

Design and Implementation of Web Based Remote Access and Automation of AC Electrical Machines

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Abstract-A virtual instrument is a computing tool to offer development of the virtual environments and remotely access web based laboratories. The electrical machines are critical instruments and it plays important role in an industries. The various fault in electrical machine includes the broken rotor bar, winding short circuit, bearing damage, or static or dynamic eccentricities. Any kind of fault occurrence due to voltage fluctuation or physical damage, it affects the overall cost, time, quality and safety. The proposed work shows the development of advanced technology using virtual instrumentation in industrial applications and showing how easily a user can monitor and control AC electrical machines remotely using web server interfacing. The mechanical approach is used for monitoring and controlling the AC induction motor for detecting fault occurrence. This system is implemented by using different types of sensors for monitoring the motor. The sensors are interfaced by using Data Acquisition Card (DAQ) and output is provided to relay which controls the switch of the motor if any fault occurs. The advantages of the implemented system is user friendly, reduce development cost, time, efficient and good infrastructure.

Keywords-AC electrical machine, LabVIEW, remoteservices, virtual lab, fault detection.

I. INTRODUCTION

The web-based laboratory is a very modern technique. But the idea of the remote access lab is not new in the early 1980s it has been introduced [1]. However, in last few years due to the progress of high speed internet which allowed the remote access techniques with the very secure manner data transmission based on networking. At the combination of both theory and practically approach is providing up-to-date measurement setup of work. Now a day's they introduced the Virtual instruments because the development of remote application is increases for measuring and monitoring the different kinds of sensors. The user can easily access the data which is acquiring from the sensor by using of virtual instruments. For the safety purpose most of the automobile industries, chemical and nuclear power plants they use the virtual instruments because the improvement of the productivity and cost effective, reliable, safe and optimize system.

Virtual instruments are system software which is used by user for the purpose of measurement and testing a system. It is a motivational component for the computational science. Virtual instruments are also used in

controlling and monitoring the devices based on data acquired by the system, and it provide the real word experiment. Internet has provided new approach and possibilities to access the system in a remote area. Basic tools can be used for remote access [2, 3, and 4] are lab-socket or Common Gateway, LABVIEW, MATLAB [5].

Generally in an industries or laboratories they manually control the system by computer technology but some time it's difficult to operate. At that time virtual instruments play a very important role, it provides the proper visualization of whatever task was performed and also it reduces the development cost and time of lab and other infrastructures which is not necessarily. A remote access lab allows performing the experiments online through the available modern technologies tool [6, 7]. It requires proper interfacing module for controlling and measurement of the various parameter of the given task in a remote place. It reduces the design complexity in the web-interfacing [8] through the available LabVIEW resources. The Data acquisition (DAQ) system directly interfaces with the system hardware which is helpful to reducing the system complexity. This paper describes the design and implementation model of remotely control the AC induction motor.

The AC induction motor works based on the principle of rotating magnetic field. It can operate in single phase power supply and converts the electrical energy into the mechanical energy. The motor can operate the various type of the load according to the industrial purpose. In industries ac induction motors are most commonly used, which can be single or three phase Induction motor, squirrel cage and synchronous AC motor.

The rest of paper is organised as follows. In section II it discuss the related work. The section III describes the design model of overall system and the section IV represents the implementation and result of the proposed system.

II. RELATED WORK

For industrial purpose a remote control based on web interfacing is almost necessarily due to the time and cost factor. Few year back, so many researches had to overcome this and also many universities are designed their own techniques. And that software technique performs the lab

experiment in a remote area for providing the flexibility to the students. It is also necessarily for the industries as well because there is are plenty of machines were running at the same time. So we can't monitor manually each and every motor individually. Also it is not possible to find out all type of fault occur in a machine. There are some remote server based techniques are introduced to monitor and control the whole system. Some institutions are developed and introduce its own system for students to perform the Lab experiments at remote place. That provides the flexibility to the user at a time constrain.

