Multi-parameter monitoring & controlling for a Boiler using PIC controller

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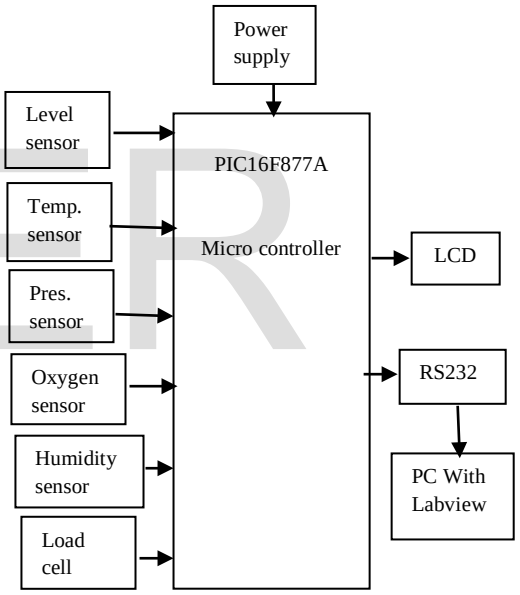
Abstract-In today's modern world, mechanical strength is only one of the many criteria, which decides the superiority of any boiler. There are many other more important aspects like efficiency, availability round the clock, ease in maintenance, environmental compliance, etc. The modern day high pressure boilers which are provided with optimised heat transfer areas for its rated duty require some of the important operating parameters to be controlled closely to maintain a steady output. Thought instrumentation is a very vast subject to be discussed, this paper highlights a few of the important instrumentation and control loops that are required for safe, economic and reliable working of the boilers.In this research project we are monitoring and controlling six important parameters with which the process output will be steady output.Here we are using sensors for the parameters are Temperature sensor,Pressure sensor,Oxygen sensor,Humidity sensor,Level sensor & load cell. This project used PIC microcontroller, sensors output produce the analog signal, This signal directly connected to PIC microcontroller. Controller output connect to RS232 with Pc using LABVIEW material. The results of simulation show that, after the fluctuations in the early control period, the controlled parameters tend to be stabilized guaranteeing the process quality in boiler.

I. Introduction

While it is theoretically possible to operate a boiler with manual control the operator must maintain a tedious, constant which for disturbances and variations of parameters. Time is needed for the boiler to respond to a correction and this lead to over correction with further upset to the boiler. An automatic controller once properly tuned will make the proper adjustment quickly to minimise upsets and will control the system more accurately and reliably.Apart from mechanical strength,it is control logic & instrumentation which decides the safety & reliability of any modern boiler.There are different types of process in which the parameters are to be controlled at specified range.So in this project we concentrated upon some parameters ,which are described below**.**

A. Boiler level monitoring & controlling system (Level sensor)
B. Temperature monitoring & controlling system (Temp.sensor)
C. Pressure monitoring & controlling system (pressure sensor)
D. Oxygen monitoring & controlling system (Oxygen sensor)
E. Humiidity monitoring system (Humidity sensor)
F. Boiler weight measurement system (Load cell)

The block diagram of proposed system is shown in figure (1)as below.



A . Boiler level monitoring & controlling system

Keeping proper water level in the boiler is of paramount importance from boiler safety point of view. This instrument maintains necessary operating water level by controlling the water inflow.In this we are using level sensor which detects the level of the liquid in the boiler.Here we use two level sensors one is low level & other is top level,which show the lower liquid & higher liquid level,so that the liquid level can be maintened with in a range .The following figure(2) shows that in manual configuration the water level increases,but after using level sensors trough controller it's level can be withstand with in 15 to 20 (say for any boiler level specified).

