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PROTECTION OF THREE PHASE INDUCTION MOTOR FROM SINGLE PHASING AND OVERHEATING AND OVERSPEEDING

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ABSTRACT: *The topic is introduced to protect an induction motor from single phasing and over temperature. Providing a protection system is very important in industries, using lot of motors such that production is not hampered owing to failure of any motor.*

The basic idea for the development of this topic is to provide safety to the industrial motor/pump/lift Motor etc. If any of the phases, out of the 3 phases is missing or if the temperature of the motor during operation exceeds the threshold value, motor stops immediately. The system uses a 3-Phase power supply where three single phase transformers are connected to it. If any of the phases is not available the corresponding transformer stops supplying power to the circuit. This leads to one of the four relays getting switched OFF. The main relay which is powered through a set of four relays gets disconnected because of one relay not being powered. Thus the main relay that delivers 3 phase supply to the motor gets disconnected. A thermister is connected to the motor body to sense the temperature. If the temperature increases then supply to the fourth relay is disconnected.

Three phase induction motor generally suffers from overheating, single phasing and phase reversal problems. The rise in temperature level of a motor during its operation beyond a permissible limit is known as overheating. The causes of motor overheating are motor overloading, distortion in the supply voltage, impaired cooling capability, unbalanced supply voltages etc. Because of overheating, we can face the problems such as Electrical fire, Insulation failure, Decrease in life time of motor due to earlier wear and tear of the motor windings etc.

KEYWORDS: *3Phase Induction Motor, Thermister, Microcontroller IC Atmega16, IC-7805, 3CO Relay, NPN Transistor.*

I. INTRODUCTION

In this project the microcontroller is used to control the three phase of induction motor. The motor protection is required as day to day life induction motor usage increases a lot as it has some specific merits. The circuit was fully controlled by the microcontroller and the micro controllers will continuously monitors the voltages of the three phases and if the voltages goes abnormal then it will switch off the motor until they are normal.
The RISC Microcontroller is powerful tool that provides highly flexible and cost effective solution to many embedded monitoring and diagnostic system. The central unit has been made around the controller with proposed architecture which will be used for diagnosis of faults in induction motor. Three phase supply is step down and given to the micro-controller. To observe the speed, tachometer, and for temperature, heat sensors are used. The circuit is connected to the LCD screen display for continuously display the running parameters R, Y, B. The three phase induction motor is also connected to the relays which in turn are connected to the micro-controller. The GSM technology is used here for the IMs used in the remote places. GSM modem is connected to the micro-controller for continuous communication. Faulty conditions are communicated with GSM which in turn sends a sms to operator's mobile phone.

1.1 Principle of Operation

In this project the microcontroller is used to control the three phase of induction motor. The motor protection is required as day to day life induction motor usage increases a lot as it has some specific merits. The circuit was fully controlled by the microcontroller and the micro controllers will continuously monitors the voltages of the three phases and if the voltages goes abnormal then it will switch off the motor until they are normal.
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II General Faults in Induction Motor

There are various faults occurring in 3 phase induction motor, but in our projectwe have protected the induction motor from the following faults only i.e
1. Single phasing
2. Over speeding
3. Over heating

2.1. Single phasing:
It is well known that a three-phase induction motor will continue to operate when disturbance of some sort causes the voltages supplied to the motor to become single- phase. The single-phasing can occur as a result of a fuse blowing or protective device opening on one phase of the motor. Other possibilities include feeder or step-downtransformer fuses blowing. Even though the motor will continue to operate in thiscondition, the motor will heat up very quickly and it is essential that the motor be removed from service by the opening of a motor circuit breaker or some other type of protective device. This paper will describe three different ways in which an induction motor will operate in a single-phase condition. For purposes of this paper "single-phase "will include any condition in which the three line-to-line voltage phases appear on the same line

2. 2Over Speeding:
Significant frequency changes never takes place on a large distribution system during a major disturbance. The most important effect of frequency change is the resulting change in motor speed. For example, if the frequency drops by 20% (Ns=120f/P). This change in motor speed may be unacceptable in many applications.

2.3 Over Heating:
Although standard induction motors can develop twice their rated power for short periods, they should not be allowed to run continuously beyond their rated capacity. Overloads cause overheating which deteriorates the insulation and reduces its useful life. In practice, thermal overload relays are provided in motor circuit.

