Design and Realization of Rotating Machinery Conditions Monitoring System Based on LabVIEW

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Abstract: Nonlinear dynamic analysis of rotating machinery system has always been the hot spot of the rotational dynamics research. This article sets up a rotating machinery condition monitoring system to realize the measurement of system dynamic characteristic parameters based on NI(National Instruments) virtual instruments technology. The measurement of vibration signal of rotating machinery system is achieved by using NI company general data acquisition module of NI Company. Meanwhile, by analyzing and processing the acquired data using LabVIEW 2012, the dynamic characteristics, such as .the speed of the rotating machinery system, the axis trajectory, spectrum parameters, are attained. The measurement results show that the rotating machinery condition monitoring system based on LabVIEW is easy to operate, easy to realize the function extension and maintenance, and that it can be used in the industrial engineering projects with rotation characteristics. LabVIEW as the development tools used by virtual instrument function is very powerful data acquisition software products support is one of the features of it, so using LabVIEW programming and data acquisition is simple and convenient.

Keywords: Rotating machinery; LabVIEW; Virtual instrument; Data acquisition; FSM (Finite State Machine)

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1. Introduction

With the rapid development of computer technology, the virtual instrument is becoming a development tendency of test field. The concept of virtual instrument is made by National Instruments(NI for short), an American company, which refers to the common computer platform that users define and design instrumentation system which has the function of test, according to their requirements; which also refers to an instrumentation system which consists of some basic hardware and software programming technology. The three main functions of virtual instruments include: data collection, data testing and analysis, output and display of result.[1]

In order to program and debug conveniently for programmers, the introduction of state machine has its advantage.

2. Introduction of Rotating Machinery

A set of rotating machinery, including the stator and rotating electric son configuration inside the stator, the stator includes a stator core including slots to provide equal in the whole circle of asphalt and configured within slots stator winding, stator coil includes volume as considerate knee trauma by plural wheel around a slot and other respective slots and the connection of a bridge connecting wires between knee around parts, each part were arranged to share in a slot electric edge and in another slot at the bottom of the bottom and a shift from electric son Per volume of edges in a slot to say below, on the other part a slots per volume through the coil end is executed per volume part of said roughly in the same direction, volume part by outside of the coil end configured bridge connecting wire is connected, and volume at least partially by the only continuous wire formed into a roll shape.[2]

2.1 3D Model of Rotating Machines

Today, 3d software is available, which has greatly facilitated our design of hardware. In this design we use SolidWorks to achieve the 3D modeling. (Figure 1)

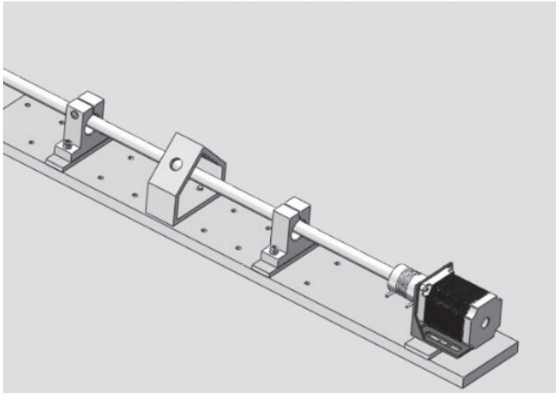
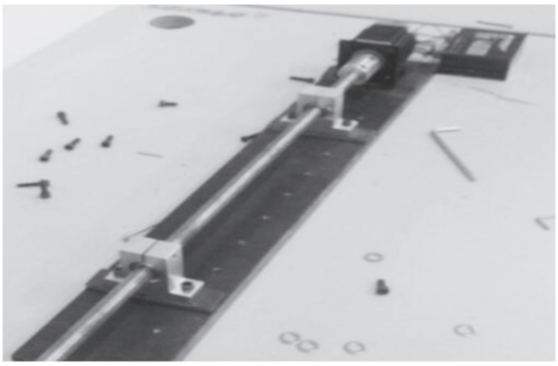


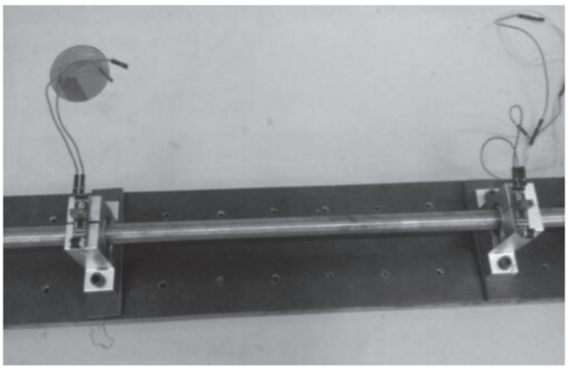
Figure 1. 3D Model of Rotating Machines

2.2 Physical Hardware Model

Through 3d modeling, we get the corresponding materials, set up corresponding physical model (Figure 2) and write the program for motor.



