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INDUCTION MOTOR CONTROL SYSTEM MONITORING STUDY

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ABSTRACT
In this project PLC based Induction motor (IM) monitoring control system has been designed developed and tested under varying load condition. Also the implementation of the hardware and software for speed control and protection for IM were completed on induction motor. The PLC function is to correlates the operation parameters to the speed requested by the user and monitors the system during normal operation and under trip conditions. The availability of drive data, coupled with the software to manipulate, analyze process the information becomes a powerful source for the user. Performance of the induction motor driven by Sensor less control AC drive proves to be more robust and reliable for speed control. The PLC based control platform makes system to be communicated to other devices on network and making the system more flexible for their operation and control. The motor protection developed in the study is much faster than the conventional techniques and applied to larger motors easily after making small modifications on both software and hardware. Adaptability of the system to be changed for different applications makes the system ready to use on an industrial application.

KEY WORDS: Plc, Induction Motor, Load Current, Torque, Inrush Current, Breaking, V-I & V-T & T-I & N-I Characteristic, Efficiency, Etc.

I. INTRODUCTION

In the modern world, the electric machinery and equipments has become an integral part of every industry. The use of electric machines especially Induction Motor (IM) for process control is very common. To enhance the production and product quality, the automation of industrial machines and processes are essential. Programmable Logic Control (PLC) and Variable Frequency Drives (VFD) are being used in industry from a long time as a part of automation. With the change in various field of engineering there is a continuous improvement in control and monitoring techniques of three phase induction motor.

The aim of the project is to develop an improved control system for three-phase induction motor with the use of PLC and Sensor less AC drive. For the control and monitoring of induction motor performance an advanced Supervisory Control and Data Acquisition (SCADA) system is being used.

STATE OF ARMS IN AC DRIVES:-

- V/F Control (Open loop)
- Vector Control
- Direct Torque Control (DTC)

MONITORING AND CONTROL OF INDUCTION MOTOR:-

Monitoring and control of the performance in the AC drives under different condition is carried out using PLC-Based controller. Programmable Logic Controller (PLC) is an electronic device that control machines

and processes. It uses a programmable memory to store instructions and execute specific functions that include ON/OFF control, timing, counting, sequencing, arithmetic, and data handling.
Based on the hardware diagram a logic program is being developed and downloaded in the memory of the PLC. Once the program is downloaded and PLC in RUN mode the system will works automatically on user defined instruction. Remote controlling of the system can be provided by introducing monitoring and control software which will communicate through PLC.

LITERATURE SURVEY:

This chapter intends to give a brief literature review of the work being carried out on PLC based industrial automation. The use of PLC with power electronics in electric machines applications has been introduced in the manufacturing automation. This offers advantages such as lower voltage drop when turned on and the ability to control motors and other equipment with a virtually unity power factor. With the use of PLCs in automation processes there is decrement in production cost and increment in quality and reliability.

PLC BASED MONITORING AND CONTROL SCHEME FOR INDUCTION MOTOR DRIVES

This chapter describes the details description of the hardware devices used in the monitoring control system for the IM. Programmable logic control is the main device which integrates other devices. HMI is used as manual control at the field level while SCADA terminal on is used as remote level control. AC Drive works as the final control element of the system whose parameter can be changed online/ offline mode. The propose system can be integrated with, LAN or Web based.This chapter gives a detail description of the hardware devices being used in developing IM monitoring control system.PLC, and Sensor less AC drive function and working principle is being explained in this chapter. Commercially available devices and their features give idea to design the IM monitoring control system in more efficient way.

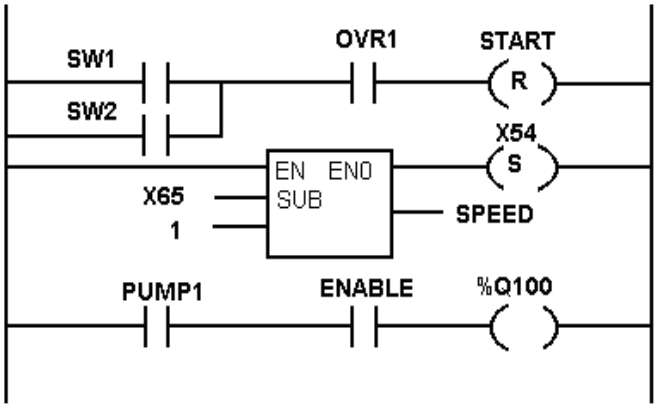

Fig.1. PLC ladder logic.

