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An assessment of IOT based monitoring and control of boiler

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ABSTRACT

The Information Technology and Process Control together plays an important role in fourth Industrial Revolution "INDUSTRY 4.0". The automation tools like PLC, PAC, SCADA, DCS etc., monitor and control any type of process and supports the Instrumentation Engineer in process industries. The persons in operator work station of DCS will normally monitor and attend the faults in process through the status of the alarms and Trends. In emergency condition, the DCS Engineer will alter the process condition through Engineering Interface console. The DCS Engineer in addition to monitoring the process through engineering interface have to attend the fault created at the site and as well as to attend the meeting with his higher officials. This project helps the DCS Engineer to monitor and control the process in case of emergency and his absence in the DCS control room. The emergency situation will be communicated to the DCS Engineer through his smart phone and makes him view the process and take appropriate actions through his mobile phone with the help of Cloud and GSM Technology.

Keywords: Industry 4.0, Io T, DSC, Remote monitoring

INTRODUCTION

Any controller setting updating, decision taking in bypassing the loop and key parameter updating in the Distributed control system (DCS) can be performed by DCS Engineer only in Engineering Work Station (EWS). He may not be present in EWS console all the time. He has to attend the problems occurring in the site and analyses the problems and make decision in correcting those problems. In addition, he has to attend weekly meeting with Head of the department and meeting with Deputy General Manager twice in a month.

The Operators mainly check the process through Trends and correct the abnormalities. In case the abnormalities are uncontrollable and DCS Engineer is out of EWS he has to come to central control room and apply the corrections in EWS. To reduce this downtime, any abnormal fluctuation can be intimated to DCS Engineer through message and from that he can view the current situation of the process in his smart phone and he can change the parameters from remote [1-5].

The need for power generation in India increases day by day due to various factors. Nearly 70% of the power production is from the Thermal power plants in various locations of the country. Boiler is the major part of any Thermal power plant and monitoring the boiler parameters such as temperature, pressure, flow and level are of great importance. It is not always possible for continuous monitoring in the control room premises because of an unpleasant industrial environment. In this project it is proposed to develop remote monitoring and control of boiler parameters and provides a friendly solution for DCS Engineers. The proposed method also

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provides an option for monitoring and control even in remote location in addition to the control room.

Operation of boiler

A function block diagram describes a function between input variables and output variables. Function is described as a set of elementary blocks. Input and output variables are connected to blocks by connection lines. An output of a block may also be connected to an input of another block. In FBD, program elements appear a blocks which are "wired" together in a manner resembling a circuit diagram. FBD is useful in those applications involving a high degree of information/data flow between control components such as process control. Function block diagram is one of five languages for logic or control configuration supported by standard IEC 61131-3 for a control system such as a Programmable Logic Controller (PLC) or a Distributed Control System (DCS) [6-11].

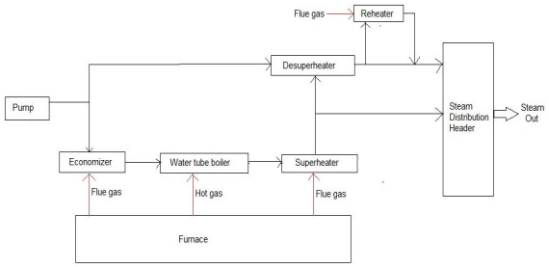

Figure 1 Boiler process

A power station also referred to as a generating station, power plant, power house, or generating plant is an industrial facility for the generation of electric power, the term generally being limited to those able to be dispatched by a system operator(i.e. the system operator can, by one means or another, alter the planned output of the generating facility). Most power stations contain one or more generators, a rotating machine that converts mechanical power into electrical power.

The different parameters in the boiler such has temperature, pressure, humidity these parameters can be controlled using IoT. There is an important parameter that has to be controlled in the boiler for the safety and to improve the reliability of the boiler. In case if these parameters are not controlled then there will be an occurrence of fault in the boiler. Inorder for the safety of the boiler these parameter values has to be controlled. So a smart way of control can be done by internet of things. By creating the webpage and the control operation can be done through the internet of things.

REMOTE MONITORING OF BOILER

Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provides human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Automation playsan increasingly important role in the world economy and in daily experience. Some of the widely used automation tool Artificial Neural Network, Distributed Control System, Human Machine Interface, Supervisory Control and Data Acquisition, Programmable Logic Controller and Programmable Automation Controller. Industrial monitoring involves monitoring and controlling of different plant's factory or manufacturing conditions while logging data to enterprise systems. There has been an ever-increasing emphasis on machine and automation efficiency, as well as performance and quality control.

Wireless technology improves the process by adding new measurements to the system that were previously impractical with a cabled solution. A Programmable Logic Controller is programmed to control the operation of the plant and a SCADA system is implemented to monitor and control the process. The proposed system offers an economical solution for multiple users in the Laboratory Environment. In the fault diagnosis of the power electronic equipment in the industries, the technical requirements are greatly reduced but the provision for backup in case of a communication failure has not been considered.

The collection of complete real-time data from different source systems such as SCADA, databases and Internet which is pushed into an online transaction process and its immediate acquisition into online analytical process. The real time data is compared with forecasted data and historical data for effective online energy managementing formation reporting system and the end-to-end energy information for better decision making is analyzed. The condition monitoring and fault diagnosis for growing figures of power generation systems which use components embodying intelligent computing models, structure with local and central information system.

