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MONITORING AND CONTROLLING OF TURBINE PARAMATERS USING MICROCONTROLLER

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***Abstract*— The project deals with the protection of 210 MW turbine generator systems. Turbine protection involves axial shift of turbine shaft, lubricating oil pressure and condenser vacuum. Shaft is a turbine and generator rotor. Axial shift measurement is very important to monitor the mechanical balance between the turbine and generator rotor. If any variation in the mechanical balance the turbine shaft will be damaged. The lubrication oil is used for the lubrication oil purpose of turbine bearings. It is maintained at the pressure of 1.2kg/cm^2. The lubricating oil pressure is reduced to below 0.6 kg/cm^2 the turbine bearings temperature will increased. The condenser vacuum is very important to steam flow from low pressure turbine to condenser. Consider vacuum maintained at -670mmHg. If decrease into -540mmHg the back pressure created in low pressure turbine and also turbine efficiency is reduced.**

Keywords— **Pic Microcontroller, Relay, Temperature sensor, Pressure sensor, Axial shaft and turbine trip**

I. INTRODUCTION

Steam turbines are utilized in numerous industries to drive boiler fans, boiler feed and water pumps, process and chiller compressors, blast furnace blowers, paper mill line shafts, sugar mill grinders, and generators in a verity of industries and application. Consequently steam turbines can range from being small and simple and design /construction to large, highly complex design /arrangements consisting of multiple sections and multiple shafts. Specifying the desired maintenance and overhaul intervals for steam turbines, therefore, has to take into account the design/construction of the turbine as well as the industry and application utilizing the turbine.

Besides the configuration and industry associated with the steam turbine, the infrastructure for monitoring, operations and maintenance including specific practices, and steam quality can have a major effect on the reliability of steam turbines regardless of the industry or application. In the next several sections of this paper, several pertinent aspects of steam turbines will be addressed. The discussions have been organized in a sequence beginnings with steam turbine component characteristics, failure mechanism, arrangements and applications. These discussions are followed by what infrastructure should be in place to operate and maintain steam turbines, what has failed based on past experience, and what maintenance should be conducted to minimize the risk of failure. And lastly, the discussion include what should be taken into account for determining longer overhaul intervals and what effects the new steam turbine technologies may have on scheduled maintenance and overhaul intervals.

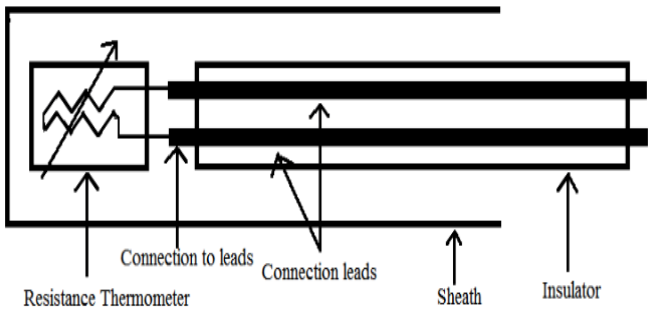

Fig. 1. Temperature sensor

A temperature-sensitive resistor is called as thermistor. They are RTD sensor may be used. The resistance of most common types of thermistor decreases as the temperature rises.

Table 1: Specification of Temperature sensor

Parameter	Range
Range	0…100^{0}C
No. of sensor	1…30
Levels	0 & 5 volts
Conditioner	Wheatstone bridge with +15 bits ADC
Dimensional	224 * 120 * 60+40mm

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Resistance temperature detectors operate through the principle of