The Zafer Aydogmus was presented web-interfacing based real time control and monitoring system using SCADA for the electrical machine [9]. Here a PLC are used to program setup and the SCADA monitor and control the system. The limitation of this system is, if there is any faulty condition occurred, was not detected and responds immediately. And also system was not cost effective. This system was introduced only for the purpose of performing the lab experiments by the university students.

R. Bayindir and S. Vadi was introduced real time monitor and control the system by using GPRS/GPS system [10, 11]. Here they provide the communication link between user and virtual instruments by connecting the system through the GPRS/GSM network. This system is cost effective but the limitation of this system is time delay. When there was any fault occurs, system transfers the information to the user. It took few seconds of time for responding, so that much of delay affects the overall system, which may be harmful for the real time operating system.

III. SYSTEM DESIGN MODEL

This paper represents the real time monitoring and controlling of the electrical machine by using the virtual instruments LabVIEW software. The basic idea of the overall developed system is shown in Figure 1. Here it indicates the flow of the overall work. A single phase AC induction motor is used to control and monitor by LabVIEW software.

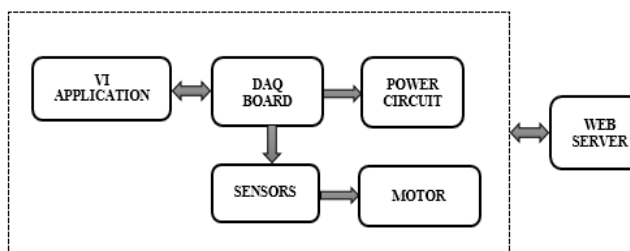


Fig. 1. The basic idea of the overall developed system

The Proposed system gives the overall information about the AC induction motor and also updates the data with respect to time. And also it detects if any fault occurs in the machine such as broken rotor bar, starter or armature fault and bearing damage are most commonly faults occur in the AC induction motor.

Once the task starts, manual operation is not mandatory, each task can be accomplished via LabVIEW software. In the Figure 2, it shows the sensors are connected to the DAQ (data acquisition) board which is connected through the power circuit. Also it shown the flow of the proposed work. Therefore, the overall design can be visualized by graphical represents.

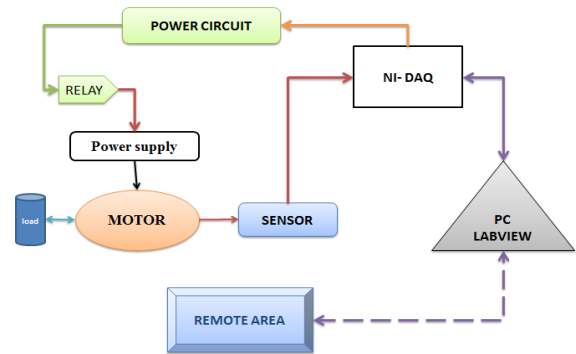


Fig. II. The structure of design

While motor is in working condition sensors acquire the data and give it to the DAQ board. Than DAQ board acquired the data and gives it to the LabVIEW, and the LabVIEW analyse the data and result will be shown in front panel window of the LabVIEW software [12, 13, 14]. After that by using the lab-socket system data can be accessible at remote place via web-interfacing.

The system design model can divided into three parts:

A. Software

In a software part LabVIEW play a very important role in overall design problem, and it provides the remote control setup by using web interfacing. It performs both monitoring and control operation on the AC induction motor, and also it indicate in display if any fault occurs in the motor. It exchanges the data files and updating the information with respect to time. The LabVIEW has been built with two interactive windows. The Front panel window where it is indicate the overall control mechanism and other one is block diagram, it uses graphical interfacing. In case of any faulty condition it gives the error message. The measure goal of the design to provides the user friendly and interactive communication. LabVIEW software is completely based on graphical programming language.

The main task of this proposed design is acquiring the sensor data, data analysis, data representation and storage the overall data by using DAQ board. A front panel consists of indicators, Boolean switches, graph and control units, and it provides the feel of real physical instruments.

