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Induction Motor Protection System

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Abstract- *Induction motors are used in many industrial applications in a wide range of operating areas because of their simple and robust structure, and low production costs. Providing a protection system is very important in industries. The purpose for development of this project is to provide safety to industrial motors, lift motors, pumps etc. The main purpose of our project is to protect an induction motors from faults such as single phasing, overvoltage, over temperature and under voltage. In this project we are using a three phase supply by using three single phase transformers. If any of the phases, out of the 3 phases is missing or if temperature of the motor during operation exceeds threshold value or if the voltage exceeds/drops threshold value motor stops immediately. If any of the phases is not available the corresponding transformer stops supplying power to the circuit. The main relay which is powered through a set of four relays gets disconnected because of one relay not being powered. And we are using a microcontroller for detection of these faults and a LCD display to show which type of fault is occurred.*

Keyword: *Microcontroller, Induction Motor, Overvoltage, Under voltage, Over temperature, Single Phasing.*

1. Introduction

There are a wide range of AC motors and motor characteristics in existence, because of the numerous duties for which they are used. All motors need protection, but fortunately the more fundamental problems affecting the choice of protection are independent of the type of motor and the type of load to which it is connected. Induction motor when supply with higher voltage than rated then induction motor over heated. In our project a variable resistance is used when supply voltage is lower than rated then voltage drop across the resistance is higher than it protects the motor from this fault. When supply voltage is lower than voltage drop across the resistance is lower than specified value and motor fails to start. When supply is only one phase, this is single phasing problem and supply voltages rated and once again motor fails to start.

In the case of motor overheating LM sensor is used which sense the temperature of winding if it is exceed the specified limit then once again motor fails to start. It is highly desired that three phase induction motor works freely from all these type of faults. Induction motor is most widely used motor. It requires least maintenance as compared to other electrical motors.

The main objective of the work is to make a cheap and reliable protection system for three phase induction motor system. The protection system should protect the system from voltage unbalancing, single phasing, under voltage, overvoltage and thermal protection. Further to improve technique to run the motor under single phasing.

Classical monitoring techniques for induction motors are generally provided by some combination of mechanical in electrical monitoring equipment. Mechanical forms of motors sensing are also limited and ability to detect electrical fault such as stator insulation failure. In addition, the mechanical parts of the equipment can cause problems in the course of operation and can reduce the life and the efficiency of the system.

2. Literature Review

Protection is very important for any system. In last passed years many techniques for protecting induction motors are developed. William H. Kersting stated that three phase induction motor can continue to run when one phase of the supply gone out of service. This may be due to any fuse blowing or opening of protective device of the motor, at step-down transformer or at feeder end. At this condition the three-phase induction motor continue to run but the motor will heat up quickly and it should be protected by removing it from the service at the instant of single phasing. When phase opens at step down transformer or at feeder end, the stator and rotor losses increases to ten times and the shaft output power decreases to negligible. But if the single phasing occurs at motor terminals the losses increases twice as compare to steady state losses and the shaft power reduces to nearly 70%. To protect the motor all the terminal should be open. Sutherland P. E. and Short T.A. described that the for single phase

fault the three phase re-closers are widely employed on distribution feeders. The majority faults are single phase. Its negative effect occurs on the other two phase customers, because the distribution line is mainly supplying the load to single phase customers. If three phase re-closers did not open from the service, and the problem arises for three phase industry. On an average single phase fault occurs at 70%, two phase fault occurs at 20% and three phase fault occurrence is 10%. Javed A. and Izhar T. have proposed the protection of three phase induction motor based on voltage measurement and is not enough to protect the motor if the fault occurs at distribution transformer or at substation feeder. If fault occurs at motor terminals then the voltage measurement can protect the motor very well. The current measurement device should be implemented within the protective device. They have also proposed a phase measurement device which can measure the phase difference of the voltages because when the fault occurs at any other location rather than the motor terminals, then the faulted phase will draw negative sequence current and work as a voltage generator. The voltage developed is close to line voltage but the measurement scheme is not able to detect the fault, however the phasor difference of the faulted phase changes. Cunkas A. *et.al.* described the protection of the induction motor under various conditions like over voltage, under voltage, voltage unbalance and over current using PIC16C84 microcontroller. Potential transformer and current transformer are used for this process. Later the values from these transformer are converted into digital values using ADC converter. The tripping circuit has been given some delay.

