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Psychology

FAULT DETECTION AND PROTECTION SYSTEM FOR A SINGLE PHASE INDUCTION MOTOR

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ABSTRACT During the working of a single phase induction motor, there arises many problems. The problems include overvoltage, over current , insulation failure, high temperature in windings leading to damage, reduction in motor life. So in order to prevent this, a new protection technique should be needed. So here we are a protection scheme using a microcontroller

KEYWORDS : ov ercurrent ,overvoltage ,insulation failure, microcontroller.

INTRODUCTION

Induction motors are used for the transformation of power from electrical form to mechanical form .They are widely used in pumps, bundling supplies, presses etc. Various motors are used for various application . although induction motors are reliable, they undergo faults and failures during working. The motor faults occur due to various conditions such as over temperature, overvoltage, overcurrent , under voltage etc. High temperature causes insulation failure. Using this protection method the motor speed could be sensed.

The motor get overheated , When it is fed with a higher voltage than its rated .The heart of the project is a microcontroller . The motor works on the basis of the signal send from the microcontroller. according to the variations in temperature, current, voltage and load , the microcontroller produces a signal to relay and tripping the relay and causes variation in the working of the motor. In order to sense the temperature a sensor is used.

BASIC FUNCTION

The motor is secured from the variation in parameters .using PT,CT and various sensor for speed and temperature , we could not only measure the parameters but also the speed can be observed .All the data collect from each sensor is collected for further processes.The microcontroller process data from various sensors during normal working. microcontroller send the signal to relay during faulty conditions ,as a result the motor is protected from damage ,in the case when the sensor input exceeds the preset value.then if the motor come back to normal working condition, the motor start working.

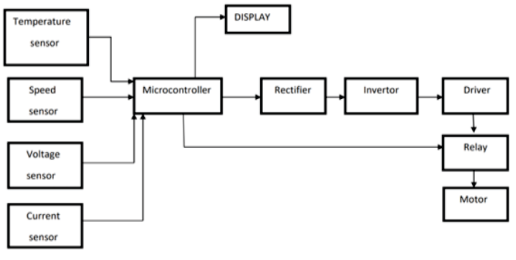
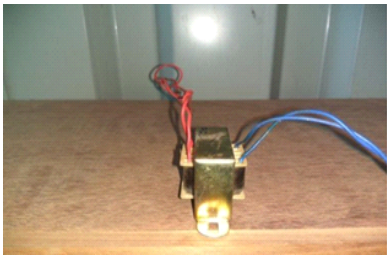


Fig1 ; Block diagram of proposed system.

HARDWARE DESIGN

A.Step down transformer

The primary winding of transformer is 230V and at secondary 12V. The secondary winding is rated of 12V, which is the RMS Value of the waveform, then the peak value will be 12*1.414=16.8V. This peak value limits a rectifier diode choice as IN4007, because it has a PIV rating more than 16V.



B. Filter Stage

The output of the rectification stage is pulsating DC which contains a minimum percentage of AC ripples. A filter is used to eliminate ac ripples. A low current rating of 50 milli ampere shunt capacitor is used to design the filter. As it is a electrolytic type it has polarities .Energy is stored in the form of electrostatic field during the first half cycle .the stored energy in the capacitor will be discharged to the load during the second half cycle,.

C. Voltage Regulation Stage

+5V and +12V regulated DC Supply is used. To get +5V DC output, the IC KIA7805 is used and for +12V output, the IC KIA7812 is used. This IC has a three terminals, pin1 is input, pin2 common pin, and pin3 gives stabilized DC output. , the capacitors and are decoupling capacitors, high frequency ground to noise signals are produced by these capacitors.

D.Rectifier Stage

At this stage, diodes are connected at the secondary winding, which is connected as a full wave rectifier. Rectification stage comprises of two half cycles, one is positive and another one negative. One is forward biased and other is reverse biased at the positive half cycle. diode gets conducted at this moment.one gets forward biased and other reverse biased during negative half cycle. Therefore with respect to ground pulsating DC will be obtained.