B. Hardware

The hardware part of the system mainly consists of a three different types of sensors, DAQ board, single phase AC induction motor and power circuit. These three sensors namely inductive proximity sensor for the RPM measurement, accelerometer sensor for the vibration

measurement and Hall Effect base linear current sensor for current measurement are used. All these sensors are directly connected to the NI (National Instruments) 6211 DAQ board, which have 8 single analogue input pins with 2 output and 12 digital input output pins. DAQ board is connected to the PC with full speed USB standard. The power circuit diagram for relay is shown in Figure 3.

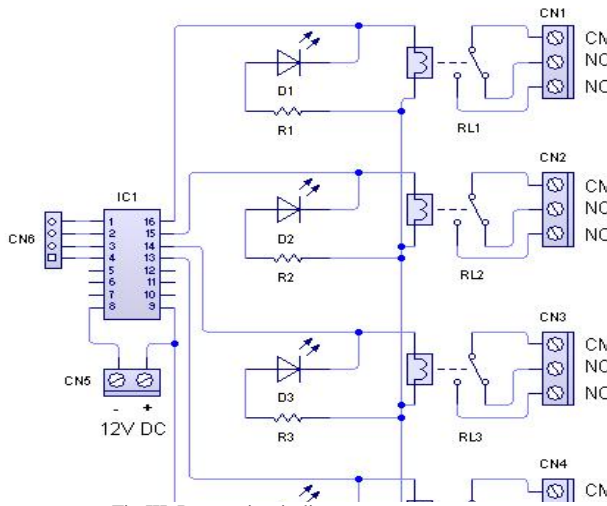


Fig.III. Power circuit diagram

The AC induction motor is used for performing the experiments. For controlling the motor while the faulty condition, the relay works as a switch. However the sensors output are exceed the ideal condition. Then relay immediately responds and it gets switched off. For operating a relay 5-12 volt voltage supply is needed. The specification of the AC induction motor used for implementation shown in Table-I.

TABLE I. MOTOR SPECIFICATION DETAILS

MOTOR TYPE	SINGLE PHASE AC INDUCTION MOTOR
CONNECTION TYPE	STAR
RATED CURRENT	1.8 AMPS
HP/KW	0.5/0.37
FREQUENCY	50 HZ
REV	2800 RPM
RATED VOLTAGE	230

C. Remote Control

The remote control is nothing but web interfacing services. This provides bidirectional communication to the client and webserver. The user accesses front panel data in a remote place by using a web-interfacing protocol is called Labsocket. Here a user sends a data transfer request to the web server, which analyses the request and gets back the response to the user. A system provides flexibility to user because at time more than one client access the data. To perform all these operation, proper internet connection is mandatory. In Figure 4 shows the basic communication process of web interfacing. With the help of Labsocket, a user sends the request to the web server. The host computer has an internet connection to log in the Labsocket website,

than synchronic with the user computer URL. And generates the HTML file for the required setup, because all the settings saved in HTML file.

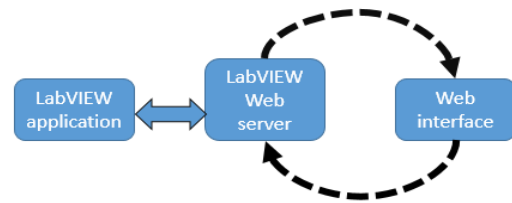


Fig. IV. The web interface process

Now user can easily access the virtual instruments in a remote place. For the safety purpose Labsocket provides the login facilities, where only authorized person uses the experimental system.

IV. IMPLEMENTATION AND RESULT

The proposed design is implemented with the help of single phase 0.5 HP AC induction motor, which is shown in Figure 6. LabVIEW software is installed in laptop and the power circuit was mounted in bread board. This system can control and monitored in both remote and local place. If there is any faulty condition occur like broken rotor bar, bearing damage and vibration or any such kind of voltage or current fluctuation, system can easily detect. Then the relays were worked as a switch and it get switched off the entire process at the faulty condition. It can easily find out the parameter where the error was occurred by using the sensor.