(a)



(b)

Figure 2. Physical Hardware Model

3. LabVIEW Introduction

LabVIEW is a highly effective graphical programming language for building data acquisition and systems surveying. With LabVIEW, you can create user interfaces that give you interactive control of your software system quickly. To specify your system functionality, you simply assemble block diagrams - a natural design notation for scientists and engineers. This tight integration with measurement hardware facilitates rapid development of data acquisition, analysis and presentation solutions. LabVIEW contains powerful built in measurement analysis and a graphical compiler for optimum performance. LabVIEW is available for Windows 2000/NT/Me/9x, Mac OS, Linux, Sun Solaris, and HP-UX, and comes in three different development system options.

3.1 LabVIEW Development

LabVIEW accelerates development over traditional programming by 4 to 10 times! With the modularity and hierarchical structure of LabVIEW, you can prototype, design, and modify systems in a short amount of time. You can also reuse LabVIEW code easily and quickly in other applications.

3.2 LabVIEW Investment

Using a LabVIEW system, each user has access to a complete instrumentation laboratory at less than the cost of a single commercial instrument. In addition, user configurable LabVIEW systems are flexible enough to adapt to technology changes, resulting in a better long-term investment.

3.3 LabVIEW Performance

All LabVIEW applications execute at compiled speed for optimal performance. With the LabVIEW Professional Development System or Application Builder, you can build stand-alone executables or DLLs for secure distribution of your code. You can even create shared libraries or DLLs to call LabVIEW code from other programming languages.

4. FSM Concept

Overall, the finite state machine system refers to the different stages will be showing a different operating states systems, which are finite, do not overlap. Such a system will at some point in a state of all ones, in which case it receives a portion of the allowable input and produces a portion of the possible reaction, and migrate to a portion of the possible states.

4.1 FSM Example

Keyboard analytical procedures, such as the program is located in the state of the A, if the trigger button 1, then go to state B, if the trigger button 2, then go to state C or transferred back to A.

Again, the actual communication example, the next crew collected signal PC control to begin the initialization state, if you press the button collection, then enter the collection interface, data acquisition or up to a certain time, then go to the data to calculate the interface, and then calculated into the stop or collection again, this is a state machine.

4.2 Elements of State Machine

4.2.1 State

State: a system in its life cycle operation at a time, when the system will perform some action, or wait for some external input.

4.2.2 Guard

When the state machine responds to an external message, in addition to determine the current state but also to determine the status of a number of conditions associated with this is established. This judge is called guard. Guard by allowing or prohibiting certain actions to influence the behavior of the state machine.

4.2.3 Event

Event: something meaningful to the system which happens in a certain space and time occurs.

4.2.4 Action

When an Event is distributed state machine system, the state machine responds with Action, for example, modify the values of variables, input and output, resulting in another Event or move to another state, and so on.

4.3 FSM Design

4.3.1 Combined Flow Chart Design (Figure 3)

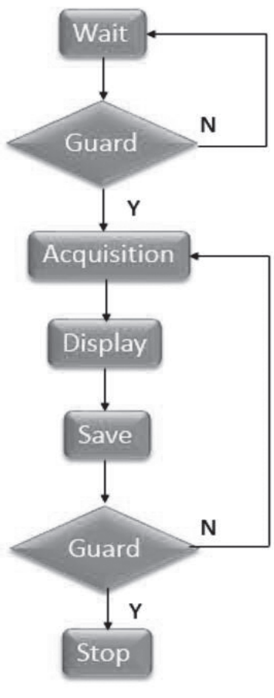


Figure 3. Combined Flow Chart Design

4.3.2 LabVIEW Program Design (Figure 4)

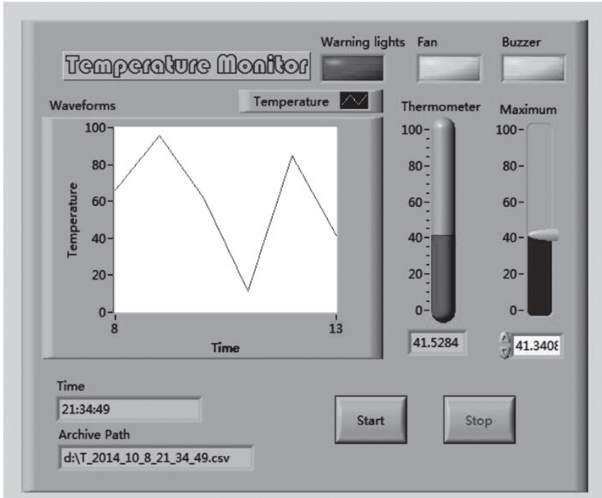


Figure 4. LabVIEW Program Design

1) Overall Procedural Framework (Figure 5)

