Fault Diagnostician of Induction Machine Using LabVIEW

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ABSTRACT*:* Induction motors are used worldwide as the "workhorse" in industrial applications. Although, Induction motors are highly reliable, they are susceptible to many types of faults. The main type of faults experienced by these motors are over loading, single phasing, unbalanced supply voltage, locked rotor, phase reversal, ground fault, under voltage, over voltage. Such fault can became catastrophic and cause production shutdowns, personal injuries, and waste of raw material. Though many researchers have developed many fault diagnosing techniques, user friendly software with automated long measurement process is needed so that the non-technical persons also can operate to identify the faults occurred. In this paper the healthy induction motor is modeled in stationary reference frame. Faulty conditions are included in the model to analyze the effect of fault in the motor using the user friendly software, LabVIEW.

KEYWORDS: LabVIEW means Laboratory Virtual Instrument Engineering Workbench, C DAQ – Compact Data Acquisition

I.INTRODUCTION

The aim of the paper is to monitor the 3 phase induction motor so that when over voltages or under voltage and over current or under current occur in motor, the motor can disconnects from the supply. The problem is that there are many undesirable things that happen to electric motors and other electrical equipment as a result of operating a power system in an over voltage manner. Operating a motor beyond its nominal range of its voltage requirements will reduce its efficiency and cause premature failure. The problem with low voltage in motor can cause high currents and overheating which will subsequently shorten motor life. Too low voltage can also reduce the motor's ability to get started and its values of pull-up and pull-out torque. The problem with over current in motor has many symptoms and can eventually lead to permanent damage to the motor or electrical device.

The structure of Induction motor behavior during abnormal conditions due to presence of faults and the possibility to diagnose these abnormal conditions have been a challenging topic for many electrical machine researchers. There are many condition monitoring methods including voltage monitoring, current monitoring, vibration monitoring, thermal monitoring, but all these monitoring methods require expensive sensors or specialized tools whereas current monitoring out of all does not require additional sensors, this is because the basic electrical quantities associated with electromechanical plants such as current and voltage are readily measured by tapping into the existing voltage and current transformer that are always installed as part of the protection system.

This project work is to diagnose the common electrical faults experimentally with the NI hardware C DAQ and the user friendly software LabVIEW. It is observed that most of the work available in literature based on MATlab or Embedded which may be difficult, in this work LabVIEW environment is used and it may be the better option for direct interfacing with the system.

II.NI LabVIEW and C DAQ

NI Lab VIEW is software where all the code is implemented and interfacing of DAQ is done. Lab VIEW is a graphical programming environment used by millions of engineers and scientists to develop sophisticated measurement, test, and control systems using intuitive graphical icons and wires that resemble a flowchart. It offers unrivaled integration with

thousands of hardware devices and provides hundreds of built-in libraries for advanced analysis and data visualization – all for creating virtual instrumentation. The Lab VIEW platform is scalable across multiple targets and OSs, and, since its introduction in 1986, it has become an industry leader. The programming that is done in this Lab VIEW software is mainly **Graphical Programming** that is Program with drag-and-drop, graphical function blocks instead of writing lines of text. The representation is mainly **Dataflow Representation** which is easily developed, maintain, and understand code with an intuitive flowchart representation.

Lab VIEW is the center piece of graphical system design and provides engineers and scientists with the tools you need to create and deploy measurement and control systems. You can get more done in less time with Lab VIEW through its unique graphical programming environment; built-in engineering-specific libraries of software functions and hardware interfaces; and data analysis, visualization, and sharing features. You can bring your vision to life with Lab VIEW. Through a world-class ecosystem of partners and technology alliances, a global and active user community, and consistent annual releases, you can have the confidence to continually innovate. Lab VIEW makes complex control simple and accessible.

Lab VIEW makes us better because code reuse saves time and effort because one of the most efficient ways to shorten development time is through code reuse. By taking advantage of existing code, whether it has already been written or is part of a resource library, developers and domain experts can focus on their applications rather than committing valuable time and resources to programming. Lab VIEW is an ideal platform for prototyping, designing, and deploying high-quality products to market fast. You can use one development environment to quickly iterate on your embedded hardware and software designs and then reuse the best parts in a final product.
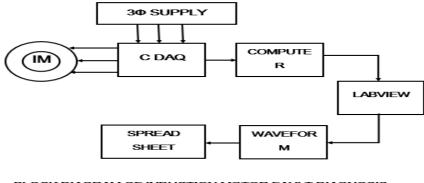
C DAQ is data acquisition. It is device which contains both ADC & DAC in it. It is interface between analog output of sensor and the PC. The data traditional experiments in it signal from sensors are sent to analog or digital domain, read by experimenter, and recorded by hand. In automated data acquisition systems the sensors transmit a voltage or current signal directly to a computer via data acquisition board. Software such as Lab VIEW controls the acquisition and processing of such data. Here we have to consider the following properties of the input signal.

