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Real Time Fault Detection System for Steam Condenser by Using PLC SCADA

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Abstract - *In this paper, a complete automation system for fault detection and control of steam condenser is developed on the basis of PLC (Allen Bradley Software) and SCADA (Wonderware intouch). Three faults are shown on the SCADA screen by using Bit logic from the Allen Bradley PLC program. Steam Condenser play an vital role in power plant to control the heat from all parts of the Plant. This PLC control system contain special unit for input outputs of devices which is connected to the SCADA system where all faults occurs in the steam condenser can be detected on the direct usage for power plant automation system. Fault detection system detects the faults when something is wrong under normal condition. When the fault has detected and isolated, then the fault identification signal given to the user on the SCADA for control of faults. The real time fault detection can be seen on SCADA Software and can be controlled using a link between PLC and SCADA software Fault detection, analysis and controlling for modern power plants (Thermal) can reduces downtime, develop more safety for power plant, and lesser the cost of manufacturing. Most of the Allen Bradley PLC uses RS-logic software for programming and SCADA uses Wonderware Intouch software for representing various animations. There are three types of fault can be detected of condenser using PLC-SCADA link.*

Key Words: Real Time, PLC, SCADA, Fault Detection.

1. INTRODUCTION

Most of the power plant has many more components in the rankine cycle. There are two main purpose of the condenser.

- To condense the steam coming from the turbinecan be used again in recycle method
- To increase efficiency of the turbine by maintaining proper vacuum.

Vacuum is one of the most important part of the cooling system. When the operating pressure is decreased vacuum is increased so that enthalpy drop of the steam in the turbine will also increase. Due to this lower operating pressure steam flow for the given power plant reduced and increases the efficiency of the turbine and turbine output.

The main function of the condenser is to create a vacuum by steam condensing inside the condenser and remove dissolved non-condensable gases. It also uses condensate water again as a feed water supply system to the steam generator [02].

PLC plays an important role in detection of fault inside the condenser. PLC uses bit logic for incoming and outgoing signals. After detecting the bit from the signal, the same signal has shown on SCADA system. Information in the form of signal can be taken from connected sensors or input devices and outputs get energized based on pre-programmed parameters. On detection of inputs and outputs, a PLC can visualize and record real time data such as automatically start and stop processes [06].

SCADA is an interaction key to put the PLC in real time. Users need SCADA (Supervisory Control And Data Acquisition) to show the incoming information from the PLC units on the SCADA screen. SCADA control and monitor the power plant remotely. The SCADA system gathers the information and transfer the information back to the system display.

1.1 Types of Faults in Condenser

A. Condenser vacuum:

Loss of vacuum is one of the most common problems in condenser which is caused due air leaking. As condenser have large surface area and many valves, fittings, and auxiliaries attached to it, it is difficult to determine and analysis the air leaks developed inside the condenser. Monitoring of the condenser is the method to determine the capabilities of air removal inside the condenser and the amount of leakage of air. A candle is used for the detection of air leaks by examining all the joints for air leaks. These leaks can be detected by putting a pressure sensor with water inside the condenser and maintaining a slight pressure for detection. Soap solution is one the best method for checking the leaks using low pressure. So sensors are placed around the condenser and give the signal to the PLC input module.

B. Condenser tube failure:

This failure occurs in the unplanned outage reports. Generally the first couple of inches of the inlet tube cause 80 percent of all tube failures to the end of the condenser. Erosion of the tube is one of the most common causes of these failures. A general solution for this problem is a ferrule which is nothing but a thin-walled metal tube expanded into the inlet of a condenser. This problem can be detected by using PLC internal logic program with the help of sensors connected to the input module of the PLC.

C. Condenser tube fouling

When impure materials are deposited on the condenser which makes an obstruction for the cooling water flowing through the condenser tube then there are changes of tube fouling. Tubes may contains mud, leaves, shells, debris, slime or algae which decreases the supply of cooling water. Algae growth causes the reduction in the heat transfer. Backwashing is an perfect method for removing foreign material. The manufacturers of condensers are continually reporting their maintenance procedures based on operating condition in many modern electric power plants. By using sensor fault detection system can easily detect this fault under some PLC internal program. SCADA is used to monitor or control this problem[04],[05].

2. Basic Block Diagram.

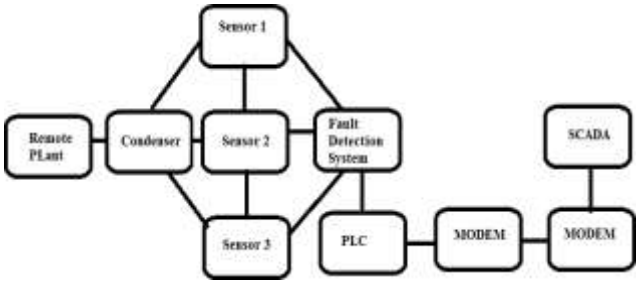

Fig 1. Block Diagram of Fault Detection System Fault

Detection system consist of number of sensors but here only three types of problem can be detected as there are only three sensors present in this system. According to the requirements numbers of sensors can be connected to the fault detection system.

