Review on Boiler Automation and Light Control in Sugar Industry

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ABSTRACT: The boiler control through automation is the main purpose of this paper as well this paper will focus on automatic light control in industry. In this paper, we are going to explain one of the effective methods for automation. It describes the effectiveness of automation using embedded systems for boiler and light automation. In the industrial sector of power plants the demand for high quality, greater efficiency and automated machines has increased in great extent [4]. Continuous monitoring and inspection is needed for power plants at regular interval of time. Some errors may get introduced during measuring. There are possibilities of increasing errors by human workers at various stages and sometimes due to lack of features of microcontroller also introduces errors[4].So to reduce these errors we use automation due to which at least the errors occurring due to human workers involvement can be suppressed.

KEYWORDS: Boiler automation, Light automation, embedded systems, Three Element Module.

I.INTRODUCTION

A boiler system is main component of a sugar plant. The control of water level in the drum of the boiler is a critical operation [2]. Nowadays, instead of conventional techniques modern techniques are being used in the industries [1].
The multipurpose boiler system installed in the Sugar Industry produces by-products like Heat, Steam and Chemical Gasses etc. In many industries the generated steam by boiler is used for electricity generation purposes instead of going to waste [3].Numerous controlling mechanisms are used to control the boiler system so that it works firmly [5].
Fig.1 shows the basic structure of boiler. The main inputs of a sugarcane plant are fuel, feed water and air. The outputs of the system are electrical power, heat loss, steam pressure, steam temperature, blow water and flue gases [1].
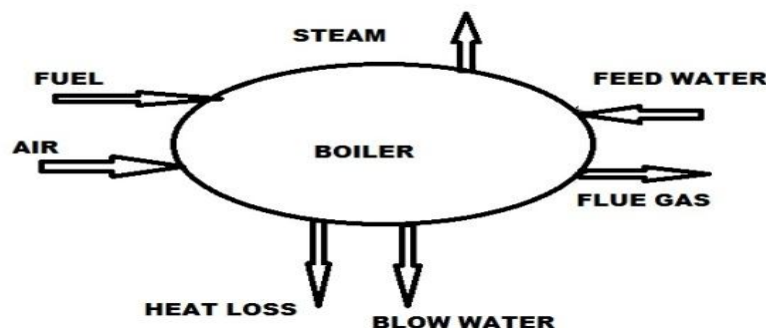

Fig.1 Basic Structure of Boiler

The conventional systems today at Sugarcane Industries operate manually; i.e. fuel and water supply to the boilers is manually provided. Hence it requires labour work [1]. In this paper we are suggesting some automation techniques to

reduce the human efforts. Reduction in human hazards, time wastage and electricity wastage can be provided by automation in light switching inside the industry.

II. BOILER IN BRIEF

Boiler is a closed chamber in which water converts to water vapors by the combustion of fuel [2]. Generally, in boilers hot flue gases coming out from the fuel combustion interact with the water pipes and as a result of this process steam is produced. Mainly Coal and coke is the prime fuel used for the boilers [2].In boilers, chemical energy of fuel is converted into the heat energy and this heat energy is absorbed by the water which converts them into vapours [2].
It is a device which creates water vapours by applying heat energy to water. A boiler must be designed to generate the maximum amount of steam in exchange of the heat released in the process of combustion of fuel [2]. By radiation, conduction and convection, heat is provided to the water in the boiler. The respective content of each i.e. steam and heat dependents on the type of boiler used in the design of the boiler and the fuel used.
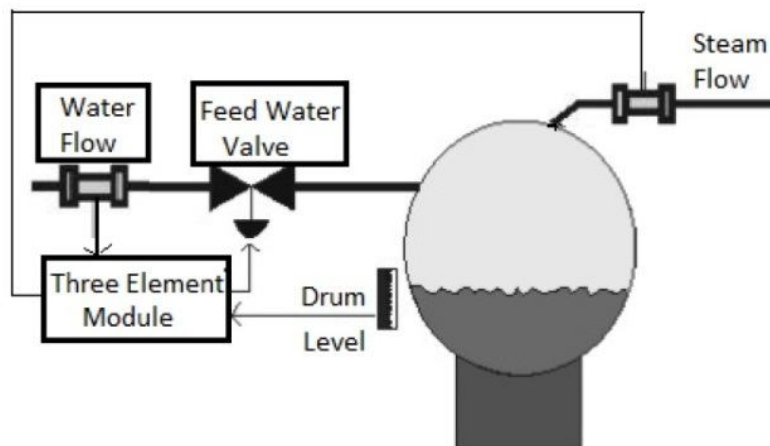

Fig.2. Three Element boiler Drum level control system [6]

Fig.2 shows the Three Element Module, which shows the basic working of automation where water flow to the boiler drum is controlled by feed water valve [6]. Three element module get feedback from the steam flow out of the drum to regulate the water supply. Also it takes feedback from drum level indicator to get basic information about the water level inside the drum.