The diagrams shown in figure 5 indicates the block diagram and front panel of the proposed model. Here the block diagram indicates the graphical code based on the icons and wired connection between them. As it consults we can monitor status of the motor like RPM, voltage and current via front panel.

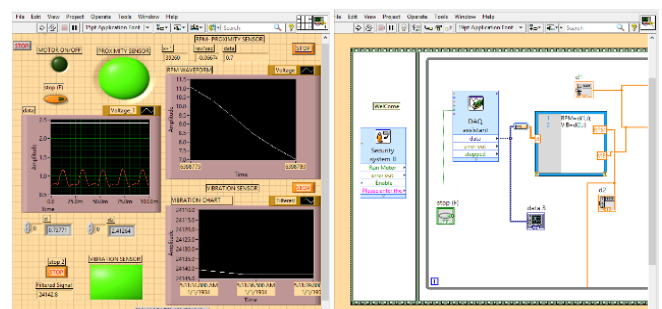


Fig. V. LabVIEW Graphical coding for the AC motor: Front panel and Block diagram.

The complete hardware setup shown in figure 6. The system acquires the data from the three different sensor Proximity inductive sensor, vibration sensor and Hall-effect current sensor using Data Acquisition Board. LabVIEW analysis the data and get the result.



Fig. VI. Hardware setup of the experiment

The proposed model is to use to understand how the electrical machine can control and monitor the system in a remote place for the industrial purpose. A power circuit four channel Relay board perform the operation of switching according to the condition. Data acquisition board generates the five volt signal to drive the relay.

A system is completely configure to the Remote server. And now we can easily monitore and control the system parameter in the Remote place. Here it shows the graph of the RPM and vibration measurement, and also includes some LED indicators, <http://shyampatel:8000/01%202nd%20review.html> is a web server link, which indicates the system working condition. A figure 7 shows the front window of the experiment.

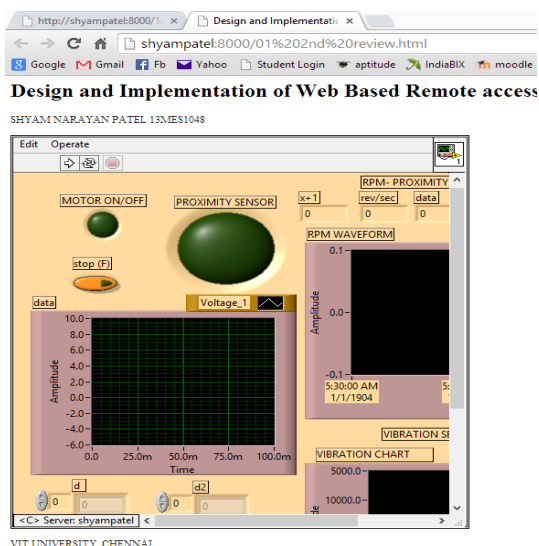


Fig. VII Creating and configuring the HTML file

It contains the IP address of the main computer. When the remote user access the link, a server synchronize and configure to the remote PC. And send the HTML files to the remote server via internet. The client can monitor as well as control the overall system via computer or mobile at remote place.

CONCLUSION

Among the various machines used in industries, it is not possible to monitor and control each and every machine manually. Using this technique, it can be possible to monitor each system in industries efficiently, hence it is time and cost optimized system. It is performing the test on the AC induction motor. The system is completely implemented for industrial purpose, allowing peoples to monitor and control the electrical machine from remote location. Thus, the system becomes a useful tool for collaborate the industrial applications, and also enables the shared uses of resources. To monitor and control the tests system, it use the virtual instruments to make the virtual environment. At a remote place, the system can be monitor and control. The target of the implements the system is to monitor and controls the electrical machine, and fault diagnosis.

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