COMMUNICATION AND NETWORK MANAGEMENT IN SENSORLESS DRIVES:- Communication architecture for monitoring and control of Sensor less drive is shown in Fig.1. It comprises of devices ***connectivity*** through personal computer and also to communicate with each other. As device connectivity is difficult, there should be a need for choosing best protocols and communication channels.

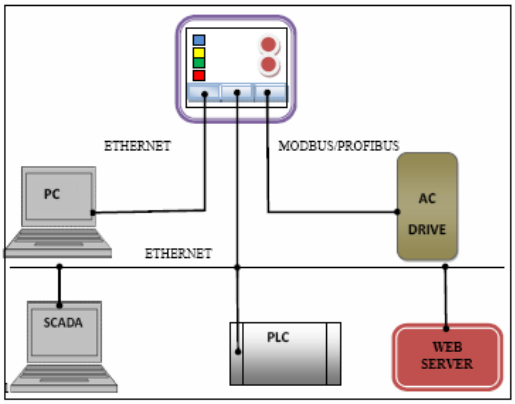

Fig. 2 Communication and networking of HMI.

EXPERIMENTAL RESULTS AND DISCUSSION ON AC DRIVE SYSTEM PERFORMANCE:-

This chapter gives a detail analysis of the control system being designed for the monitoring control of three-phase induction motor (IM).Various experiments has been performed on the drive and result has been plotted. The PLC is controlled through analogue & digital inputs & outputs with varying load torque and speed of the drive and IM are acquired through SCADA of an induction motor. Also the PLC continuously monitors the inputs and activates the output according to the control program. The supervisory control system is being run on the screen of PC. Different parameters such as voltage current, torque, speed frequency and their effects are analyzed in real-time can be real-time.

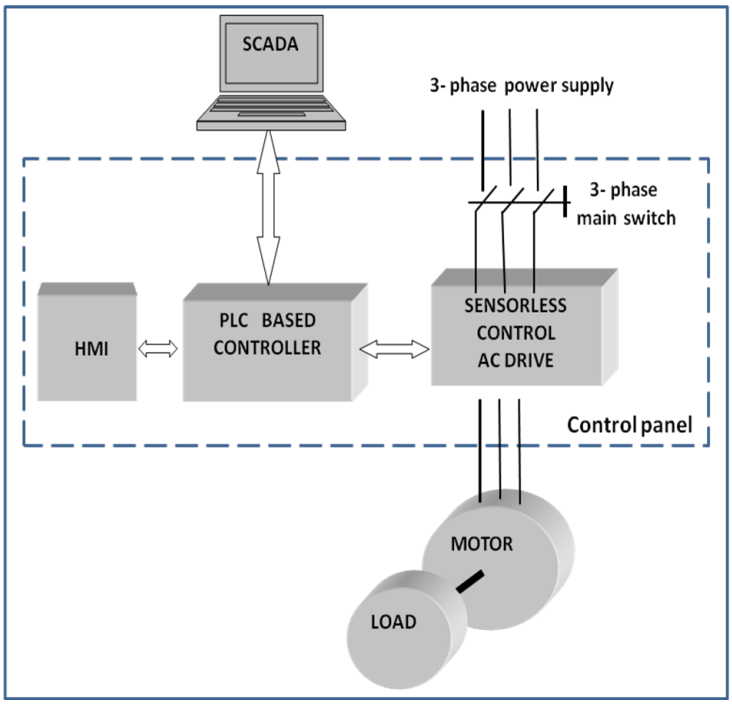

Fig.3. A Schematic diagram of experimental setup

Tables:-

CONNECTION TYPE	*Δ*
AMB. TEMPERATURE	*50 oC*
INPUT VOLTAGE	*415VOLTS +/-10%*
INPUT CURRENT	*7AMP*
RATED POWER	*3.7KW*
INPUT FREQUENCY	*50HZ*
POLE NUMBER	*4*
RATED SPEED	*1440RPM*
EFFICIENCY	*0.85*

Table 1. Induction Motor specifications.

CONCLUSION

In this project thesis monitoring and control system is designed for sensorless vector control drive. The system is successfully implemented and tested. After detailed experiment it is observed that proposed system is a feasible method for monitoring and controlling the IM. With the use of Sensorless control the system is more reliable as there is no external sensor involved in the system. The system is not having precise control as compared to other feedback system. The control system designed is based on the most advanced technology which gives high amount of flexibility and efficiency. Effective Speed control especially in low speed is the most efficient feature of the system.

FUTURE SCOPE OF WORK:-

There are various other methods for the control of IM, like Advance vector control , Direct torque control, Sensor less direct torque control. These methods can also be used as monitoring and control system of IM. The monitoring system can be connected to the web, making the system control from any place. The system would be more adaptive so that it can be configured for different type of application such as servo motors, stepper motors etc.

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