III MICROCONTROLLER ATMEGA16

Features

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
- 131 Powerful Instructions
- 32 x 8 General Purpose Working Registers
- Fully Static Operation
- Nonvolatile Program and Data Memories
- 16K Bytes of In-System Self-Programmable FlashEndurance: 10,000 Write/Erase Cycles
- 512 Bytes EEPROMEndurance: 100,000 Write/Erase Cycles
- 1K Byte Internal SRAM
- Programming Lock for Software Security

Peripheral Features

- Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and CaptureMode
- Real Time Counter with Separate Oscillator
- Four PWM Channels
- 8-channel, 10-bit ADC
- Byte-oriented Two-wire Serial Interface
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator

Special Microcontroller Features

- Power-on Reset and Programmable Brown-out Detection
- External and Internal Interrupt Sources
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby

I/O and Packages

- 32 Programmable I/O Lines
- 40-pin PDIP, 44-lead TQFP, and 44-pad MLF
- Operating Voltages

– 2.7 - 5.5V for ATmega16L
– 4.5 - 5.5V for ATmega16

- Speed Grades

– 0 - 8 MHz for ATmega16L
– 0 - 16 MHz for ATmega16

IV CIRCUIT DIAGRAM

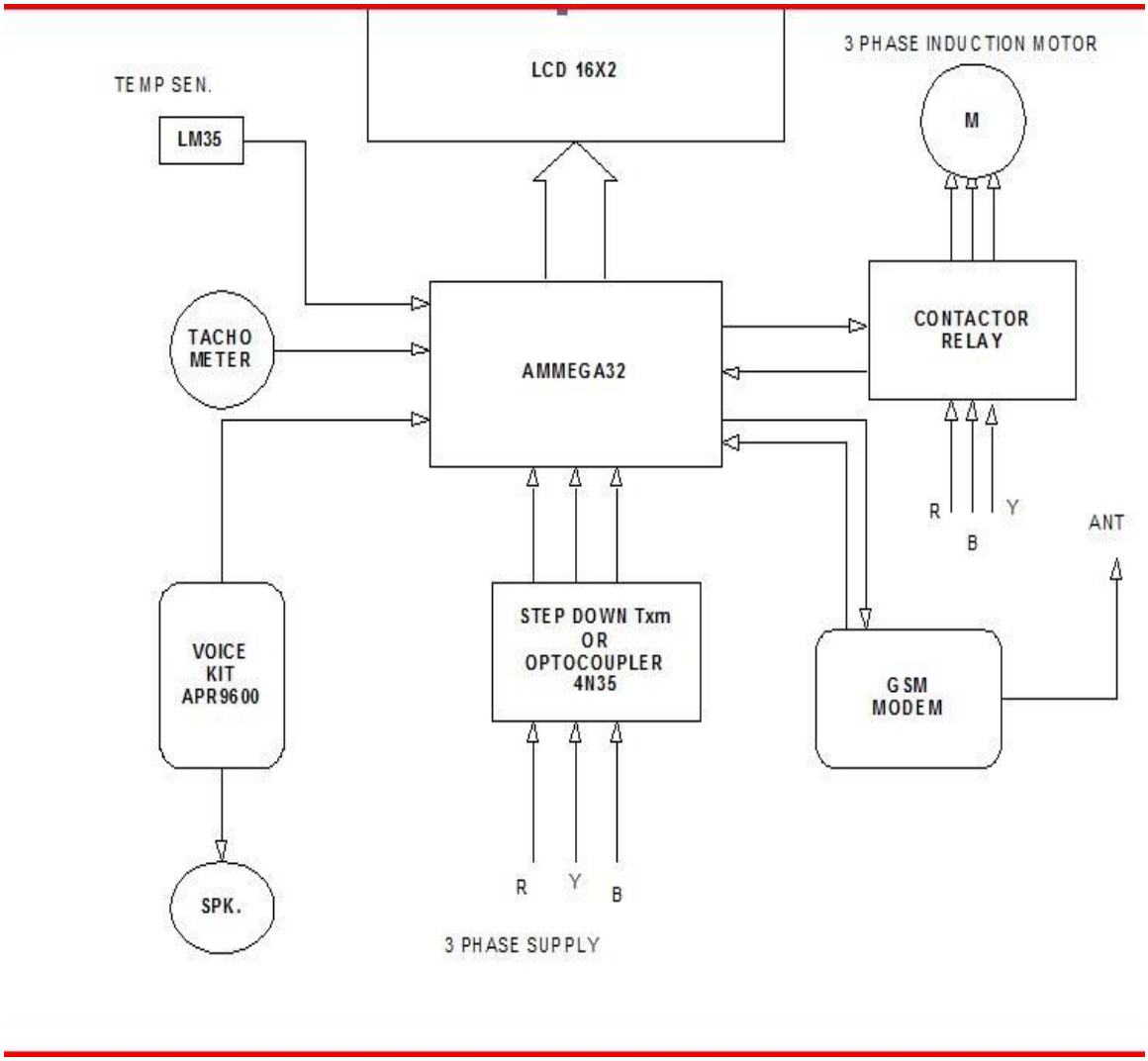

Fig: 3.1 Block diagram of I.M parameter control system with fault Announcement

V MAIN CIRCUIT DIAGRAM

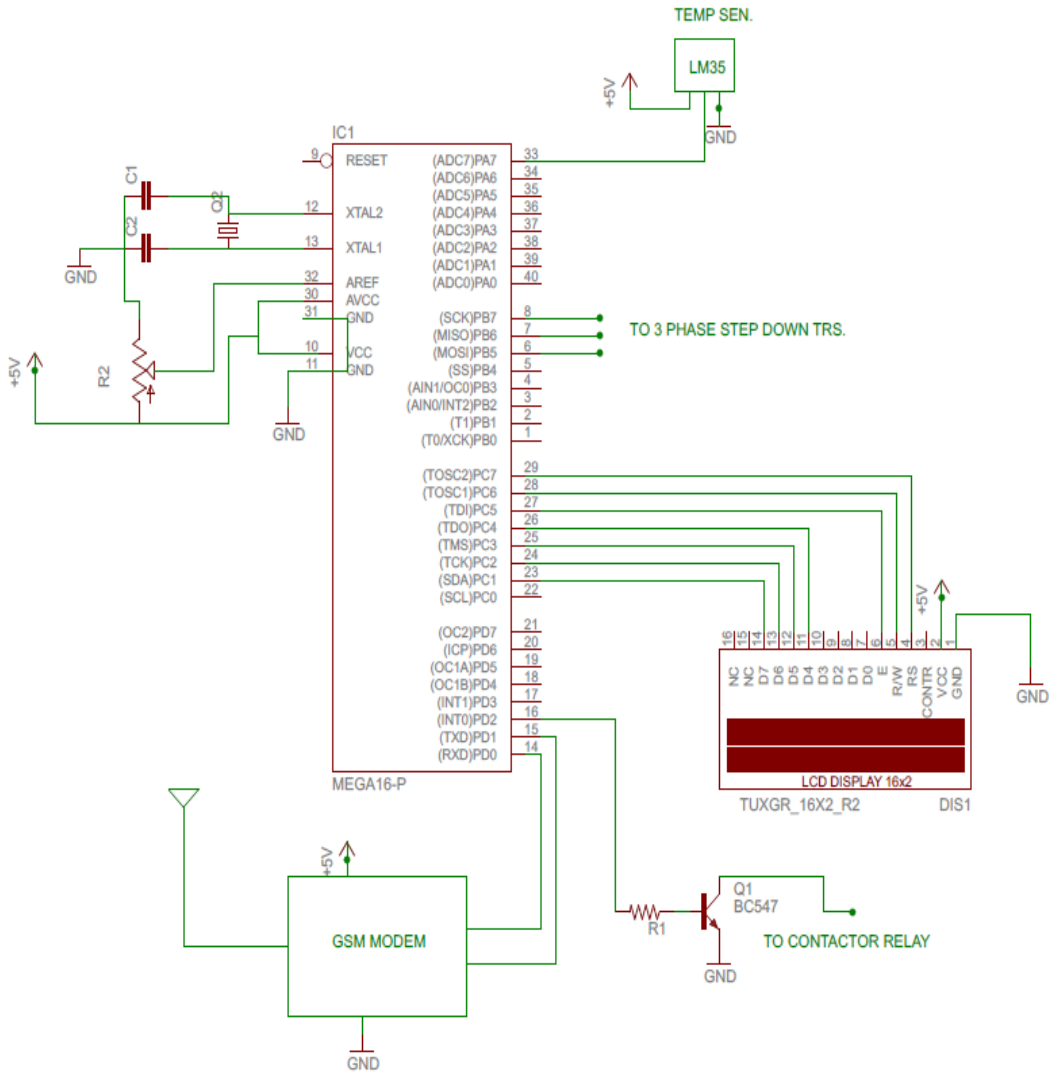

Fig 3.2: Circuit Diagram

VI WORKING OF INDUCTION MOTOR PARAMETER

As shown in circuit diagram the three phase supply to the circuit is stepped down using three single phase step down transformer of rating 12-0-12 of center tap type. The AC supply of level 12 V is then rectified using a bridge converter of fully controlled type. As IC LM339 works on the supply voltage of 5V, so the voltage level is further decreased using resistor (330k).The input of 5V is given to the comparator at non inverting terminal through IC 7805 to three different pins of port b that is $B_{0.0}$, $B_{0.1}$ and $B_{0.2 \text{ is used as i/p}}$. its signal given to the npn transistor which act as switch when it open from four relay one of the relay gate energized which disconnect the dc supply to the 3co relay . The 3c/o relay is use to trip the circuit..

