PLC Based Induction Motor Control And Overload Protection

Pooja Bodake[1], Shubham Suryawanshi[2], Snehal Uphade[3]
[1]Sandip Institute of Engineering And Management
[2] Department of Electrical Engineering

Abstract—Induction motors are widely used in various industrial fields because of their simple, easy and reliable operation .So continuous monitoring and controlling is necessary to get proper output and efficiency. In this paper we are controlling speed of the indication motor by using PLC.

PLC also helps to indicate direction of the motor. Here induction motor is protected from overload .Therefore as soon as such a faulty condition arise the motor should be turn off automatically simple by tripping MCB. Programming is done by PLC and program is designed according to requirement .The PLC compare the operational parameters with the speed demand by the user and monitors the system during normal operation and under trip condition PLC improves to a higher accuracy in speed regulation as compared to V/F control system Thus PLC proves itself as a very versatile and effective tool in industrial control of electric drives.

Keywords—PLC-Programmable Logic Controller,VFD-Variable Frequency Drive, MCB-Miniature Circuit Breaker, SMPS-Switch Mode Power Supply.

I.   INTRODUCTION

In today's situation, with the rapidly changes in industries and information technologies, some traditional bilk electronic appliances have to be monitored for a long time. The control of all of these equipments has been performed by the use of computers of them .Programmable logic controllers (PLC) are widely used in industrial control because they are inexpensive ,easy to install and very flexible in application .The use of PLC advantages lower voltage drop when it is on and it has the ability to control motor and equipment with unity power factor .The biggest benefit of using PLC is the ability to change and replicate the operation and communicating information.

Induction motor plays important role in industries due to its various benefits ,monitoring of speed of IMK is necessary because of its high performance variable speed application .So here in our project we are using programmable logic controller (PLC) to monitor and control the speed of the motor and protecting the motor from the overloaded .Due to overvoltage ,sometimes motor undergoes undesirable stress causing faults .Therefore such faults needs to be detected in ladder diagram, a software logic control ,with the number of inputs taken by the system and generating the output , depending on the logical program .This helps to control electrical parameters of the motor with less number of components and less wiring

with more flexibility. Every motor requires a drive to control the speed of motor so here we are using variable frequency drive (VFD) as a drive .VFD is an electronic device which varies the frequency and speed of the motor according to the requirement of load .VFD is used to control the direction of motor and rotation speed of three phase induction motor.VFD converts supply voltage and frequency with maintaining v/f ratio constant to drive the motor at desired speed When motor undergoes overload the MCB will trip automatically and the buzzer will get operated and because of this all system gets stopped .Hence the whole system gets protected from damage. Thus in this project, speed control and protection of IM is done by automation.
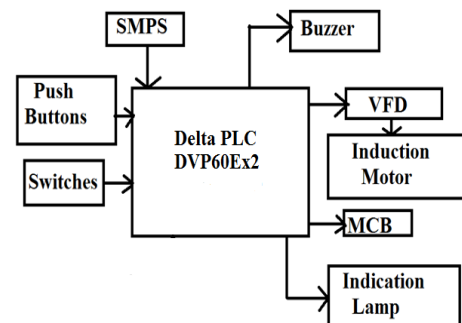
II.   PROPOSED SYSTEM

Fig.1 Block Diagram

A. PLC (Delta DPV60EX2):- A PLC controller is used for automation process to sense, activate ,and control industrial equipment .Its easy starting procedure hand extending principle , function of sequential or position control timed counting and I/O control are widely applied to the fields of industrial automation control. I/O points of PLC are used to allow electrical signals to be interfaced.In this we are controlling speed analysis, direction of rotation. The PLC that we are using offers high speed, stable and higher reliable application in all industrial automation machine. This PLC having the 36 digital input and 24 digital outputs. In this we are controlling the speed without changing the hardware connection by the means of changing only the program.

B. Induction Motor: - An electrical motor is such a electromechanical device which converts electrical energy into a mechanical energy. In case of three phase ac operation, most widely used motor is three phase induction motor as this type

of motor does not require any starting device or we can say that it is self starting induction motor. In our project we are using Crompton greaves 3 phase induction motor of capacity 2HP. Three Phase induction is having less armature reaction and brush sparking because of absence of commutator and brushes which results in less losses.

