Speed control of I.M Using PLC AND SCADA

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Abstract: Automation is referred as creation of technology and application to control and monitor a system by evaluating its parameters. Automation also replaces the humans by well controlled and planned processes. Automation is the need of the hour in all fields of engineering but when it comes to the field of Electrical Engineering, it has become mandatory to continuously evaluate new techniques for practical implementation to make automation efficient and more accessible in all the sectors. This paper presents an efficient mechanism for speed control of induction motor which is conventionally controlled by a driver circuit and is referred as Open loop System There is a need to remove all the disadvantages of driver circuits and the aim is to make a more accurate closed loop control of motor speed. This system design uses a Variable Frequency Drive mechanism to control the speed of IM and also there is a continuous monitoring of speed in the system. The speed can be tested under different conditions like when the motor has a load connected to it and when the motor is in no load condition.

Keywords : Variable Frequency Drive, Programmable Logic Controller, Supervisory Control and Data Acquisition.

I. INTRODUCTION

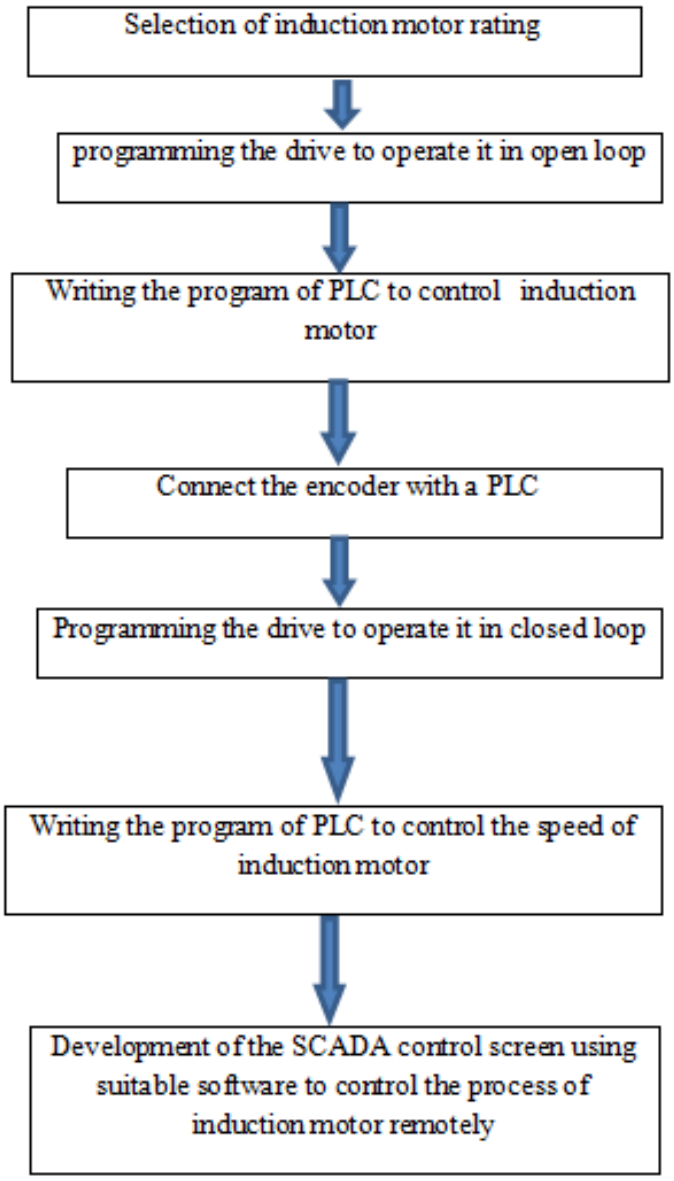
Induction motors are widely used motors in manufacturing industries and plants due to its construction. They can operate in any environmental condition as well as are cheaper in cost as they do not have brushes, commutators, slip rings which are present in other motors They do not require a lot of maintenance. Induction motors can be operated in a wide variety of environments. A motor driving and a system to control it is used with different methods.

The speed of Induction motor gets affected by change in supply frequency, change in the number of motor stators, and the input power variations. The speed of motor can be changed manually or in an automated manner. For automated speed control, computer with programmed logics are used and the logic for each application is different. PLC and SCADA is used to implement this project. A variable frequency drive mechanism is used to control the speed of IM.

