Design of Remote Monitoring System of Rotor Experiment Based on Virtual Instrumentation

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Abstract. A remote monitoring system of rotor experiment in laboratory is presented. The type of the key sensor is accelerometer which is for measurement of vibration signal. The hardware of system is based on NI-PXI system which is very popular automatic testing system and to be available in market. The software of system is based on LabVIEW which is to be for design of GUI of monitoring interface. The system is working well in laboratory. So it is good reference for other design.

Introduction

With recent development of web technologies, there is trend to form a network of laboratory which allows control and measurement of experiments by the internet. Experimental equipments which are far away can be connected together to work cooperatively. For the sake of this goal, rotor experiment is sponsored to form a remote monitoring system. Its objective is to make experimental laboratories with facilities like motor experiment, which is available for remote participation and monitoring. Such a network of equipments in laboratories can also be useful to provide a complete educational experience in distance-education programs in which theory is complemented with hands-on experiments.

This paper presents post/under-graduate level project work based on design and implementation of a remote monitoring system and an automation testing system using virtual instrumentation technologies.

The paper has been organized as follows. Starting with brief introduction in Section 1, architectures have been included in Section 2, which includes descriptions on system utilized (with subsections like hardware, sensors). Section 3 titled software design consists of program by LabVIEW. Section 4 presents conclusions, on implementation of remote monitoring system of rotor experiment. Section 5 contains acknowledgment, and list of references.

Architecture of Hardware and Sensor

There are two equipments in this system, which includes rotor test-bed and PXI automatic testing system. The sensors are also important parts for acquiring data. The architecture of system is shown in figure 1.
Hardware of Equipment

Multi-functional flexible rotor experimental system is the key experimental equipment in higher educational laboratory. It can provide vibration experiment and simulate many kinds of vibration of rotating machinery, and it can achieve functions of acquisition, measurement and analysis through the data acquisition system. Figure 2 shows the rotor experiment. The rotor experiment has not web interface, and can not be used for remote data processing.
With the NI platform, any sensor or actuator can be connected to any “thing” to generate accurate and large amounts of data, it has the advantage of being able to connect to the network and can be used for remote data processing[1]. Figure 3 shows the PXI automatic testing system. The hardware of remote monitoring system of rotor experiment is showed in Figure 4.

The main work is use PXI automatic testing platform to implement remote monitoring for rotor experiment.

**Hardware of Key Sensors**

An accelerometer is a device that measures proper acceleration, it has multiple applications in industry and science[2]. A single-axis models of accelerometer which type is 352c33 is selected to measure vibration on rotor experiment in this system.

SHT75 is a relative humidity and temperature sensors with 4 pins. The sensors integrate sensor elements plus signal processing in compact format and provide a fully calibrated digital output[3].

**Framework of Software**

LabVIEW is graphical programming software which has great conveniences from other software languages, so in this monitoring system, LabVIEW is adopted to design the monitoring software which is accord to PXI automatic testing system.

**Design of Font Panel**

There are two font panel in the system, which includes server font panel and client font panel. The panel of server is displaying of the local parameters in rotor experiment. In general, the panel of server mainly includes three parts which are vibration, temperature, current value, as shown in Figure 5.
The panel of client is similar to the panel of server, which is shown in Figure 6.

**Design of Block Diagram**

The key work of this section of block diagram is to determine the parameters of TCP modules. The communication between server and client in remote monitoring system is based on standard TCP protocol with C/S program mode.

The TCP Listen VI generates a connection reference whenever the client connects on the specified port. Note that the client has 30 seconds to connect before the server times out. The first module in client of block diagram is “Open a TCP connection” which is the TCP Open Connection function. Note that the port must match the one specified in TCP - Server.vi. The part of client of block diagram is shown in Figure 7.
Conclusion

The hardware and software implementation of remote monitoring system have been described in this paper. Experimental testing results on rotor testing bed show that it can work well. The data acquisition and display terminal offer a platform for collecting, displaying, monitoring which are considerably significant for experimenters analyzing results and diagnosing.

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References


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