ARM Processor Based Monitoring and Controlling of Turbine Parameters in Thermal Power Plant

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Abstract— Conventionally in the case of thermal power plant, the turbine parameters like temperature, speed, lubrication oil level and vibration are monitored by using MATLAB. If any problem occurs in the system, it can be controlled only by means of manual process and the protection system is based on the relay mechanism.It can be connected with the pressure switches and it has drift occurrence problem in the switch, which causes failure in the action of the switch. In the proposed system, with the help of high speed ARM processor all the turbine parameters and its protection system can be measured, monitoredand controlled automatically. The parameter variations can be graphically represented by using Lab VIEW.

Keywords: ARM 8 processor, Lab VIEW, Sensors, Automation System and Cooling fan.

I. INTRODUCTION

Normally, the turbine system is a rotary mechanical device that extracts energy from fluid flow and it generates the power. If the turbine parameters move to an abnormal condition, it will cause a very high damage. In this paper, it mainly focuses on monitoring and controlling of the turbine system parameters. In the existing system, all the parameters in the turbine system can be monitored by using the MATLAB and it can be done by using the manual process. In order to overcome the drawbacks in the existing system the proposed system is employed. The ARM processoris used which is the heart of the system that controls all sub devices connected across it and it is a very high speed response. For the monitoring and controlling the parameters, temperature sensor, speed sensor, level sensor and vibration sensor is used to sense the temperature, speed, lubrication oil level and vibrations in the turbine system respectively. By using the processorthese four parameters can be monitored and it can be controlled automatically and graphically represented by using Lab VIEW.

II. LITERATURE SURVEY

PengGuo and David Infield et al (1)describesthe Condition monitoring can greatly reduce the maintenance cost for a wind turbine. In this paper, a new condition- monitoring method based on the nonlinear state estimate technique for a wind turbine generator is proposed. The technique is used to construct the normal behavior model of the electrical generator temperature. A new and improved memory matrix construction method is adopted to achieve better coverage of the generator's normal operational space. Generator incipient failure is indicated when the residuals between model estimates and the measured generator temperature become significant. Moving window averaging is used to detect statistically significant changes of the residual mean value and standard deviation in an effective manner; when these parameters exceed predefined thresholds, an incipient failure is flagged. Examples based on data from the Supervisory Control and Data Acquisition system at a wind farm located at Zhangjiakou in northern China have been used to validate the approach and examine its sensitivity to key factors that influence the performance of the approach. It is demonstrated that the technique can identify dangerous generator over temperature before damage has occurred that results in complete shutdown of the turbine.

ShiyamSundar S et al (2)describes the Laboratory Virtual Instrumentation Engineering Workbench (Lab VIEW) is widely used in industry for supervisory control and data acquisition of industrial processes. This paper describes simulation of system for laboratory based thermal power plant generator setup using Lab VIEW data logging and supervisory control (DSC) module. Using the input, output and functional parameters the simulation of generator unit and alarm handling technique is achieved.

Krishna Prasad Dasari and Dr.A.M.Prasadet al(3)describes the main aim of the paper is evaluate the method of environmental impact of power plant discharge by reducing the temperature difference between effluent and costal water and flow control. Water temperature control and flow control measurement have been designed in advance technology of industrial control area for thermal discharge model test. Digital temperature sensors, level sensors, Flow meters, different modulated circuits, dedicated interface are used in the test and controlling of the system is adopted in software designing and programming. Measurement procedure, data processing and controlling are done by Proportional – Integral – Derivative (PID) controller. The numerous analyses of these applications it is shown that measurement is satisfactory, precise and reliable meeting the requirement of test. This technology can be implemented where the thermal effluent are discharged in coastal areas.

Jaishree.S, Dr.K.Sathiyasekar and Sonika.S et al (4) describes the Wind Turbine blast is identified as a major problem against green energy. It is not only the threatening factor for the people but also causes dangerous hazard for human life. To overcome this problem and to increase the green energy, a simple system is introduced to monitor and prevent the fault occurrence in Small Wind Turbine. It collects all the parameters like temperature, vibration, oil level and speed from main components of the turbine and sends it to the control room via wireless Zigbee. At Control room through PC (Personal Computer) it is possible to view the current status of the Wind Turbine. In Case of fault occurrence indication from control room automatically command will send to wind turbine section to overcome the fault than the fault occurrences can be prevented.