It is very important to monitor the speed of IM in different conditions and take up action accordingly. SCADA has a set of connections for HMI , networking , i/o signals and sensors, a database and software mechanism helps for user interface. In this project PLC and SCADA are used in combination to keep machine human interface , where in different parameters can be monitored in a manufacturing industry or plant. There are situations when the places at which motors are installed is inaccessible due to environmental conditions or any other constraints, here the process of automation is used to control and monitor the parameters remotely. PLC have now become the first choice for automation projects owing to the ease of use and efficient as well as reliable performance. The failure rate of PLC is very less hence it is very much preferred at industrial level. The Ideal choice for Speed control of Induction motor in this project is therefore PLC.

II. Methodology

2.1 Process Chart



Procedure:

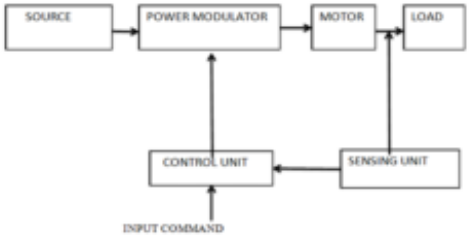
An Induction motor whose speed has to be controlled is used according to the rating and application in which it has to be used. The drive is then programmed in a manner so that it can operate in Open Loop at the initial stage. The parameters are monitored by collecting relevant data. A program is a set of instructions and commands that are made based on logics and algorithm of any control system. A PLC requires a program to be designed for monitoring and controlling the speed of IM. The program is written and tested at the initial stage by compiling and running it on simulation softwares. The program must be tested for different conditions so that it doesn't fail at the implementation stage of the project. All the errors detected are removed out and corrected so that an efficient and optimized program is designed.

The PLC is then connected to an Encoder , the function of an Encoder is to measure the speed and movements at different angles. The output of Encoder is in Electrical form which helps to process these signals easily. The contactors are also used in this system to make contacts at different positions and control the speed of motor. The second stage of the process chart is to configure the motor drive into Closed Loop configuration in order to control speed according to the changing conditions and needs.

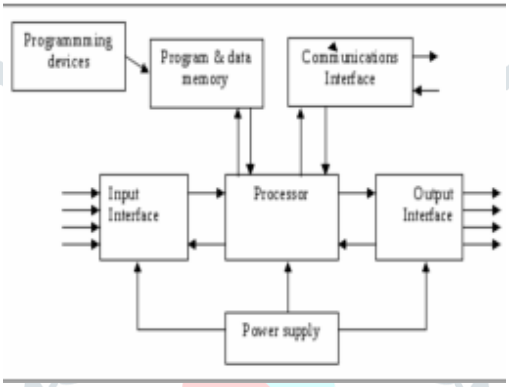
SCADA control screen has to be designed to make it user friendly and easily accessible to all the users as well as control the speed of IM remotely through different circuit configurations.

2.2 Variable Frequency Drive

It works on the principle of changing the speed of motor by changing the frequency of supply. When the supply frequency is changed, the voltage at the motor also changes and it is also represented as V/f method and it is given by relation $V1 \alpha f.\Phi$



2.3 PLC (Programmable Logic Control)



Block Diagram of PLC

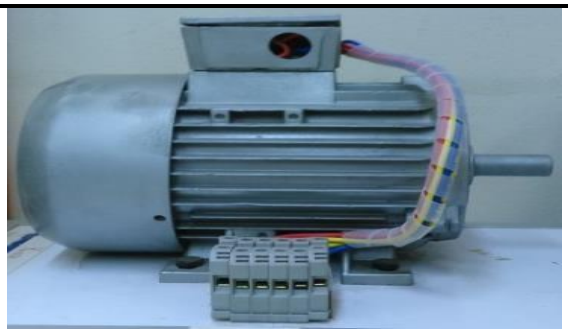
The programmable logic control is the essential element in automated systems. Above figure shows the basic block diagram of a PLC. A processor is used to process the available input information and complete tasks according to the program and logic of each application. There is a provision of input interface and output interface which is a part of UI section which enables the users to communicate with the system.