1. Sampling rate
2. Resolution
 3. Range

III.SYSTEM DESIGN

1.   **Block Diagram**

BLOCK DIAGRAM OF INDUCTION MOTOR FAULT DIAGNOSIS USING LABVIEW

Hardware

Designing of this system is possible when you select the specific device and software to suite. For this we selected NI Compact DAQ device and NI labview software. With the help of these, 3-phase ac motor can be implemented successfully with the help of sensor technology. To the DAQ we connected sensor circuit. Whenever the motor getting

started, sensors detect the voltage and current of the ac motor and sends the signal to computer (labview) through DAQ device. Based on the voltage and current(Low, Medium and High), the motor operated through relay circuit.

We will use the DAQ Assistant Express VI to create a task in NI-daqmx. NI-daqmx is a programming interface we can use to communicate with data acquisition devices. Refer to the Getting Started with labview» Getting Started with DAQ»Taking an NI-daqmx Measurement in labviewbook on the Contents tab in the labviewhelpfor information» about additional ways to create NI-daqmx tasks. In the following exercises, we will create an NI-daqmx task that continuously takes a voltage reading and plots the data on a waveform graph.
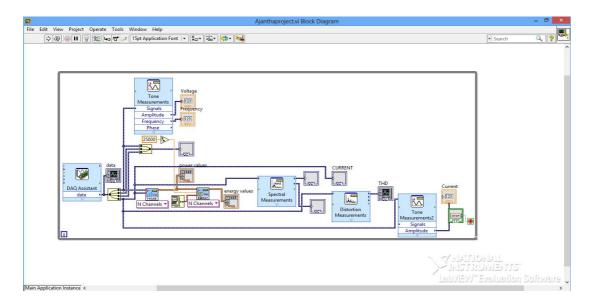
IV.PROGRAMMING

Labview is a graphical user interface language where we can drag and drop the code instead of writing. Labview provides built-in template vis that include the subvis, functions, structures, and front panel objects we need to get started building common measurement applications. Complete the following steps to create a VI that generates a signal and displays it in the front panel window. The labview consists of FRONT PANEL and BLOCK DIAGRAM, the front panel consists of Controls and Indicators which means inputs and outputs and the block diagram consists of graphical coding.

On the block diagram, display the Functions palette and select Express» Input to display the Input palette. Select the DAQ Assistant Express VI, shown at left, on the Input palette and place it on the block diagram. The DAQ Assistant launches and the Create New Express Task dialog box appears. Click Acquire Signals» Analog Input to display the Analog Input options. Select Voltage to create a new voltage analog input task. The dialog box displays a list of channels on each installed DAQ device. The number of channels listed depends on the number of channels you have on the DAQ device. In the Supported Physical Channels list, select the physical channel to which the device connects the signal, such as ai0, and then click the Finish button. This is the graphical code of this project.
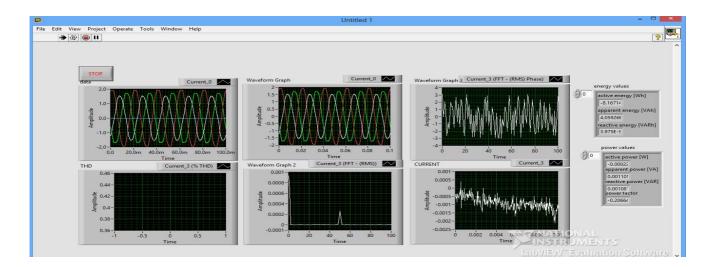
V.RESULT & CONCLUSION

Results include the successful operation of 3 phase Ac motor monitoring and parameter calculation. Whenever the motor exceeds its ratings the pc detects and the signal is acquired by the DAQ. Based on the voltage and current rating i.e., low, medium, and high, voltage and current rating is set.

Thus the fault diagnosis of induction motor is done. This designed system detects the fault that is over voltage or over current and it gives indication to the end user of that induction motor. So it protect the motor from the damage. So the motor gives good efficiency and efficient voltage and current waveforms. So it saves money and time. By comparing with normal operation of motor it will measure all the parameters easily and efficiently. It will be also helpful to the industrial applications.

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