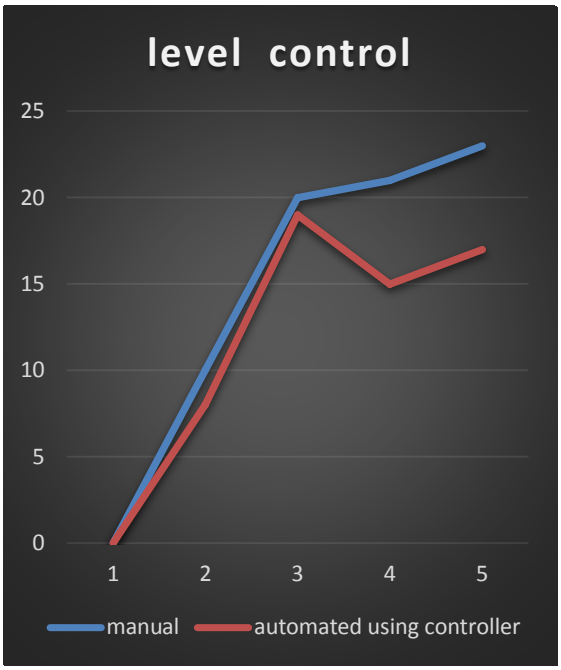


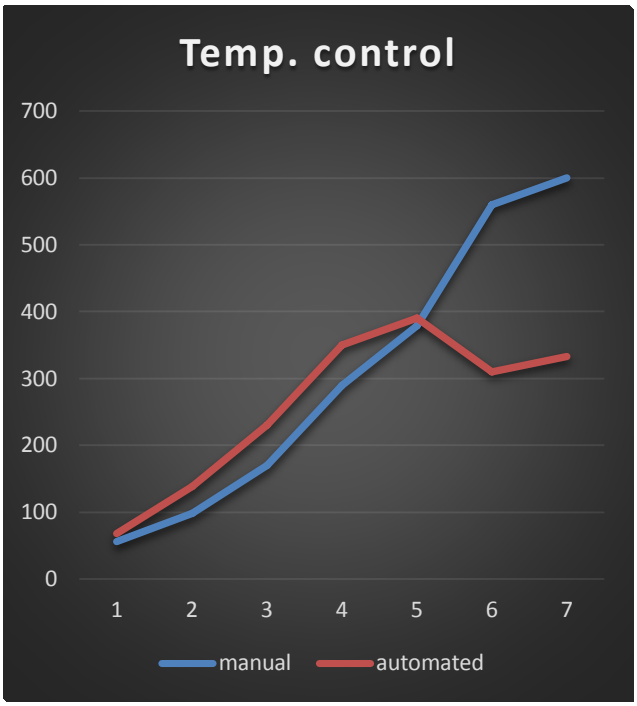
Figure (2):Level monitoring & controlling

So if top level sensor is mounted at 20 & low level sensor is mounted at 15 ,then level can be maintened between these two levels.

B. Temperature monitoring & controlling system

For heavy oil fired boilers, the fuel needs to be heated to reduce viscosity and improve atomization. Low fuel temp can result in incomplete combustion, unstable flame and backfiring. Fuel temp monitoring system should stop the burner firing below safe temp.Since different process requires different operating temperature range,so in this as temp. Varied initially but using controller we maintened the temperature range**.**The figure(3) shows the idea about the proposed system for temperature monitoring & controlling.

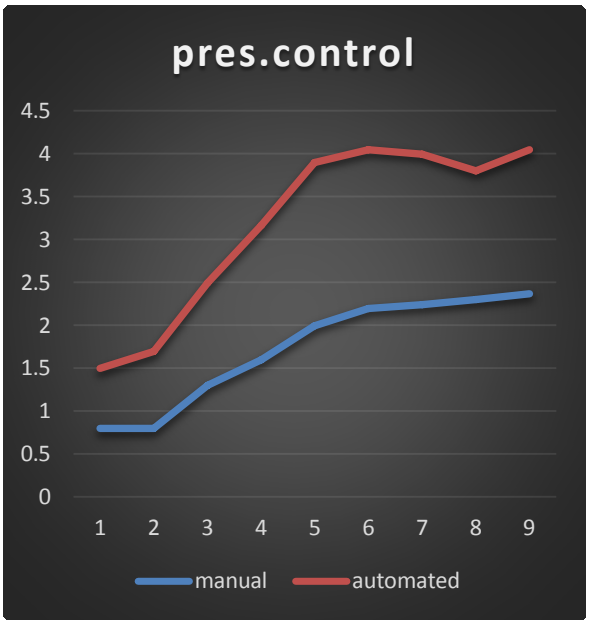
The above graph ,in manual control the boiler is heated and has no ability to control the temperature in the specified range.Let here the temperature range is taken for the process is 300°c to 400°c.But after using of temperature sensor and controlling the range through PIC controller it can be achieved



Figure(3):Temp.monitoring & controlling

C. Pressure monitoring & controlling system

This will ensure availability of air for combustion. Unavailability/ shortage of air results in similar situations mentioned above. The burner should trip automatically in case in case air is not sufficiently available.So to control the pressure of air with in a range specified for process ,we use pressure sensor which will maintain the pressure level.The below figure(4) shows how pressure is stable after initial stage using PIC controller.



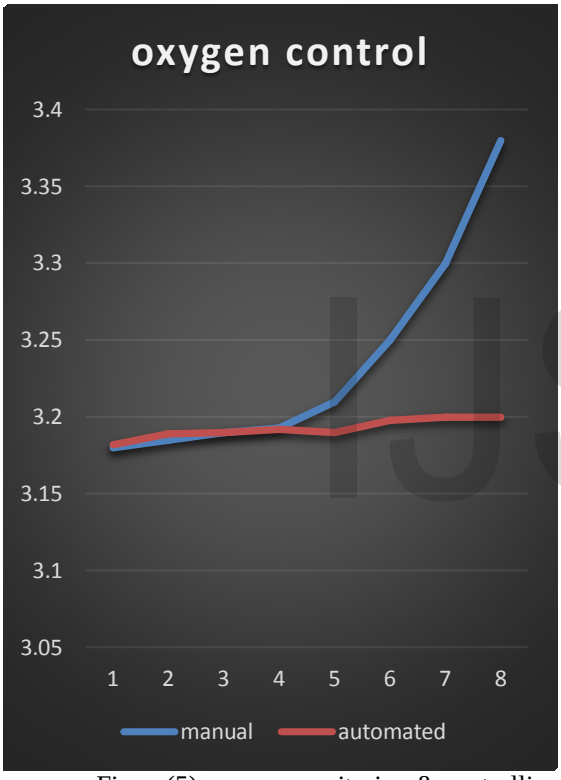
Figure(4):pressure monitoring & control

From figure(4),in manual control the air pressure inceases gradually.For the process say it is maintened with in 2psi to 2.5psi.But in manual control it can't be achieved.So using

pressure sensor we monitor the pressure level and using controller the specified range can be achieved.

