The common factor attributing to this problem is the high pressure drop across the valves. So the main aim of our project is to perform an analysis for evaluation and optimization of the system by reducing the pressure gradually in stages in the main line of the PRDS system and to indicate the need for further research and recommendations for performance comparisons, assessments and improvement in design after identifying the potential areas of improvements. Due to the importance of the pressure reducing and de-superheating system the attention of the designers has been concentrated on this particular topic. The [1].

II. SYSTEM MODEL APPROACH



Pic Microcontroller: The Microcontroller that has been used for this project is from PIC series.PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instructions and data allowing simultaneous access of programming and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has in immunity to than other fabrication techniques.Digital To Analog Converter: The DAC0808 is an 8-bit monolithic digital to analog converter (DAC) featuring a full scale output current settling time of 150 ns while dissipating only 33MW with +5V supplies. No reference current(IREF) trimming is required for most applications since the full scale output current is typically 1 LSB of 255 IREF/256.Relative accuracies of better than +0.19% assure 8-bit monotonicity and linearity while zero level output current of less than 4MA provides 8-bit zero accuracy for IREF 2mA.Microcontroller Board: The reference input to the microcontroller is given by the keyboard through pull-up resistors (p1.0-p 1.4).The pressure (p0.0-p0.7) and temperature (p3.0-p3.7) values from the feedback loop are given to the controller via the bus. The control signals from the controller given to the latch and to the DAC.The Controller also provides the process the values to the LCD display(p1.5-p2.3).The ports(p2.4-p2.7)are used for the indication of normal and worst conditions. The pin number 18 and 19 are for delay calculation. Here crystal oscillator is used for this purpose. Here the microcontroller receives the temperature and pressure set values and then the microcontroller interprets the values gives that to the latches.Transformer: The potential transformer will step down the power supply 230V to 0-12V level.Then the secondary of transformer will be connected to micro bridge rectifier.The advantage of using micro bridge rectifier will give maximum peak voltage as

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DC, cost of the circuit is reduced and reduce the space for bulky components.Bridge Rectifier(W04):W04 is a single phase full wave micro bridge rectifier. This micro rectifier converts the given AC input to DC output with 4A current. It can accept 400V AC input for the rectification process and output will be 12V DC. It has operating temperature range from -55 deg.c to 125 deg.c and storage temperature range from -55 deg.c to 150 deg.c. It is more suitable for printed circuit board.it has moulded plastic cases and solder plated leads.Filter: Here capacitor acts as a filter.

