

Speed Monitoring & Temperature Protection of Induction Motor using Arduino

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Abstract— In this project performance of automation for the monitoring and switching of Induction Motor in case of abnormal condition are defined. Automation makes life easier, reliable and cost efficient for human. There are several types of faults occurs in induction motor which effects the quality of products. So for each type of fault separate protection equipment are needed which result in high cost. Arduino is cheap in cost and user friendly to operate. Hence by using arduino overall cost for protection system reduces.

Key words: Arduino, Induction Motor, Abnormal Condition

I. INTRODUCTION

Industrial share of energy consumption in India is 67.5%. Induction motor are widely used than DC motor because of its advantages. Induction motor are backbone of industry. For that purpose automation in industry is essential for accurate operation and fault detection. There are several types of fault occur in industry which result in performance of induction motor. The electric motor is now essential source of power in many industry. The work perform by this motor has vast application. IM are most widely used motors for appliances, induction control and automation, hence they are robust, reliable and durable. Induction Motor is used in various sector for performing different operation such as domestic, commercial and industrial.

Induction motor generally suffers from under voltage, over voltage, overheating, single phasing and phase reversal problems. Due to this type of electrical faults the winding of induction motor get heated which leads to insulation failure and thus reduces the life span of motor. When the induction motor supply with higher voltage than rated then induction motor start overheating. Speed of induction motor also very important factor for performance of induction motor.

The protection of induction motor plays an important role in improving life of motor. There are various type of protection provided to the induction motor. But important protection criteria for the induction motor protection is focused on the temperature and speed control of induction motor. These factor affect the performance of induction motor. Hence continuous monitoring of speed and temperature is important. From the monitoring of induction motor we get various information about the speed and temperature of induction motor and from this information we can provide protection if required.

II. LITERATURE

A. 'Detection of Fault of Three Phase Induction Motor Using Arduino Uno R2 Microcontroller'

Author: Nagesh Vasant Bhakare, Laxman Mukinda Ghanvat, Sandesh Balasaheb Patil and Dodamani Sunanda R.

The authors in this literature have discussed the main concept of the project is to develop an induction motor protection system for protecting the motors from any damages occurring from single phasing, over current and over voltage. The induction motors are predominant in industrial applications. Thus this project helps to provide protection to the industrial motors if any of the phases misses out of the three phases, or if the voltage of the motor exceeds the threshold value. The proposed system uses three-phase power supply where in three single-phase transformers are connected to it. The system has a set of op-amps used as comparators for comparing input voltages.(1)

B. Derating of Induction Motors Operating With a Combination of Unbalanced Voltages and Over or Undervoltages

Author: Pragasen Pillay, Senior Member, IEEE, Peter Hofmann, and Marubini Manyage

This paper defines the proper application of induction machines during supply of unbalanced voltages in the presence of overvoltage and under voltages. Differences in the voltage unbalance are also examined. As per NEMA defined for unbalanced voltages as a basis to include the effects of under voltages and overvoltage for motor, through motor loss calculations. (2)

III. SPECIFICATION OF COMPONENT

- 1) *Arduino Nano*
No. of Pins - 14
Flash Memory – 32 kb
Input voltage - 7 to 12 VDC
- 2) *Single Phase Induction Motor – 230V, 2 Amp,*
1500 Rpm
- 3) *Relay – 230V, 10 Amp*
- 4) *Battery – 9V, 0.5 mAh*
- 5) *IR Transmitter & Receiver –*
Wavelength - 1050nm, Input supply - 5 VDC

