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Micro Controller Based Fault Detection and Protection of Induction Motor

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ABSTRACT: Three-phase induction motors are widely used as electromechanical energy conversion device and industry's workhorse. Although induction machines are considered robust and relatively reliable due to their well-developed manufacturing technologies and simple design. If failure occur, it may severely disrupt industrial processes and even lead to accidents. To prevent these failures many techniques have been developed for earlier. The computer based protection methods are costlier and the electrical parameters cannot be visualized by Programmable Logic Controller (PLC) based method. The old classical methods are complex. Hence to protect an Induction motor easily, a microcontroller based fault detection and protection of Induction motor is proposed. This paper tends to develop for protection of three phase induction motor from temperature by using temperature sensor and also use of single phase to three phase convertor circuit to prevent from over voltage and under voltage, over current, over speed, Line frequency and phase failure .

KEYWORDS: Convertor Circuit, Induction Motor, Temperature Sensor, Micro Controller.

I. INTRODUCTION

LITERATURE SERVEY;

A large number of motors are being used for general purpose in our surrounding from house- hold equipment to machine tools in industrial facilities. Among all these motors Induction Motors are the most widely used motor for appliances, induction control, and automation; hence they are robust, reliable and durable. Although Induction Motors are reliable, they are subjected to some undesirable stresses, causing faults resulting in failure. Failure of such Induction motor may cause plant shutdown, personal injuries and waste of raw material. However, induction motor faults can be detected in an initial stage in order to prevent the complete failure of an induction motor and unexpected production costs. The main reason for the motor faults is mechanical and electrical stresses. Mechanical stresses are caused by overloads and abrupt load changes, which may cause bearing faults and rotor bar breakage. The electrical stresses may produce stator winding short circuits and result in a complete motor failure. The electrically related faults such as over-voltage, overcurrent, under-voltage, under-current, overload, and over temperature. Various protection methods are available in literature which uses components such as timer, contactors, voltage and current relays are used. The protection using solid state relay has been discussed [2] by designing sensing and control unit for the agriculture purpose using motor current signature analysis [MCSA] with wavelet transformer methods [3]. Artificial intelligent fault monitoring approach [4] Fourier spectral analysis using FFT and MATLAB programming for fault frequency methods [6] and Zig Bee based [7] methods are proposed. The above said methods are simulation based methods. Recently the PLC based protection systems including all variable parameters of three phase induction motor have been proposed [5]. This method is based on computer and programmable integrated circuit (PIC). This eliminates most of the mechanical components. But they are highly complex system and costlier. In order to overcome these problems, the microcontroller based fault detection and protection of induction motor is proposed. In this proposed system, the induction motor is monitored by

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using microcontroller which plays a major role. The presented methods monitor the operating induction motor continuously with the minimum interaction of human body. Microcontroller based protection is having advantages over computer and classical based protection.

II. PROPOSED METHODOLOGY

In this proposed work a single phase supply, because it is easily available. Simple concept of single phase to three phase convertor is used to run the three phase motor. Initially single phase supply is given to a step down transformer then a full bridge diode rectifier circuit is used to convert single phase AC supply to DC supply and then is rectified using rectifier circuit. The DC supply is given to H bridge inverter circuit which is made up of 6 MOSFET IC, to control the output the driver circuit made up of opto-coupler the opto-coupler is used and is connected to micro controller circuit. The micro controller is used to control gate drive circuit and control the H bridge inverter circuit. The micro controller IC used is 89S52 and to provide the supply to ro controller one more transformer and also full bridge diode rectifier circuit is used to get a supply of 12v DC. This explanation is all about the conversion from single phase to three phase convertor and also controlling the inverter with the help of micro controller circuit. With this conversion we can overcome this fault as over voltage, under voltage, over current and also single phasing fault. For temperature control or to protect from temperature , temperature sensor LM235 is used this sensor is connected to micro controller, because if temperature increase above 80ºC then the micro controller give the signal to buzzer to produce sound to alert the operator and also turn off the Induction Motor.