If the faults occurs in the condenser sensor will detect it. All three sensors represent three types of faults. Sensor 1 show condenser vacuum problem while sensor 2 represents condenser tube failure and sensor 3 gives the failure of condenser tube fouling. After detection of fault, fault detection system gives the signal to the input module of the PLC which is connected to the modem for remote location. Finally SCADA shows the entire power plant animations[01].

3. PLC Internal Program.

In PLC internal program bits or bytes are used for trigger the faulty condition. When any fault present on the condenser there will be no bit triggering, but if fault occurs on the condenser system any bit or byte will trigger and hence PLC program will execute.

There are two conditions for Fault detection system

1. When Faults occurs on system (Bit is triggered)

2. When no fault occurs on system (Bit is not triggered)

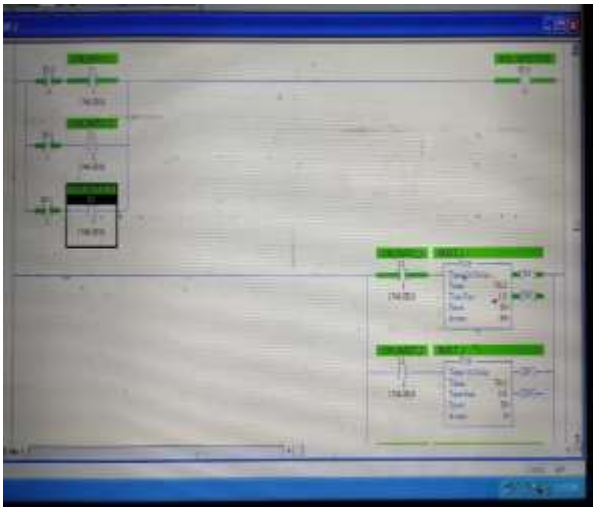

Fig 2. PLC Allen Bradley ladder logic Program For Fault Detection

Ladder logic is one of the easiest methods than written codes in C language or assembly language. So detection of fault with the help of PLC is easy for power plant than using a micro-controller process [03].

4. RESULT

SCADA is used for real time fault detection and visualization of remote power plant. SCADA is nothing but a process animation for real time. It is not a 100% controller but can do things like stating a process or stopping a process.

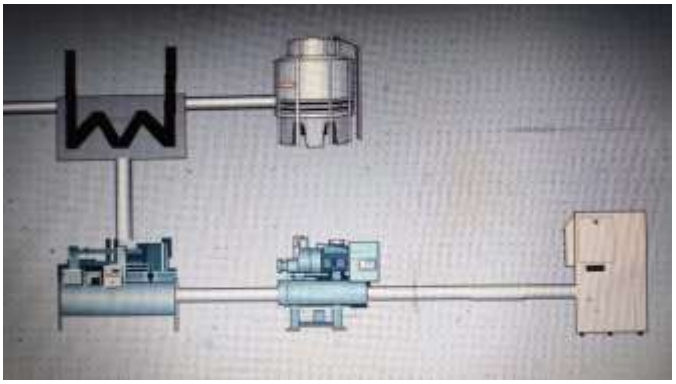

Fig 3. Condenser visualization on SCADA Screen

If any problem occurs on the condenser alarms willactivated on the basis of PLC program. There are three alarms for three problems.

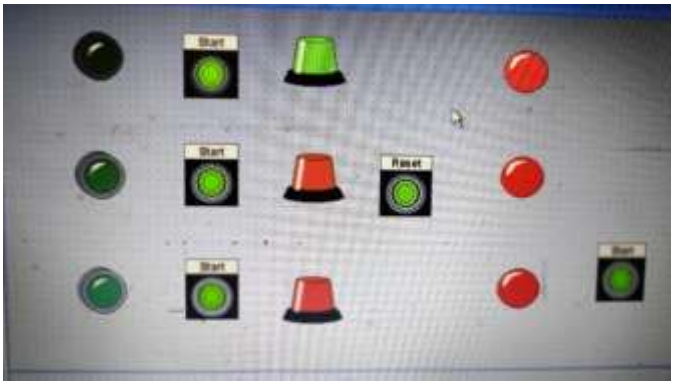

Fig 4. Faulty Condition on Condenser

4. CONCLUSION

Thus in this paper we have detected three faults of condenser by using link of PLC and SCADA with the help of some ladder logic.

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