Industrial Boiler Parameter Monitoring and Control using Internet of Things: A Review paper

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***Abstract*- The need for power generation in India increases day by day due to various factors. Nearly 70% of the power production is from the industrial plants in various locations of the country. Monitoring and control of these power plants at all times is a must, since these industrial plants are operated continuously. Boiler is the major part of any industrial plants. Hence monitoring the boiler parameters such as temperature, pressure and humidity are of great importance in industrial plants. It is not always possible for continuous monitoring in the plant premises because of an unpleasant industrial environment. In this project it is proposed to develop remote monitoring and control of boiler parameters using wireless communication. The proposed method provides a complete solution for these constraints in remote monitoring by using various sensors for temperature, pressure and humidity measurement. This method uses Internet of Things (IoT) as the platform of communication. The proposed method also provides an option for monitoring and control even in remote location in addition to the control room. Internet of Things (IoT) will play a major role in the future concept of power plant integration. The proposed method will suit and provide a start-up initiation for this future concept.**

Index Terms- Boilers, Internet of Things, NodeMCU, sensors, cloud.

1. INTRODUCTION

At present industries are increasingly shifting towards automation. In Thermal power plant, Combustion of coal in the boiler converts the water into steam. This steam with high pressure and temperature is given to Turbine which rotates Turbine shaft. This Turbine shaft is connected to the Generator shaft. By rotating Turbine Shaft, Generator shaft also rotates and Power will be generated. Temperature and Pressure are the two main parameters to be controlled in steam. Boiler tubes will be puncture if temperature of steam increases. So, temperature of steam should be monitored and controlled. The boiler tank level must be controlled to the limits specified by the boiler manufacturer. If the boiler tank level goes beyond these limits, boiler water carryover causes the turbine damage resulting in extensive maintenance costs or outages of either the turbine or the boiler. If the level is low, overheating of the water wall tubes may cause tube puncture and serious accidents, resulting in expensive repairs and injury or death to personnel. A puncture most commonly occurs where the tubes connect to the drum. The different parameter in the boiler such has temperature, pressure, Humidity these parameter can be controlled using IOT (Internet of Things). This is an important parameter that has to be controlled in the boiler for the safety and to improve the reliability of the boiler. It is not always possible for continuous monitoring in the plant premises because of an unpleasant industrial environment. In this project it is proposed to develop remote monitoring and control of boiler parameters using wireless communication.in addition to the control room. Internet of Things will play a major role in the future concept of power plant integration. The proposed method will suit and provide a start-up initiation for this future concept. A crucial control problem in boiler control is the monitoring and controlling of water level in a boiler drum. Many industrial plants have boilers for generating process steam, and of course boilers are central to thermal power generation. The boiler drum is where water and steam are separate. The design of the boiler drum level control strategy is normally described as single-element, two-element, or three-element control. This article explains the three designs. Integrating loops are difficult to tune, and can easily become unstable if the controllers integral time is set too short (i.e. high integral gain). The process imposed requirement

for a long integral time makes the loop slow to recover from disturbances to the drum level. If the drum level is low, and more feedwater is added to increase it, the drum level tends to decrease first before increasing. This is because the cooler feedwater causes some of the steam in the evaporator to condense, causing the volume of water/steam to decrease, and hence the drop
in drum level. Conventional feedback control has difficulty in coping with this inverse response. A control loop using high controller gain and derivative action may work well in other level applications.

2. LITERATURE REVIEW

Once we get the idea about problem occurred then we have to analyze that problem. For this analysis we have to study total concept behind the problem. Before going to make new system it is more important to study the existing system. From this study we get to know what kind of requirements are fulfill till date and how to make the system more advanced and efficient than previous one using the latest technology. Our proposed system involves following research paper analysis: Rahul Malhotra1 [1] et al describes Conventional Proportional Integral Controllers are used in many industrial applications due to their simplicity and robustness. The parameters of the various industrial processes are subjected to change due to change in the environment. These parameters may be categorized as steam, pressure, temperature of the industrial machinery in use. Various process control techniques are being developed to control these variables. In this paper, the steam flow parameters of a boiler are controlled using conventional PID controller and then optimized using fuzzy logic controller. The comparative results show the better results when fuzzy logic controller is used. Maximum overshoot for fuzzy logic controller is measured as 9.35% as compared with 47.3 % given by conventional PID controller. According to Mr. Malikamber, Mr. Tamhankar we can build a system which can beused as super visory control and data acquisition that is SCADA. For that they uses IEEEC37.1 standard. This system provides the monitoring and controlling of the different device present in the industrial environment. Mr. Zafar pointed us towards the system in which we can access the process control library from outside the college campus using web technology. Prof. Jaikaran Singh, Prof. Mukesh Tiwari, Mr. Manish Shrivastava says that how the automation becomes an essential part of the industrial development. If we replace the old running manual process of operations by new emerging automated technologies then our product efficiency is increased in great extent. We can able to produce high quality of product within a less time consumption than manual controlling. Most of the automated system based on the new emerging software technologies. Mr. Bulipe Srinivas Rao, Mr. NOme, Prof. Dr. Srinivas Rao proposed a system which is used for weather monitoring using Arduino development board. According to their research we can monitor the weather conditions of location from anywhere using internet of things. But it is a system which only monitoring the weather condition. There is no any controlling part in the system. They used different sensor such as temperature, light, sound etc.Subodh Panda et al describes the important issue in the modern thermal power plant is to develop methodology concept algorithm technologies for designing a control system which must be able to evolve, self-develop, self-organized and self-evaluated and to self improve. Although linear model can provide acceptable performance for many systems they may be unsuitable for non-linearity. So it is highly required for a model that reflect the nonliner relationship between cause and effect variable. Implementation of soft sensor in neural network estimate process data using self-organizing neural network. Here basic requirement of design a neuron control with soft sensor are the knowledge of fundamental relationship of process variable and the parameter in the question .It is called a process neural network which is an extension of traditional neural network in which the input and output are time variant. So the data processing is better than traditional neural network so it is highly suitable to minimize heat loss at blow down station and increase its ability by operating at peak. The Internet of Things is a technological revolution that represents the future of computing and communications, and its development depends on dynamic technical innovation in a number of important fields, from wireless sensors to nano technology(Accessed dated on 20/04/2013. The first Internet appliance was a Coke machine at Carnegie Melon University in the