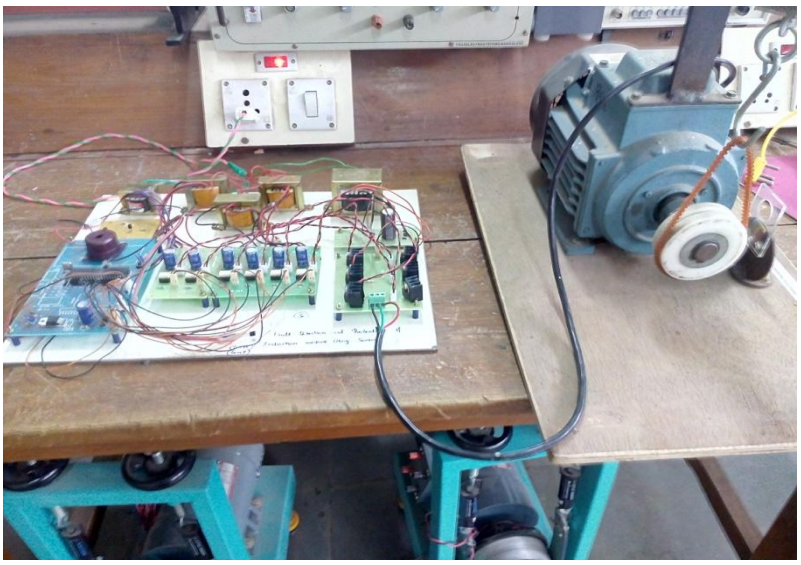

Fig 1 Experimental Setup

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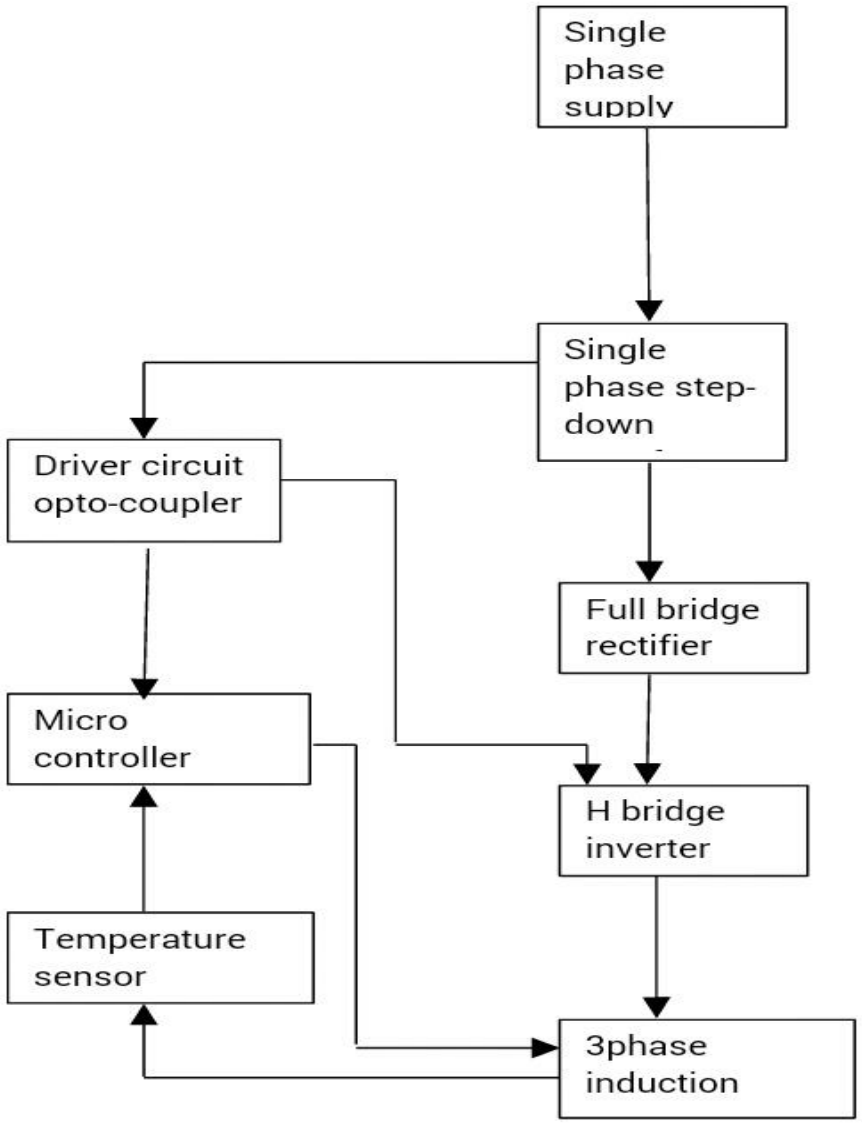

Fig 2 Block Diagram

ADVANTAGES;

1. The life span of the motor increases up to three years.
2. Applicable for all types of induction motors and wide ratings.
3. Easily installed for agricultural motors and provides maximum protection.

APPLICATIONS

This system can be used where 3 please supply is not present.
This system is applicable for low and medium rating motors only.

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III. RESULT AND DISCUSSION

Specifications of sample induction motor; 3 ph, 415V, 0.9A, 50Hz, 0.5HP, 1400RPM
In this experiment a temperature sensor LM235 is used to protect the induction motor from over temperature and other fault such as over voltage, over current, single phaseing also protected with the help of AC-DC-AC convertor.

Test Results:

Motor parameters	Motor without fault condition	Motor under fault condition
Voltage	415V	410V
Current	0.85A	0.8A
Temperature	50°C	80°C
Fault	No	Over Temperature
Rpm	1400	1400
Motor health	Good	Bad

Table 1

IV. CONCLUSION

The induction motor is an important class of electrical machine. Day to day it has more than 85% of industrial usage because of its simple construction and reliable. By having these advantages in agricultural and industrial fields we are protecting Induction Motor.we are providing protection from over voltage over current and also single phase by the use of single phase to three phase convertor method and with the help of temperature sensor we can protect our induction motor from over temperature.

V. FUTURE SCOPE

1. A real time clock can be added so that the ON time and the OFF time of the motor can be entered and the system will switch ON the motor and it will switch OFF at the predetermined time.
2. An electronic lock can be provided so that unauthorized persons can't use the motor.
3. Higher application.
4. Wireless implementation by FM/RF.
5. This project can be extend to protect the induction motor form phasor faults and phase reversal.

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BIOGRAPHY

Rana Tasneem graduated from P.D.A college of engineering Gulbarga, pursuing post graduation from The P.D.A College of Engineering kalaburagi.

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