III.SCHEMATIC DIAGRAM

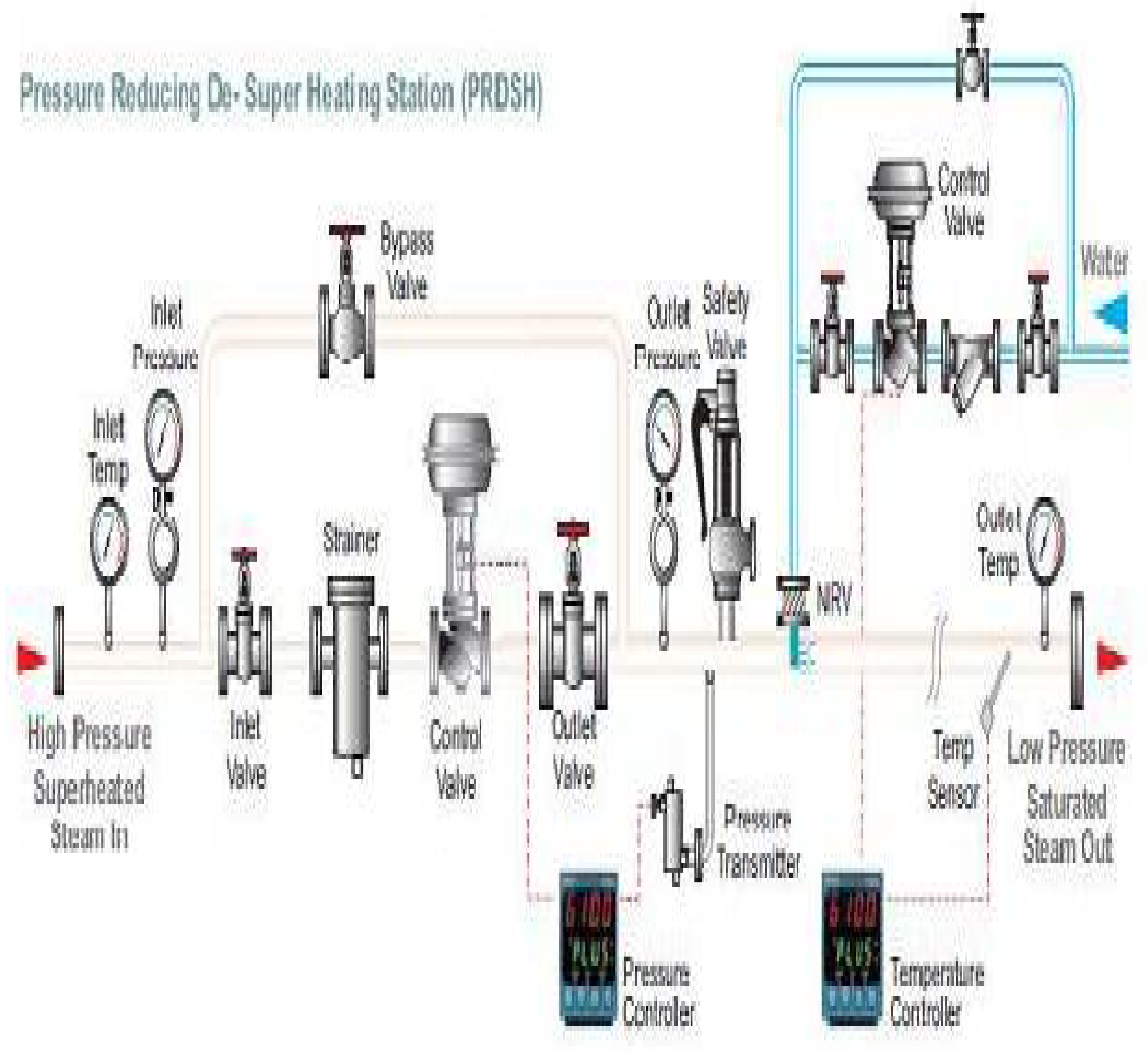

Figure1: schematic diagram for pressure reducing De-super Heating station In thermal power station the steam control is using the integrated circuit (*I.C).* By this method we are overcoming the disadvantage of old technology used in the thermal power plant. This new method greatly reduces the huge reduction of human interaction with the thermal boiler. This is mainly used to control the pressure and temperature of steam for heating the boiler. Mainly reduce the wastage

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V.RESULT AND IMPLEMENTATION

In this paper the Pressure reduced de-superheated steam system using microcontroller is used. In future it is possible to install the microcontroller based PRDS system in the Thermal power stations which may reduce the complexity during control operation and also reduce the size of the system. Further the system can be expanded for the leakage control also.FEATURES OF 16F877A:High-performance RISC CPU, Only 35 single word instruction to learn, All single cycle instructions except for program branches which are two cycles, Up to 8K x 14 words of flash memory, pin out compatible to the PIC 16C73/74/76/,Interrupt capability(up to 14 internal/external).Memory Organization:There are three memory blocks in each of the PIC16F877 MUC'S .The program memory and data memory have separate buses, so that concurrent access can occur.Program Memory Organization: PIC16F877 devices have a 13-bit program counter capable of addressing 8K*14 words of FLASH program memory. Accessing a location above the physically implemented address will cause a wrap around of fuel.