3. Block Diagram of Proposed System

The block diagram of this system represents the protection system for induction motor which can be used to protect motors in industries, pumps, lift motors etc. For the implementation of various protections, protection schemes are used and blocks are named. For detection of fault microcontroller is used and for display of type of fault we used a LCD Display. Relay unit is connected to the motor through contactor. Encoder circuit is used for encoding. And all protection blocks are shown in diagram. In this block diagram phase sensing block represents the fault condition sensing when one phase is not connected. And temperature sensing unit represents the fault condition when temperature exceeds the threshold value. And overvoltage/undervoltage block represents the fault conditions when voltage exceeds/drops the reated value and display the fault name on LCD.

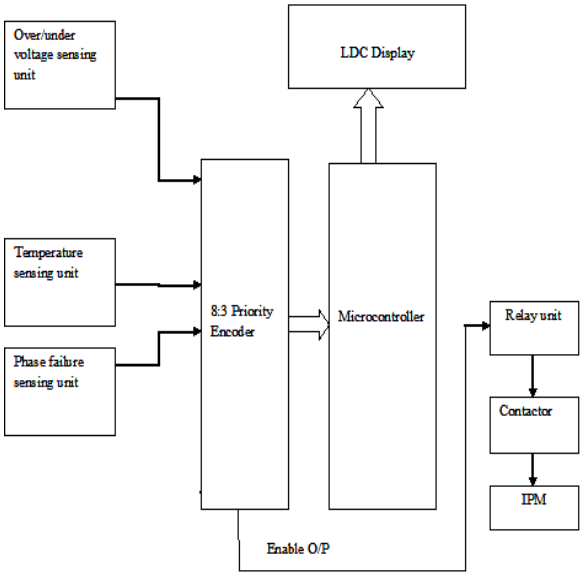

Figure 1. Block Diagram of Proposed System

4. Circuit Diagram of Proposed System

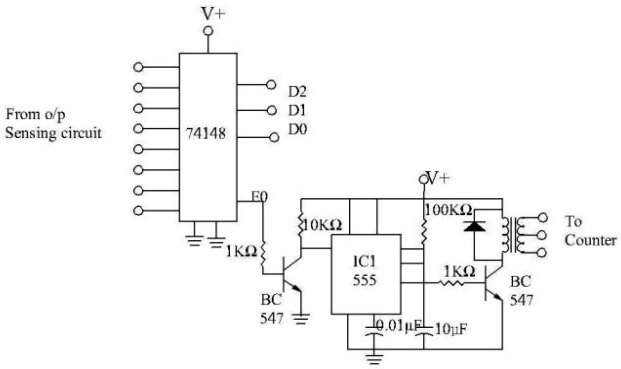

Figure 2. Encoder Circuit Diagram

In hardware implementation sensing circuits were designed and those sensor circuit outputs are connected to the 8:3 priority encoder circuit using IC 74148 as shown in figure 2. This encoder generates three bit BCD output and one bit enable output. The BCD output which is generated by the priority encoder is completely based on the input provided by the designed sensing circuits. The BCD outputs are connected to the 89C52 microcontroller. The main function of microcontroller is to display the fault conditions on LCD display as shown in the figure3.

The enable output of encoder is used to prevent tripping of the circuit at the starting and it generates the control signal to drive the relay driver. Which in turn isolate relay from switching of the motor during the faulty conditions. The faulty conditions considered are Over/Under voltage, over current, over temperature, phase failure, over speed and frequency.