The research based on real-time web based machine tool and machining process monitoring system and steps for implementing e-manufacturing system. The system architecture of a multi layered distributed SCADA system used for monitoring and controlling on establishing the link with icons on graphics panels that integrates all three levels of process control from operator panel with the distributed PLC system. The online controlling of industrial process via GPRS enabled mobile phone. It provides selection of process values, alarms with graphical user interface and remote controlling in user defined time. The online report diagnosation and GPRS network latency issues are not considered [2].

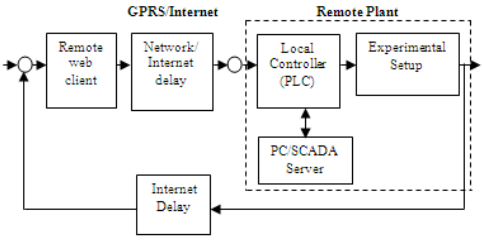

Figure 2 web-based supervisory control over the internet

In this system, the goal is to maintain a particular relationship between input to the system and output from the system when the process is critically disturbed. As shown in the Fig 2, the web based supervisory control and information system is based on a web client / server configuration. Information exchange between experimental pilot plant and Internet-based clients allows the client to remotely monitor, control and thereby modify the parameters of the process plant. Web based supervisory control and information system strategy must be employed towards solving the problems associated with communication latency, security and user interface issues. The design of web-based remote supervisory control and information system, implementing the effective point-to-point network communication architecture and ideal control strategy, aids in decreasing the Internet latency and maintains system stability.

The Internet is the easiest and cheapest technology for public communication and it makes sense to extend this technology to achieve communication among any two systems. The overall architecture of the proposed system. It consists of two centers, namely the DCS station and remote support center. The solution is to get data automatically from remote installations. The data may come from their proprietary systems and GPRS/Internet is used to send this information on regular intervals via email to the central support team with the details of DCS processor functionality, client information, plant status, etc.

The system solution should be in a position to run local commands to extract data immediately in case of critical events. The system should also be able to allow the central support team to see a live view of the running application in order to analyze the system.

FAULT DIAGNOSIS

Distributed Control System is used in a wide variety of industrial process automation applications. The absence of an on-line monitoring system for DCS with expert maintenance support was the motivation behind developing the present system. This system focuses on on-line monitoring and a maintenance strategy plan. The field survey conducted provided information on the aspects that influence the DCS routine maintenance both through plant engineers, operator interviews, and by the study of a practical example. A novel on-line information system for DCS with an expert support is developed based on the field survey and literature review. The maintenance time of a distributed control system is often fixed as short as possible to achieve the optimum control over the process especially, when the process belongs to dynamic system. In DCS, the controller elements are not central in location but are distributed throughout the system with each component sub-system controlled by one or more controllers. The entire system of controllers is connected by networks for communication and monitoring. When the control system fails, the breakdown maintenance strategy is usually repairing and replacing. The main factors affecting the total downtime of a system are maintenance delay, accessing the information from the controller processor, diagnosing the issue if possible onsite, logistics, repair/replacement, test, and validation. Since the number of factors involved in a maintenance schedule is large, diagnosis time may have a significant impact on the mean down time. In order to minimize the diagnosis time, an intelligent and dedicated on-line monitoring system is required to make the DCS take care the entire process of the plant in the optimum manner. The DCS processor is a crucial element that requires efficient performance monitoring, fault diagnosis, and expert support. The DCS processor information and critical alarms are stored in the back-end support files. The processor status is continuously acquired and compared with the reference functional database instantly. The collected processor information is formulated in an informative document and sent to the service engineers and expert for on-line diagnosis of the proposed system which provides greater advantage to the plant engineers and management people, in the following ways:

- Expensive overseas telephone calls can be avoided;
- No need for onsite visit by service engineer;
- Training and retaining the experienced engineers can be reduced; and
- Independent routing of issues without involving onsite and customer
- Service database.

To ensure the security over the Internet environment, the Open VPN client certificate-based security is developed and implemented successfully in the experimental system. A point-to-point connection is programmed in M2M and routed configurations are made that help to make remote access facilities. It uses SSL=TLS security for encryption and is capable of traversing Network Address Translators (NATs) and firewalls. Open VPN allows peers to authenticate each other using certificates or username=password. It allows the server to release an authentication certificate for every client using signature and Certificate authority. It uses the Open SSL encryption library extensively as well as the SSLv3=TLSv1 protocol. Open VPN uses the Open SSL library to provide encryption of both data and control channels. Each may also use the HMAC packet authentication feature to add an additional layer of security to the connection (referred to as an ‘‘HMAC Firewall’’ by the creator). It uses hardware acceleration to get better encryption performance.

CONCLUSION

The various Literature that we have studied shows the problems in the remote monitoring and control of process. In DCS plant the problems encountered by the DCS Engineer can be reduced by monitoring the plant parameters in his smart

phone with a high security of VPN. The status of emergency can be communicated to the DCS Engineer through SMS and parameter monitoring can be viewed in his phone and can analyse and make decision of the plant status from remote place.

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