III. WORKING PRINCIPAL

This paper demonstrates the automation system in which water supply to the boiler is automatic, as per the requirements and factory lights are according to sunlight intensity. Light bulbs get ON/OFF accordingly. Now a days water supply to the boiler is a manual process. Usually electricity wastage is high in bigger industries. The main purpose of this paper is to reduce electricity wastage and reduce human efforts. According to the measurement of the boiler's temperature, it gives readings on graphical LCD and then as per requirements of water to the boiler. Automatic water supply will be provided to the boiler and to reduce electricity wastage, light bulbs in the industry are automated according to sunlight intensity; lights will be ON and OFF.
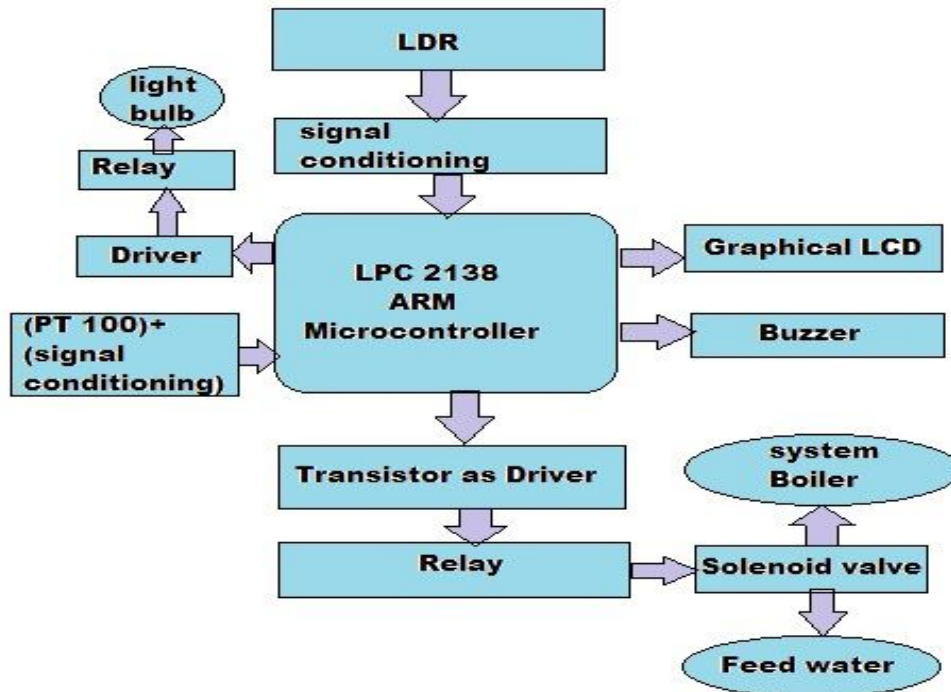
Fig.3 Block Diagram for Automation of Boiler and Light control.

Block diagram for Automation of Boiler and Light control is shown in Fig 3.It is divided in three modules. Module 1, Module 2 and Module 3
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Module1: LDR detects the sunlight intensity inside the industry and accordingly it sends the signals to LPC2138 ARM Microcontroller; sometimes the signal is so weak that it needs to be nourished. To avoid this barrier we use signal conditioning. Signal conditioning includes amplification, filtering, isolation and converting. Here we are going to use amplification for signal conditioning. If the signal from LDR is negative it means there is a need of lights to be ON so respective signal is sent to the Light bulbs through the Driver and Relay.
Driver used is NXP LPC and Relay used is Thyratron.

Module 2:
We are using PT100 for detecting the temperature of boiler. PT100 gives the exact temperature of the Boiler. It will be continuously displayed on Graphical LCD. This signal is then given to Microcontroller. If temperature is higher than the threshold temperature it means there is need of water inside the Boiler, so signal is sent to Solenoid valve and solenoid valve will provide water to the system boiler from feed water tank.

Module 3:
In case of critical condition, if any disorder occurs in any part of the design, it may lead us to the danger and hence to avoid this we are providing a Buzzer with a Reset Switch. In case of any critical situation, a message is sent to the administration section by blowing the buzzer, so that it can get under control.

IV. OPERATION IN AUTOMATION

Initially the boiler is filled with some amount of water and required amount of fuel is fed. According to the procedure required contents are added to boiler to produce sugar. When the boiler temperature goes high or low, then its value is digitally flashed on graphical LCD. If the temperature goes high,it means water should be added to boiler and so water will be provided automatically to the boiler.We have provided solenoid valve to boiler for water supply. Whenever

there is need of water in the boiler, the temperature will raise(due to continous heating) and the solenoid valve will open automatically and water is supplied to the boiler.
Generally there are following kind of valves used in the industry.
1. Simple Butterfly valve
2. Commercial Ball Valve