In software implementation has been carried out using the algorithm has been carried algorithm for the implementation of program is given below. If any fault occurs then the microcontroller sense the corresponding fault and displays the result on LCD display

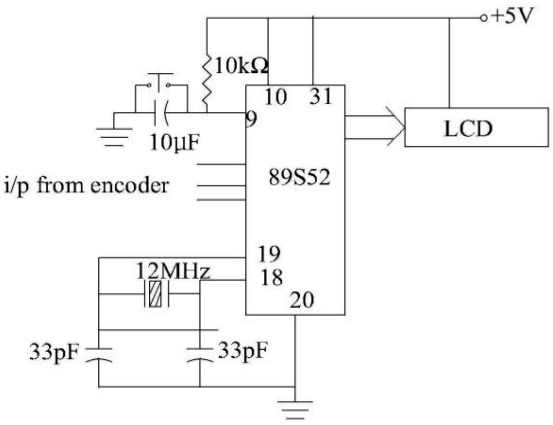

Figure 3. Microcontroller Circuit Diagram

5. Experimental Setup

Hardware presented in the experimental setup is hard framed to protect it from amy mechanical damage and provide robustness. The base of setup was madeup of hard wood to provide mechanical strength and upper layer with black sheet is used.

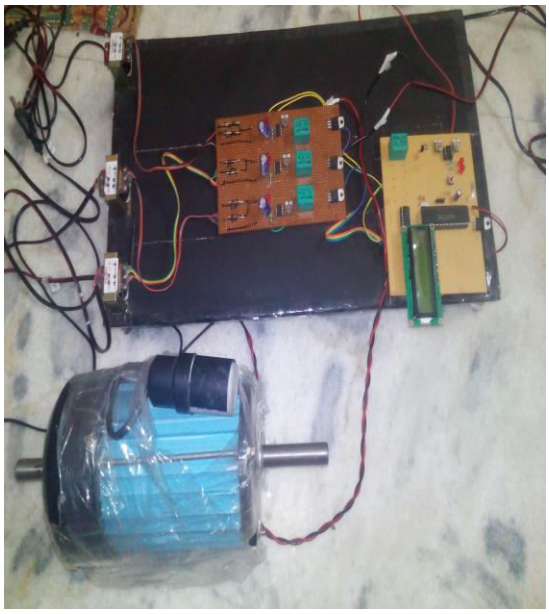

Figure 4. Experimental Setup

6. Conclusion

This paper has successfully presented a reliable, fast and efficient system for induction motor protection. This system can be implemented in any industries and paper mills where motor protection is an essential requirement. This system will save time, reduce the amount of work of the administrator has to do. Protection of three phase induction motor from over/ under voltage, over current, over speed, temperature, frequency and phase failure provide the smooth running of motor which also improves its lifetime and efficiency. Hence protecting the Induction Motor by various faults. This prototype model of microcontroller based protection system is very simple in design, reliable, highly versatile, and cost effective and gives quick response.

7. References

[1]. Malik Abadulrazzaq Alsaedi. ―Fault Diagnosis of Three-Phase Induction Motor: A Review‖. Optics. Special Issue: Applied Optics and Signal Processing. Vol.4,o.1-1,2015,pp.1-8.doi:10.11648/j.optics.s.2015 040101.11

[2]. Ms. Patil Smita Jaywant, Mr. Patil Sachin sambhaji and Ms.Patil Pragati Deepak ―Fault Detection and Correction of 3-phase Induction Motor‖. International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 3, Issue 8, August 2014.

[3]. Sumit Narwade, Prasad Kulkarni and C.Y.Patil ―Fault Detection of Induction Motor UsingCurrent and Vibration Monitoring‖. International Journal of Advanced Computer Volume-3 Number-4 Issue-13 December-2013.

[4]. Ramazan Bayindir, Ibrahim Sefa, Ilhami Colak and Askin Bektas ―Fault Detection and Protection of Induction Motors Using Sensors‖. IEEE Transactions on Energy Conversion,Vol. 23, No. 3, September 2008.