D. Oxygen monitoring & controlling system

Oxygen plays important role in the efficiency of the boiler.Due to over of oxygen it may create corrosion problem. That problems due to boiler system corrosion cost industry billions of dollars per year.Some of the process also requires a particular amount of oxygen like calcinations process etc.So excess of oxygen can also affect the production ,So the flow of oxygen is maintained as per the process with in boiler.Figure (5) shows the control of oxygen flow to the boiler.



Figure(5):oxygen monitoring & controlling

For oxygen monitoring ,oxygen sensors are deployed.It will measure the oxygen presence amount and send the data value to controller.Here the value for oxygen is to be maintened with in 3.19 to3.20 (say).So this level is controlled by PIC controller ,where the product will be more effective and the boiler remains corrosion free.

E. Humiidity monitoring system

Measurements of the water vapour content in atmosphere and surface are required for the better understanding of the physical, chemical, and possibly also exobiological processes in the upper Martian surface.So a humidity sensor is deployed in order to measure the humidity concentration near about the boiler.So that it would be known that the operation of boiler under that condition is allowed or not.Below is the figure(6) of a Humidity sensor.


Figure(6):Humidity sensor

F. Boiler weight measurement system

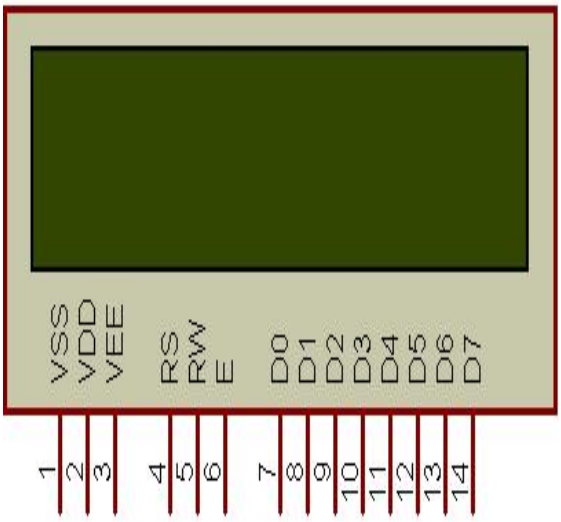
Since boiler has the capacity to process the amount of liquid,so the weight of the boiler should be estimated at regular interval of time through load cell sensor.If the weight of the boiler exceeds then automatically it will stops the inlet flows of the material & feed water flow.
A **load cell** is a transducer that is used to convert a force into an electrical signal. This conversion is indirect and happens in two stages. Through a mechanical arrangement, the force being sensed deforms a strain gauge. The strain gauge measures the deformation (strain) as an electrical signal, because the strain changes the effective electrical resistance of the wire. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cells of one strain gauge (quarter bridge) or two strain gauges (half bridge) are also available. The electrical signal output is typically in the order of a few millivolts and requires amplification by an instrumentation amplifier before it can be used. The output of the transducer can be scaled to calculate the force applied to the transducer. The various types of load cells that exist include Hydraulic load cells, Pneumatic load cells and Strain gauge load cells.

II. LCD

The LCD is more energy efficient and offers safer disposal than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.
The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these

simple looking LCDs which can give a new look to the application.

From the LCD we can get the monitored value and also when the parameters are controlled the value also shown by the LCD.Te following is a figure(7) of LCD.



Figure(7):LCD Display

III. PC with labview

A PC with Labview is needed in order to get the simulated results.Those values will be obtained in graphical format of lab view,where we will get the monitoring and controlling of the parameters.Also use the Embedded C coding to control different parameters.

IV. .Result

The values of different parameter can be shown through a PC having labview tool.The actual value of the parameter will be indexed in the respective parameter position.So the controlled values can be viewed from the control room.

V. Conclusion

In a head-to-head comparison with manual control system & proposed system,the proposed system outperforms than that of manual system. The major advantages to the system are that it can be aimed toward a small target and then accurately feedback data to the control system. However, the major care to be taken that ,the system is the controller & sensors should be maintened properly & regularly as they are performing in hazardous conditions. So in this proposed project all the parameters are monitored & controlled using different sensors & PIC controller,in order to produce effective product through the process using boiler system.And all the parameters are controlled with in arrange of values .which are different or specified for different processes.

VI. References

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