MahmoudMeribout et al (5) describes new multiphase flow metering device for real-time measurement

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of oil, gas, and water flow rates is presented. It is composed of several electrical and acoustic sensors whose signals are digitalized and processed by a multilayer neural network. This latest uses the physical models of multiphase fluids to reduce the complexity of the parameter space while improving its accuracy. Furthermore, to overcome the uncertainties of the electrical sensors in the range of 40%–60% and above 90% water- cut (i.e., ranges where most of the multiphase flow meter fail), two rings of high- and low-frequency ultrasonic sensors are used for low and high gas fractions, respectively. The results of experiments that have been conducted in an in-house laboratory-scale multiphase flow loop show that real-time classification for up to 90% gas fraction can be achieved with less than 10% relative error.

III. EXISTING SYSTEM

In the existing system, the turbine parameters like temperature, speed, lubrication oil level and vibrations in the thermal power plant can be monitored and controlled by using the MATLAB. If any problem occurs in the turbine parameters, it is difficult to monitor and control automatically. There is no waveform representation and automation process was available in the existing system.

IV. PROPOSED SYSTEM DESCRIPTION

In order to overcome the problem in the existing system, the proposed system is employed. The proposed system is to monitor and control the turbine parameters by using the advanced processor. It operates at very low voltage and it consumes less power. The number of the devices can be connected according to the input and output ports. The advanced processor is used for real time monitoring of data. The parameters in the turbine system can be monitored and controlled by using the ARM processor.

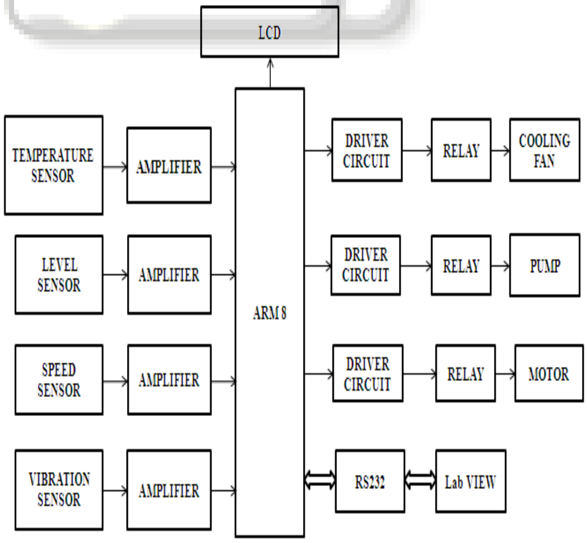

Fig. 1: Block Diagram of Proposed System Using ARM Processor

For the monitoring of temperature, speed, vibration and lubrication oil level, the temperature sensor, speed sensor, vibration sensor and level sensor can be used. All these parameter output is given to the amplifier unit. The output of the amplifier is then given to the processor. PC is connected to the processor via RS 232 and it is a serial communication cable. So the parameters can be monitored and controlled by using the embedded processor. Whenever lubrication oil level becomes low, automatically it activates the relay to turn on the DC pump. Speed can be set as constant of 3000 RPM and according to the speed, the vibration can be controlled. Temperature is controlled with the help of cooling fan. By using the embedded processor all these four parameters are monitored and it can be controlled automatically. The parameters variations can be graphically represented by using Lab VIEW.

V. SENSOR DESCRIPTION

A. Temperature sensor

Temperature sensor is used to sense the temperature in the turbine system. In my project, thermistor type temperature sensor can be used. A thermistor is a type of resistor whose resistance varies with temperature. The word is a portmanteauof thermal and resistor. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting over current protectors, and self-regulating heating elements.

B. Vibration sensor

Vibration sensor is used to sense the vibration in the turbine system. For measuring of the vibrations, piezoelectric sensor can be used. A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal.

C. Speed sensor.

Speed sensor is used to sense the speed of the turbine system. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

D. Level sensor

Level sensor is used to sense the lubrication oil level. Level sensors detect the level of substances that flow, including liquids, slurries, granular materials, and powders. All such substances flow to become essentially level in their containers (or other physical boundaries) because of gravity. The substance to be measured can be inside a container or can be in its natural form (e.g. a river or a lake).