IV. BLOCK DIAGRAM

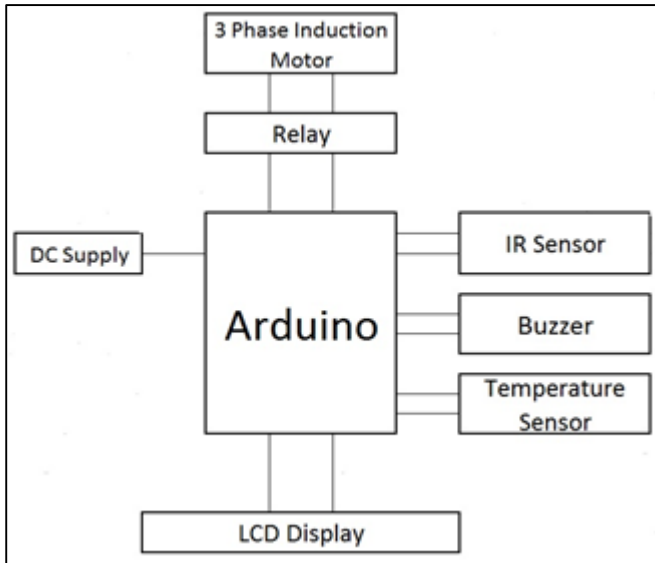


Fig. 1: Block diagram for speed monitoring and temperature protection of IM

V. WORKING

In case of any fault occurrence two main parameter changes. First is speed and second is temperature. There are occurrence of fault such as overvoltage, overcurrent, interturn, phase to ground fault which can be sensed. The project based on arduino for speed and temperature monitoring and control of induction motor by using communication protocol of arduino. Arduino is programmed with the reference data for detection of any kind of fault. As we all know that when fault such as overvoltage and under voltage across induction motor changes. Supply voltage is inversely proportional to torque of induction motor, hence its immediate impact on speed is occurred. In case of interturn fault and phase to ground fault Value of current in the circuit increase tremendously .Which resulting in high heat loss in winding. By using Proximity sensor and temperature sensor we can detect fault condition. (3)

After detection of fault condition it generate control signal to stop induction motor. Arduino check the parameter frequently, if any fault occurs then parameter of the system changes. Arduino compare this change in parameter with reference quantity and come to know that fault has occurred. Then it gives controlling signal to relay which breaks the circuit. In high power industrial motor application relay is not sufficient to operate fault current alone so circuit breaker are used often. LCD display is also provided for continuous monitoring of speed and temperature. In large scale industry even though fault occur in single machine it can slip off from operators eyes, hence alarm circuit is also provided. (4)

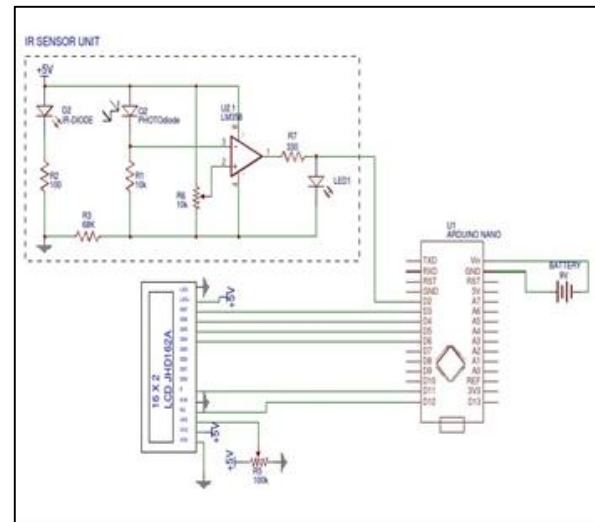


Fig. 2: Equivalent Diagram for IR sensor with LCD display

VI. ADVANTAGES

A. Ready to use:

The biggest advantage of arduino in induction motor is its ready to used structure. As arduino comes in a different component such as 5 V regulator, a burner, an oscillator, a microcontroller, serial communication interface, led and headers for the connection.

B. Effortless Function:

During coding of arduino, you will notice some functions which makes the life so easy. Another advantages of arduino is its automatic unit conversion capability. You can say that debugging you don't have to worry about the unit conversion.

C. Automated System:

In the arduino base monitoring and protection system, arduino system is fully automated, the advantage of this is that human interface is avoided and any type of accident also avoided.

D. Over and under Speed Protection:

This system provide the protection for over speed as well as under speed of induction motor.

E. Alarm facility:

This system provided alarm in case of fault occurs in induction motor.

VII. CONCLUSION

In this project, we have design and implemented an efficient temperature controlling and monitoring of speed by using arduino board. Output is verified at various temperature. It is observed that when the temperature of motor is more than predetermined value, arduino monitor and protect the motor by controlling temperature and also monitor the speed of induction motor.

The system is very cheap as compare to present protective devices used in industry.

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