2.4 SCADA – Supervisory Control and Data Acquisition

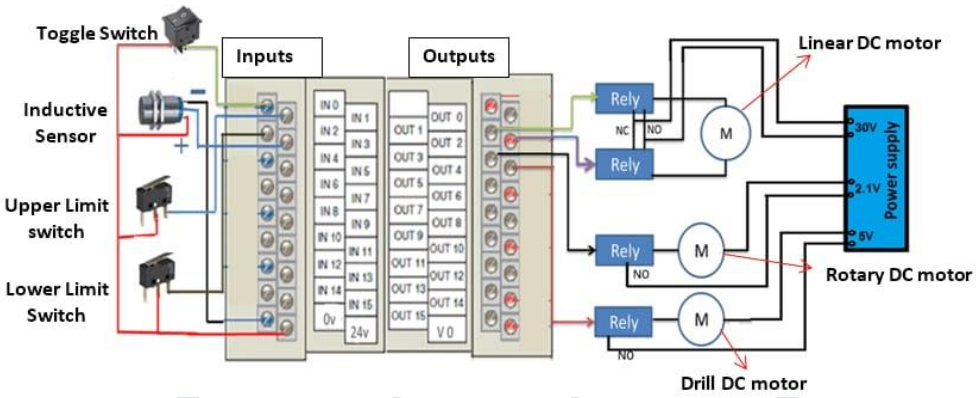
In this project SCADA is used with PLC to provide controlling of speed of motor manually as well as remotely.SCADA has evolved over the past years and has now found its place in almost all the systems using PLC in automation industry. It provides human machine interface, also provides data acquired by different sensors connected in the system or output of a system which is to be controlled or kept in estimated range of values

2. 5 Three Phase I.M

Induction motors has found its use in many manufacturing plants and industries where there is a need of machines and motors which do not require great maintenance. IM speed control is a very important aspect as there is a need in some applications to maintain a constant speed in spite of variations in different parameters as well as there is a need in some applications to frequently change the speed of Induction Motor.



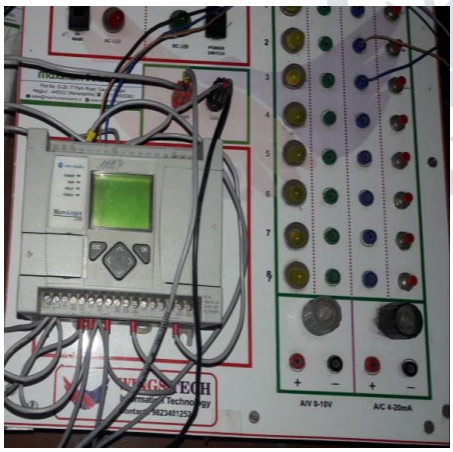
Induction Motor



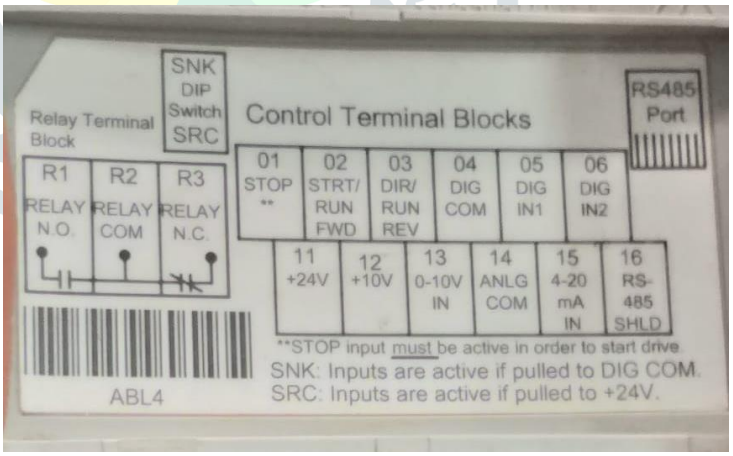
Connection with Motor

III. Implementation

The implementation of this project shows different connections required for designing this system. The SCADA And PLC designed screen as the implemented block which was run successfully. The micro-master connection is of great importance which helps for commissioning in open and closed loop system



Connections



Symbolic conventions

Schematic output

IV. Conclusion

This project included the speed control of Induction motor in an optimized and efficient manner with the use of PLC and SCADA which have added advantage of controlling the speed in an automated manner as well as manually in case of failure of system at any point of time. The project was tested for different speeds and at different load conditions and resulted in good efficiency. The future modification can be to control the speed of different motors through a single designed system which shall be very helpful at industrial level.

References

[1] Ayman Seksak Elsaid et al. Int. Journal of Engineering Research and Applications ISSN: 2248-9622, Vol. 6, Issue 1, (Part - 4) January 2016, pp.98-104

[2] Vaibhav Gupta et al. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 03 | Mar-2018

[3]Piyush Ahuja et al. International Journal of Innovative Research in Science, Engineering and Technology ISSN: 2319-8753, Vol. 5 Issue 2 , Feb- 2016

[4] N.M Rao et al. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume :04 Issue 02 | Feb- 2017

[5]Mahesh Kumar et al. . Journal of Engineering Research and Applications ISSN: 2248-9622 , Vol.7, Issue 1(Part4),Jan-2017,pp34-39.