early 1980s. Programmers working several floors above the vending machine wrote a server program that chased how long it had been since a storage column in the machine had been unfilled. The programmers could connect to the machine over the Internet, check the status of the machine and determine whether or not there would be a cold drink awaiting them, should they decide to make the trip down to the machine.

3. PROBLEM DEFINITION

To design and implement the industrial boiler control system for monitoring the pressure and temperature and humidity of the boiler and control the water valve using Internet of things.

4. PROPOSED WORK

There are three different types of sensor such has temperature sensor, pressure sensor and humidity sensor are connected to the NodeMCU board. so that the analog values are converted into digital values and these parameters are connected to ESP8266.So these values are displayed in the LCD screen. When there is an external disturbance given to the parameters the values are been changed. These are sensed by the different kinds of sensors has shown in Fig.1. A set point values are kept for all the parameter values once if the values are exits the high value then there will be a occurrence of fault in order to avoid that fault online monitoring has been done and the if the parameter values if it exits over the limit it can be controlled by the online through internet. A webpage has been created and the total control operations can be done through the webpage A. NodeMCU NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term ”NodeMCU” by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the Eula project, and built on the Espresso NonOS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs. B. Temperature Sensor The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. C.
Pressure Sensor Pressure sensors are used for control and monitoring in thousands of everyday applications. Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude. Pressure sensors can alternatively be called pressure transducers, pressure transmitters sensors, pressure indicators and manometers, among other names D. Humidity Sensor The HR202 Humidity Sensor Module can be applied to the storage compartment, indoor air quality control, building automation, medical, industrial control systems wide range of applications and research fields. Easy to interface with your microcontroller.

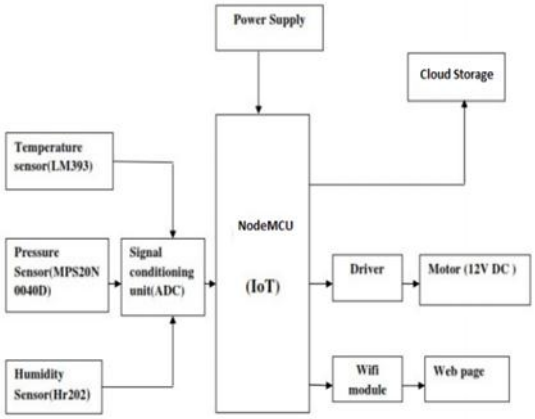

Figure 1. System Architecture

5. COMPONENTS OF SYSTEM

1. Temperature Sensor
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2. Pressure Sensor
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sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude. Pressure sensors can alternatively be called pressure transducers, pressure transmitters sensors, pressure indicators and manometers, among other names

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4. Nodemcu Controller

NodeMCU is an open source LUA based firmware developed for ESP8266 wifi chip. By exploring functionality with ESP8266 chip, NodeMCU firmware comes with ESP8266 Development board/kit i.e. NodeMCU Development board. NodeMCU Dev Kit/board consist of ESP8266 wifi enabled chip. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with TCP/IP protocol. For more information about ESP8266, you can refer ESP8266 WiFi Module.

5. Database

A database is a gathering of data that is composed with the goal that it very well may be effectively gotten to, oversaw and refreshed. Information is composed into lines, segments, and tables, and it is listed to make it less demanding to discover applicable data. Information gets refreshed, extended and erased as new data is included. Databases process remaining tasks at hand to make and refresh themselves, questioning the information they contain and running applications against it.

6. CONCLUSION

A different approach to develop an intelligent boiler to monitor and control the boiler working with their corresponding humidity and temperatures in power station is proposed. Therefore an intelligent sensor for measurement of humidity and its corresponding flame temperatures estimation using IoT can be made possible to control the water valve for online monitoring. As a result an intelligent system can be developed to monitor and control the pressure ratio. The pressure is also minimized there by reducing the temperature. The major idea behind this research is to identify the adverse conditions contributed by high temperature. The future scope of the system would be to deploy the Space which will facilitate the buildup of a physical model instead of NodeMCU enabling an online IoT based monitoring scheme.

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