In case fault occurs in induction motor the voltage levels to the input ports falls to zero (0). The microcontroller is programmed such that if any of the signal to the port B0.0, B0.1 and B0.2 becomes zero, (display faulty phase no on LCD) it will operate a relay and trips the motor.

Now again due to overload on induction motor the ambient temperature of the motor rises above permissible level the heat sensor(LM35) sense the rising temperature and gives the signal to the microcontroller which is connected to ADC0 at Pin 40. This gives tripping signal to the relay.

The circuit is also facilitated with Dot Matrix LCD display (JM162A) which continuously displays the normal running parameters like R, Y, B phases and the temperature of the motor. In case fault arises or the temperature goes beyond the permissible thermal limit it will display the faulty phase or and the exceeded temperature.

To make use of project at remote places the circuit is facilitated with Global Mobile Communication (GSM) technology. The microcontroller is in continuous communication with GSM via signals R_x (Receiving signal) and T_x (Transmitting signal) at baud rate of 9600 bits / sec port PD_0, PD_1 using AT commands. The faulty condition is communicated with GSM which in turn sends SMS to the operator's mobile phone. Illustrating the cause of motor tripping.

5.1Circuit Explanation

The circuit diagram consist of microcontroller,relays,heat sensor,voice kit and a LCD display.
The Main part of the above circuit diagrams is the Microcontroller ATMEGA16 the Microcontroller will switch on the motor only the following conditions are satisfied.

1. If all the phases are present.
2. If temperature is within the limit.
3. If speed is within the limit.

The circuit uses to converts 230 V AC to 5 V DC. It uses bridge circuit and 1C 7805 voltage regulator.230VAC from the step down transformer is first step down into 12V DC which is further converted into 5V DC.
Again 3 ouptocouplers areuse to isolate the 230v ac supply from 5v dc.Crystal oscillator is used to provide clock to microcontroller.If any of the condition given above is not satisfied a tripping signal is given by microcontroller to relay which eventually disconnect the motor from circuit and immediately stop it.
The Microcontroller will control the whole circuit according to program burned on itsROM. All the conditions are displayed over the LCD display,and also voice it is there to announce the fault.GSM modem sends the sms to operator giving information about the fault.

VII APPLICATIONS

The LM35 can be applied easily in the same way as other integrated-circuit temperature sensors. It can be glued or cemented to a surface and its temperature will be within about 0.01°C of the surface temperature. This presumes that the ambient air temperature is almost the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature. This is especially true for the TO-92 plastic package, where the copper leads are the principal thermal path to carry heat into the device, so its temperature might be closer to the air temperature than to the surface temperature. To minimize this problem, be sure that the wiring to the LM35, as it leaves the device, is held at the same temperature as the surface of interest. The easiest way to do this is to cover up these wires with a bead of epoxy which will insure that the leads and wires are all at the same temperature as the surface, and that the LM35 die's temperature will not be affected by the air temperature The TO-46 metal package can also be soldered to a metal surface or pipe without damage. Of course, in that case the V− terminal of the circuit will be grounded to that metal. Alternatively, the LM35 can be mounted inside a sealed-end metal tube, and can then be dipped into a bath or screwed into a threaded hole in a tank. As with any IC, the LM35 and accompanying wiring and circuits must be kept insulated and dry, to avoid leakage and corrosion. This is especially true if the circuit may operate at cold temperatures where condensation can occur. Printed-circuit coatings and varnishes such as Humiseal and epoxy paints or dips are often used to insure that moisture cannot corrode the LM35 or its connections. These devices are sometimes soldered to a small light-weight heat fin, to decrease the thermal time constant and speed up the response in slowly-moving air. On the other hand, a small thermal mass may be added to the sensor, to give the steadiest reading despite small deviations in the air temperature

VII CONCLUSION

The circuit was fully controlled by the microcontroller and the micro controllers will continuously monitors all the three parameters that are three phases, speed, temperature and if the parameter goes abnormal then it will switch off the motor until they are normal. It's not only protecting motor from transient voltages, it also switch on the motor automatically without manual requirement. The manual monitoring of this motor is difficult so automatic protection of induction motor has such an importance. Also with the use of GSM the project can be made useful in remote places where maintenance is the major problem.

REFERENCES

- www.atmel.com
- www.microcontroller.net
- www.electronicsforyou.com
- Texas manual.
- www.vegarobokit.com
- IEEE journals and magazines
- EE times.