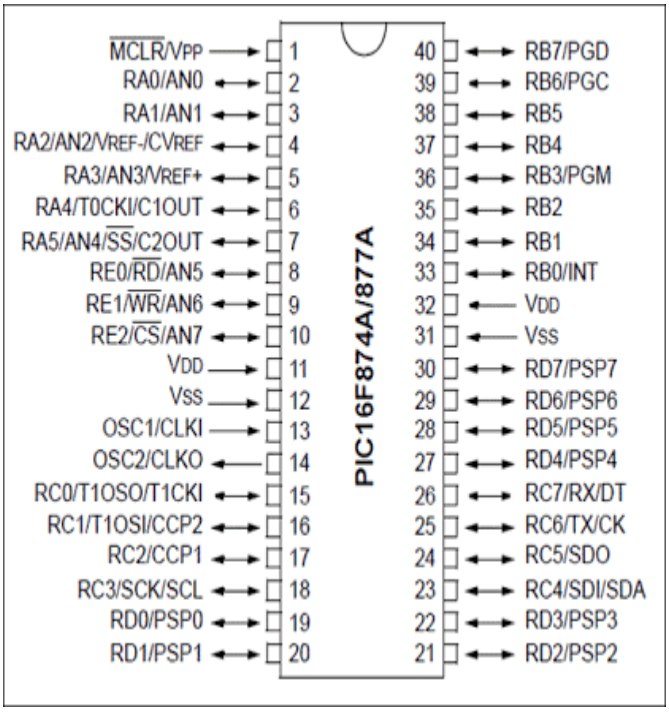

Fig. 2. PIC Microcontroller

Electrical resistance changes in pure metal elements. Platinum is the mostly widely specified RTD element type although nickel, copper and balco (nickel-iron) alloys are also used. Platinum is popular due to its wide temperature range, accuracy, stability the degree of standardization among manufactures. RTDs are characterized by a linear positive change in resistance with respect to temperature. They exhibit the most linear signal with respect to temperature of any electronic sensing device.

Microcontroller

The PIC microcontroller PIC16F877A is one of the most renowned microcontrollers in the industry this microcontroller is very convenient to use the coding or programming of this controller is also easier.one of the main advantage is that it can be write erase as many times as possible because it has total number of 40 pins and there are 33 pins for input and output.PIC16F877A is used in many pic microcontroller project.PIC16F877A also have many application in digital electronic circuit.

PIC is a family of modified Harvard architecture microcontroller made by microchip technology, derived from the PIC1650 originally developed by general instrument's microelectronics division. The name PIC initially referred to "peripheral interface controller". PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

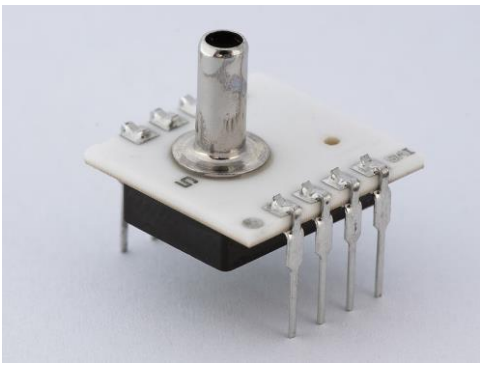

Fig. 3. Pressure sensor

Pressure sensor

Pressure sensor uses the changes in thermal conductivity of a gas due to density changes to measure pressure. A common example of this type is the pirani gauge. Measures the flow of charged gas particles (ions) which varies due to density changes to measure pressure. Common example are the hot and cold cathode gauges

A pressure sensor is a device for pressure measurement of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical.

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, pressure senders, pressure indicators, piezometers and manometers, among other names.

Pressure sensors can vary drastically in technology, design, performance, application suitability and cost. A conservative estimate would be that there may be over 50 technologies and at least 300 companies making pressure sensors worldwide.

There is also a category of pressure sensors that are designed to measure in a dynamic mode for capturing very high speed changes in pressure. Example applications for this type of sensor would be in the measuring of combustion pressure in an engine cylinder or in a gas turbine. These

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sensors are commonly manufactured out of piezoelectric materials such as quartz.