VI. SIMULATION RESULTS USING LAB VIEW

The turbine parameters for both the normal and abnormal conditionsare graphically represented by using Lab VIEW. In the fig.2, it represents the normal condition of the parameters. The speed can be maintained as 3000, according to that vibration also maintained. It indicates the oil level as 12 and temperature as 450. It can be graphically represented and displayed the parameters is in normal condition. In the fig.3, it represents the abnormal condition of parameters. The speed can be exceeding to 6000 and according to that the vibration can be varied. The oil level decreases to low as 8 and the temperature can be exceeding to 700. It can be represented by using the graphical method and displayed the parameters is in abnormal condition.

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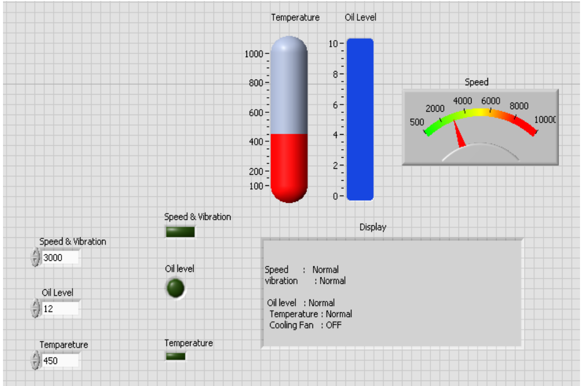

Fig. 2: Normal Condition of Parameters

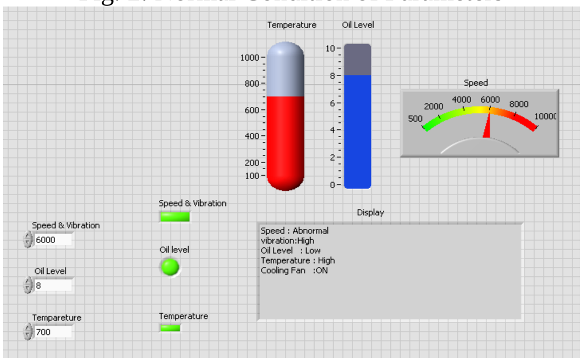

Fig. 3: Abnormal Condition of Parameters

VII. SIMULATION RESULTS USING ARM 8 PROCESSSOR

In the UTLP kit, the control panel consist of four options areTemperature sensor, Speed sensor, Level sensor and Vibration sensor. When selecting the option 1, it represents the temperature. If the temperature can be raised to higher level automatically the cooling fan will be ON.

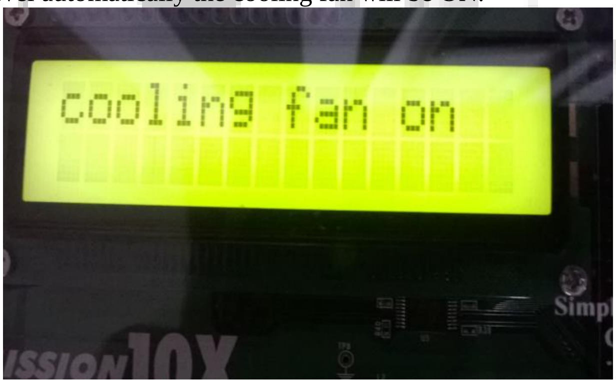

Fig. 4: Representation of Temperature

When selecting the option 2, it represents the speed. If speed is increased to higher level, it automatically reduces the speed.

Fig. 5: Representation of Speed

When selecting the option 3, it represents the level of lubrication oil. If the oil level decreases to lower level, it automatically represents as abnormal condition.

Fig. 6: Representation of Lubrication Oil Level

When selecting the option 4, it represents the vibration level. If the vibration is in normal condition, it represents as normal.

Fig. 7: Representation of Vibration

VIII. CONCLUSION

In this paper, the turbine parameters like temperature, speed, vibrations and lubrication oil level are monitored and controlled automatically with the support of ARM 8 processor. It provides an excellent solution for the existing system by overcoming the drawbacks. The simulation results are obtained by using Lab VIEW. In future, the work can be enhanced by increasing the number of parameters in the turbine system and the parameters can be monitored and controlled through the online system. It can be extended by using wireless technology like GSM which helps to send the parameter value to the authorized person.

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