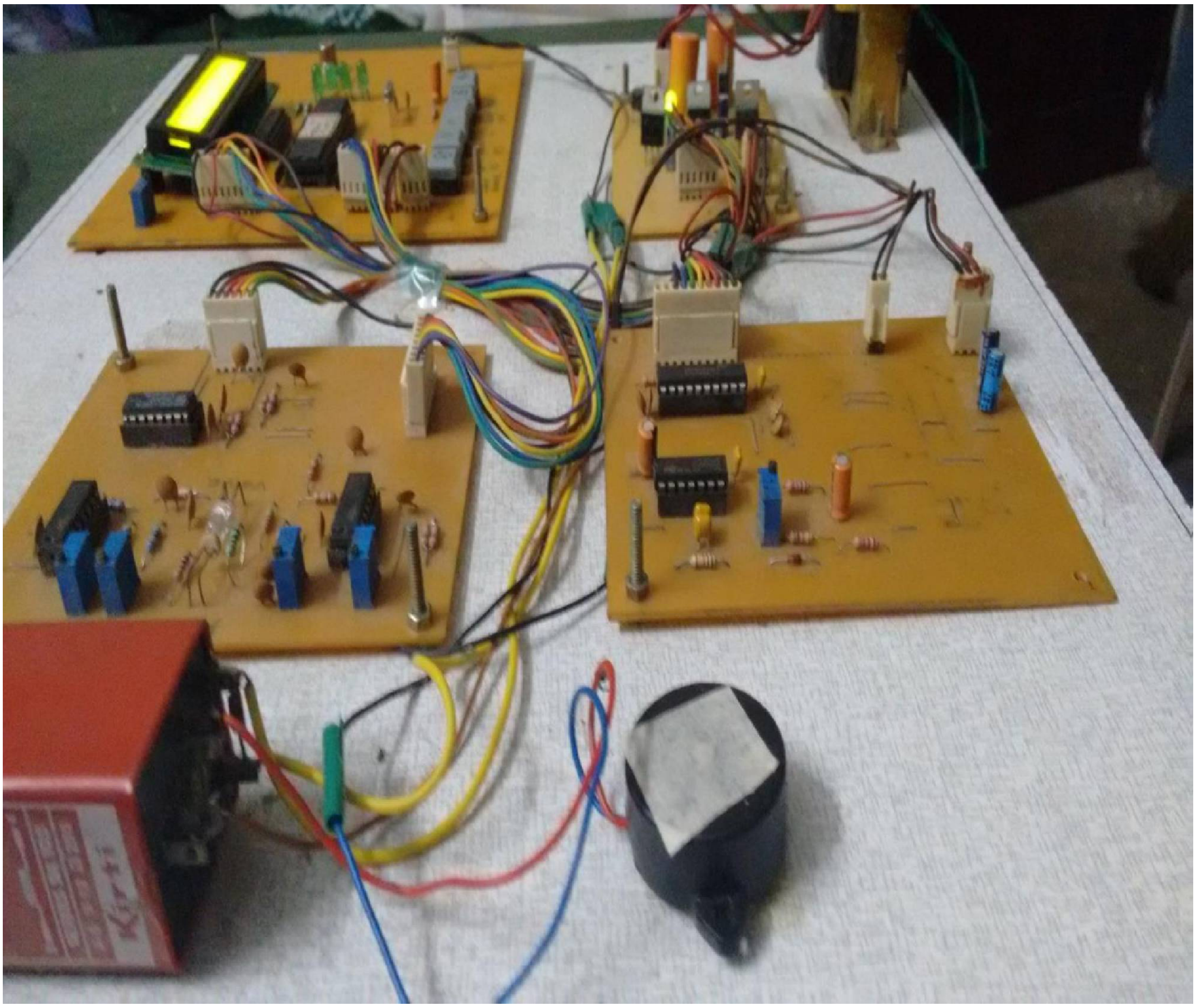

Figure2: Kit Diagram for pressure reducing De-super heating system

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Data Memory Organization: The data memory is partitioned into multiple banks which contain the general purpose registers and the special functions registers. Bits RP1(STATUS<6)RPO(STATUS<5)are the bank selected bits.In this paper we are reduced the pressure using microcontroller. For demo purpose, we reduced the control valve with help the led circuit, feedback by using an relay circuit, then we can set any pressure range and reached the required pressure for using LCD display, LED indication (OK).

APPLICATION AREA: ATOMIZING process, HFO(Heavy Fuel Oil) and HEATING process.

VI.CONCLUSION

The microcontroller based PRDS system makes the control easier and in addition it can be able to display the process value and provides indications during abnormalities. The prototype of this digitalized PRDS system is designed and tested for small loads and then the system seems to be faster and no appreciable errors have been detected. The design is much simpler and also economical. In future its is possible to install this microcontroller based PRDS system in the thermal power stations which may reduce the complexity during control operations and also reduce the size of the system. Further the system can be expanded for the leakage control also.

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