C. VFD (Variable Frequency Drive):- In this we require handling high power devices operating electronically to control and protect the induction motor and also we required high input to the VFD. A VFD is useful for application where speed control is of an essential ,where according to variations of load speed is need to be vary .here we are using The VFD because it has and advantage of controlling of speed from the initial starting condition i.e. from 0to its rated speed . Here VFD is the link between the PLC and the induction motor.

D. SMPS (Switch Mode Power Supply):- A SMPS is an electronic power supply unit, that incorporates a switching regulators to convert electrical power efficiently .A SMPS passes power from Dc or Ac source to Dc loads. Here we are using the SMPS to provide the supply to PLC.

E.MCB (Miniature Circuit Breaker):- This circuit barker is one type of the protective switch which can operate automatically or manually. MCB protect the electrical circuit from the damage caused by the excess current from an overload.MCB are time delay tripping devices to which the magnitude of over current controls the operating time. This means it get operated whenever overload exits long enough to create damage to the circuit.

F.Buzzer:- a buzzer is audio signaling device which may be mechanical, electromechanically or piezoelectric, typical uses of buzzer includes alarm device, times and conformation of user input.

III.   FUTURE SCOPE

Motor speed can be controlled and multiple motors can also be controlled with required modification in the software and torque control can be done by extension of analog quantities like over current protection, thermal protection .By connecting required number of electrical devices, it can extend to developed the SCADA system and those types of systems are more reliable.

Prototype Hardware System:

IV.   RESULT

The use of PLC in automation process improves reliability, flexibility and also reduces production cost. To obtain accurate industrial electrical drive ,system it is necessary to use PLC interface with induction motor .So this not only reduces starting current but also maintain high starting torque which required various application by changing the logical program only, it varies the output of the system. In the past an engineers had been designing the system which require many hardware and wiring but because of automation with the help of PLC we does not require that much of hardware and wiring PLC interacts with the external world through its input and output in easy way.

V.   CONCLUSION

In this paper ,successful experimental result were obtained from the previously described scheme indicating that the PLC can be used in automated system with an induction motor .The aim of this project was motivated to control the speed of the motor using PLC .The effectiveness of the PLC based control software is satisfactory up to 94% of the synchronous speed .We observed that Both the hardware and software were in close relation .A complete study on the PLC has imparted a very good idea about the industrial automation system.

VI. REFERENCES

[1]. Yasar Bibir', H. SelcukNagay', " Design and implementation of PLC based monitoring control system for three phase induction motor fed by PWM converter'',International journal of system applications, engineering and development , vol. 2,pp.128-135, 2008.

[2]. Chetan Borse', ' Akshay Pandhare' , 'Randhir Kumar' , "PLC Based Induction Motor Starting And Protection'' , International Journal of Engineering research and general science, vol. 3 ,pp. 893-897,Issue March 2015.

[3]. Sujit John Mathew' , ' B. Hemalatha' ," Fault Identification and Protection of Induction Motor Using PLC and SCADA'' , International journal of advance research in electrical, electronics and instrumentation engineering,pp. 8748-8754, vol. 3 Issue 4 April 2004.

[4]. L. Venkatesan' , ' S. Kanagsvalli' , 'P.R. Aarthi' , 'K.S. Yamuna' , "PLC SCADA Based Fault Identification And Protection For three phase Induction Motor'',TELCOMNIKA Indonasian journal of electrical engineering, vol. 12,pp.5766-5773 Issue August 2014.

[5]. Mahaesh Kumar' , ' B. Ramachndra' , " Speed Control of Three Phase Induction Motor using PLC Under open and close loop condition'' International Journal of Engineering research and application, vol. 7 , pp. 34-39 ,Issue January 2017.

[6]. Awadallah Sulieman Rahama', 'Dr.Dalia Mahmoud', "Control of induction motor by using programmable logic controller(PLC)",International Journal of science and research,vol. 5, pp. 1923-1926,Issue 5 May 2016.

[7]. Ayman SeksaSk Elsaid', 'Wael A. Mohamed', Salah Ghazy Ramadan', "Speed control of induction motor using PLC and SCADA system", vol.6, pp.98-104, Issue 1 January 2016.

[8]. Piyush Ahuja','Rajiv Kumar','Kumar Dhiraj', " Control and monitoring of 3 phase induction motor using PLC",vol.5,pp.1225-1229, Issue 2 Feb 2016.

[9]. M.G.Ioannides', "Design and implementation of PLC based monitoring control system for induction motor",vol.19, Issue 3 Sep 2004.