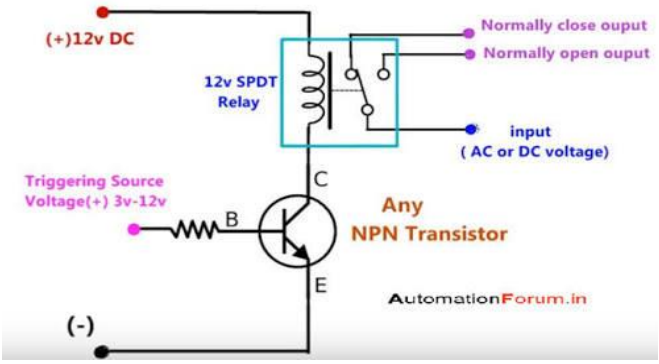

Fig.4. Relay circuit

Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

Proposed block diagram

The proposed system is the monitoring and also controlling the steam turbine can be done by using micro controller. The project deals with the protection of 210 MW turbine generator systems. Turbine protection involves axial shift of turbine shaft, lubricating oil pressure and condenser vacuum. Shaft is a turbine and generator rotor. Axial shift measurement is very important to monitor the mechanical balance between the turbine and generator rotor. If any variation in the mechanical balance the turbine shaft will be damaged. The lubrication oil is used for the lubrication oil purpose of turbine bearings. It is maintained at the pressure of 1.2kg/cm^2. The lubricating oil pressure is reduced to below 0.6 kg/cm^2 the turbine bearings temperature will increased. The condenser vacuum is very important to steam flow from low pressure turbine to condenser. Consider vacuum maintained at -670mmHg. If decrease into -540mmHg the back pressure created in low pressure turbine and also turbine efficiency is reduced.

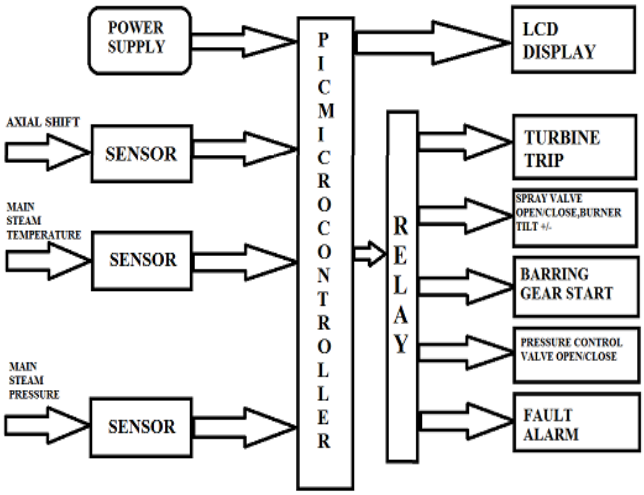

Fig.5.Block diagram of proposed system

A. LCD display

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit liquid directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

B. Power Supply

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a fall-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.

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C. Axial Shift

Running the turbine with excess axial shift may damage the thrust pads in the thrust bearing. If the axial shift exceeds -1.7mm or +1.2mm the turbine has to be tripped and bring the turbine to rest as soon as possible by opening the vacuum breaker.

D. Turbine trip

Every steam turbine is also provided with emergency governors which come into action under specific conditions. In general, an unplanned or emergency shutdown of a turbine is known as a “turbine trip”. The turbine trip signal initiates fast closure of all steam inlet valves (e.g. turbine stop valves-TSVs) to block steam flow through the turbine.

The turbine trip event is a standard postulated transient, which must be analyzed in the safety analysis report (SAR) for nuclear power plants.

II. EXPERIMENT AND RESULT

Thermal protection of critical parameters is critical for preventing catastrophic turbine breakdown, prolonging turbine lifetime and avoiding the extraordinary financial losses due to unexpected industrial process downtime caused by turbine failures. The review of available critical parameters and this critical valves has been concluded that these critical parameter namely vacuum condenser, lubricant oil and axial shift of the turbine should be maintained according to its critical valve, and if it drops below the critical value will cause damage to the turbine and hence this project is very helpful for this purpose.

III. CONCLUSION

The system of protection in turbine generator system is relay and hard wired system. The existing system has lot of disadvantages such as high power consumption, slower operation rate, high maintenance cost, consists of so much of wires, improper operation at critical stage, is not safer, since using of dc supply.

These disadvantages are eliminated by using PIC controller. PIC is a controller which is used for the protection of turbine generator system. PIC controller operates at very low voltage and it consumes lesser power**.** PIC controller uses simple user friendly programming and reduces the hardware components. Program used in the PIC can be easily altered and effectively controlled.PIC IC is used for real time monitoring of data that can be done in relay system.

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