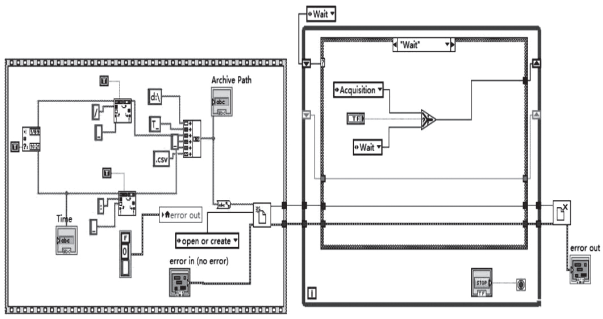


Figure 5. Overall Procedural Framework

2) Wait Part of the Program (Figure 6)

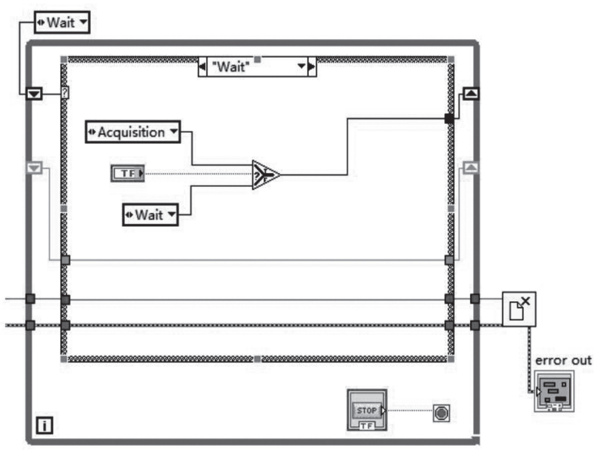


Figure 6. Wait Part of the Program

3) Acquisition Part of the Program (Figure 7)

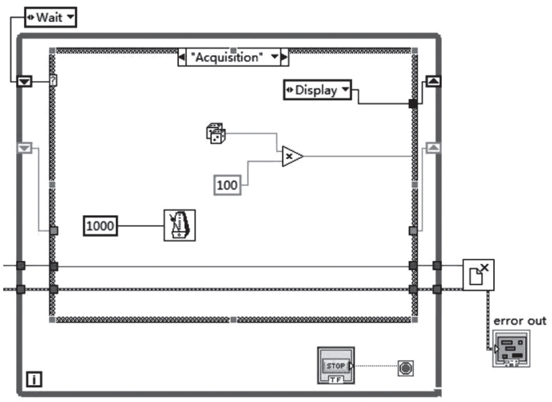


Figure 7. Acquisition Part of the Program

4) Display Part of the Program (Figure 8)

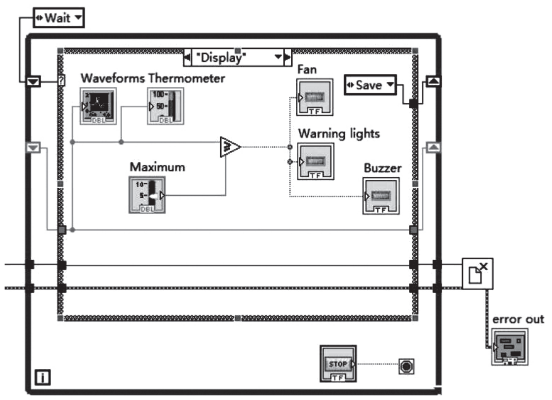


Figure 8. Display Part of the Program

5) Save Part of the Program (Figure 9)

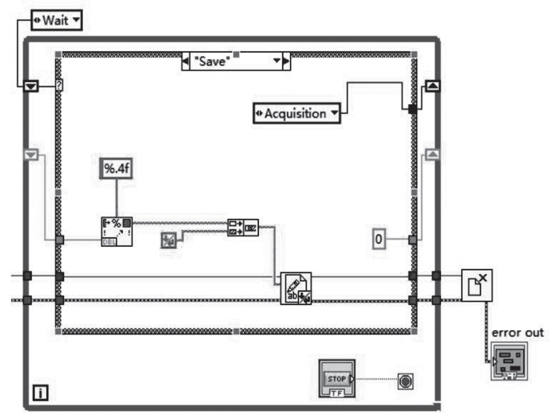


Figure 9. Save Part of the Program

5. Conclusion

This article combines LabVIEW data acquisition system designed state machine architecture that can be easily programmed by reasonable arrangements architecture program. In the meantime, facilitate error-checking for procedures, improve system reliability. On this basis, the other functions of collection can be further improved, laying a solid foundation for optimizing the programme.

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