Fig. 4 Simple Butterfly valve   Fig. 5 Commercial Ball Valve

Here we are going to consider solenoid valve for better performance. Solenoids provides fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.
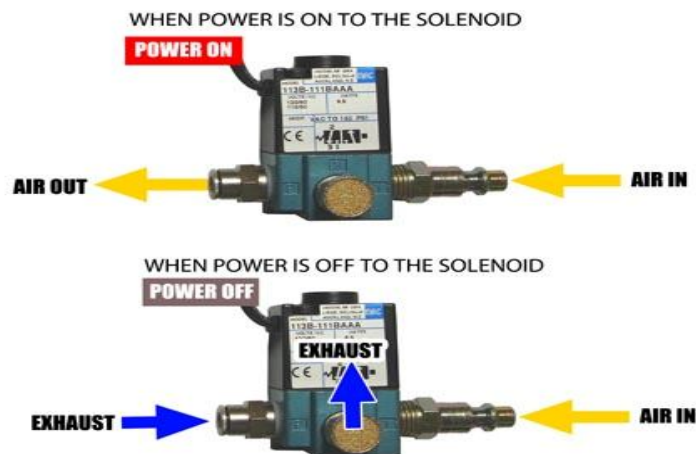

Fig. 6 Solenoid Valve

If the temperature goes below the threshold value, it gives indication to increase heat to boiler.
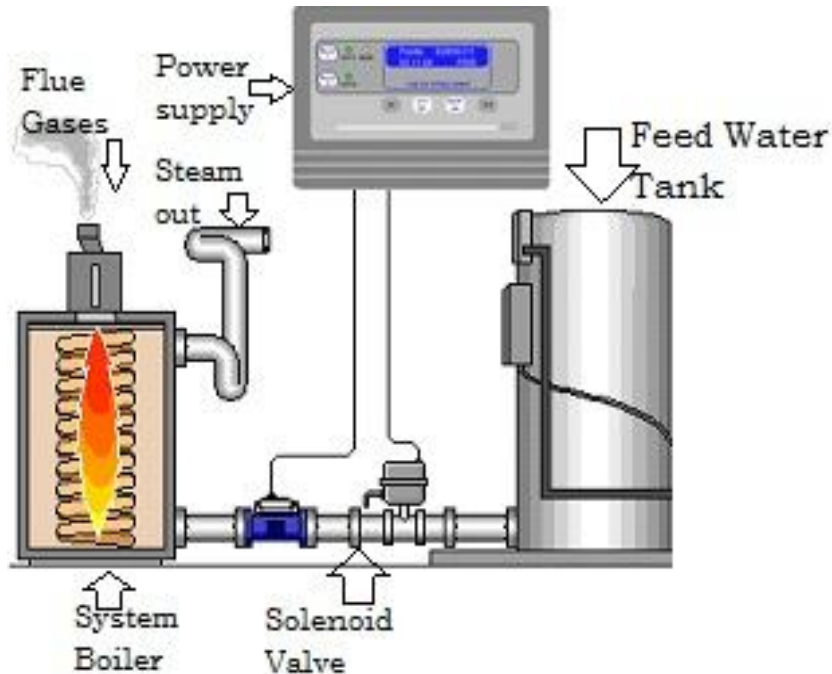The basic schematic of the system is shown in the Fig. 7.

Fig. 7 Schematic Diagram of Boiler Sytem

Another feature of this system is when the light intensity inside the industry decreases the light bulbs will automatically switch ON. Till darkness, lights will be ON.Basically this phenomenon of automatic switching of lights will reduce the human efforts and also will reduce electricity wastage. Sensors will identify the light intensity and accordingly lights will be ON or OFF. We are providing signal conditioning. If in case we are receiving weak signals from the sensers, then signal condictioning will give us the exact signal as expected to the sensers.In this case parallel work is done. If in a specific area not a single machine is running and nobody is present in that area then lights will automatically gets switched OFF. The human body detecting senser will work to get information about if any human body is there in specific area or not. According to the information from the sensers the signals will be sent to controller and microcontroller will do the task of keeping lights ON or switching them OFF.The emmergency switch i.e. Reset switch is also provided. It works when there is case of any critical condition and it'll give a message signal to a administration section by blowing buzzer.

V.BOILER APPLICATIONS [4]

Applications of Boiler are inlisted below:
- Boilers are getting used in stationary applications to provide heat, hot water and steam for domestic purposes as well as in many industrial applications.
- Boilers are being used in movable applications to provide steam for locomotion in vehicles such as trains, ships, and boats.
- Steam boilers are used as steam generators to generate electricity for the energy generating industries.
- Boilers are also being used in agriculture as well for soil steaming which improves the furtility of the soil.
- Boilers are being used in heating systems, the best example of this type is for cement production.
- Boilers are getting used in textile industries for spreading colours through the clothsheet, for bleaching and many other industries like plastic and paper recycling and chemical industries.
- The larger boilers are used in "Thermal power stations".Larger Boilers are used to convert water into steam and to rotate turbines, to generate the Electricity.

VI. CONCLUSIONS

The Paper is well equipped with study of the integral parts of the entire process. Also it consist the implementation and problems related to the integral parts involved in entire process [2].The Paper has furnished itself to study the several parts of the entire process involved. Their implementation, deployment, problems and errors that may show up have also been given their immense importance [2]. The most important feature of any power plant is the boiler control. Number of techniques can be implemented but, depending upon the purpose of company which method has to be used is decided relying on numerous objectives like excellent quality, increment in efficiency, high profit etc. The paper proposes the reduction of manual faults and the time required. It tries to implement cost effectiveness and reliability with less man power.

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