E.Over /under voltage sensing circuit

when any one of the line voltage increases above the rated voltage over voltage occurs ,as a result harmful effects are produced on machine insulation .over voltage sensing unit is designed to overcome this problem .to step down the line voltage to 12Vthree potential transformers are used . This step down voltage is rectified and filtered to get a DC voltage proportional to the line voltage. This DC voltage is compared with reference voltage ..During under voltage Ie, when the supply voltage goes below rated voltage, as a result stator and rotor losses increases .the voltage sensing circuit plays another important role; for the single phase supply the voltage transformer is used as a voltage sensor. The primary of transformer is used in parallel with the supply and the secondary conducts by mutual induction phenomenon.

F. Overload sensing circuit

To increase the overload, overload sensing circuit is designed .the motor gets heated up and causes harm to the motor when the current goes beyond the rated current .the overload sensing circuit is designed to overcome this situation. using Hall Sensor module AC5712.The designed circuit is used to monitor the load current, it senses the current up to 20Amp. This module gives a DC output .and the output is proportional to theinput AC line current. This DC voltage is further amplified, using a reference voltage it is compared using a comparator .to one of the inputs of priority encoder the comparactor output is fed.



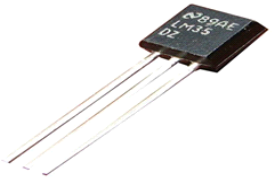
I. Speed sensing circuit

Increase in operating temperature and decrease in the functional horse power, occurs with respect to the speed increase, it leads to the reduction in the motor's lifetime. The speed sensing circuit has been designed to sense the speed. The output of the sensor is proportional to the speed of the motor. This DC voltage is compared in the comparator form by LM 324 using a reference voltage. And then the output is fed to the priority encoder IC 74148.



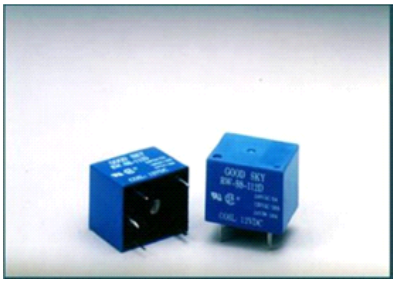
J. Temperature sensor

under load condition when motor runs over time, the efficiency of the motor gets reduced in the cases of overheating. Semiconductor IC LM35 is used to sense the temperature. This sensor provides 10mv/ºc output voltage. the output voltage proportional to the increased temperature.using an op-amp LM 324 output is amplified .and the output is compared with the reference voltage . The output is fed to the priority encoder IC 74148



K. Relay

Inorder to trip the signal and to stop the Motor relay JQC3F is used.it is capable of 240V/7.5A AC.high rated relays are used for high temperature and various chemical solutions.

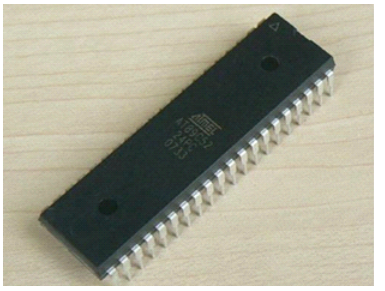


L. Microcontroller

The microcontroller used is the 89C51. This 89C51 is very reliable and efficient at mel high density nonvolatile memory technology is used for manufacturing. The 8-bit flash allows the memory of program to reprogram.it can also be reprogrammed by conventional programmer. This as it provides highly flexible and cost effective Solutions it is used in many embedded control applications.

CONCLUSION

The system mainly focuses on the protection , safe and efficient working of the motor . if any fault occurs the microcontroller on receiving the trip signal from relay will sends the signal to stop the working of the motor .In this project the occurance of the fault are greatly reduced and maximize the efficiency.by using this system insulation failures can be completely eliminated. In industries we can control 3 phase machines using this system



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