Three Phase Induction Motor Parameter Monitoring and Alert System with Digital Display

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Abstract— Induction motor are geographically spread and with the aid of Internet, it is possible to collect appropriate information from these motor to a central node for diagnostic purposes under the supervision of high voltage engineering experts. The aim of this paper is to show the main problems related to induction motor and to review mitigation methods for the monitoring and diagnosis of induction motor. Monitoring of ac motor is necessary for operating efficiently. There are many undesirable things In the present scenario induction motor plays an vital role in industrial and domestic application. The change in parameter such as voltage, current, temperature and frequency may effect the performance of induction motor, which may lead to the decrease the efficiency of induction motor . In view of this, the monitoring of such parameter are very essential. Since their project review that to detect and monitor the fault by microcontroller and which can be displayed by display unit.

Keywords: PT, CT, LCD

I. INTRODUCTION

Induction motors are one of the most important components of electric networks. These devices are very expensive and therefore diagnosis and monitoring systems will be valuable for preventing damage to them. a facility for viewing the status of induction motor remotely by experts who will make an appropriate decision in case of a problem is needed to prevent premature damage to the induction motor. The that happen to electric motors and other electrical equipment as a result of operating a power system in an over voltage manner. Operating a motor beyond its nominal range of its voltage requirements will reduce its efficiency and cause premature failure. The economic loss from premature motor failure can be devastating. In most cases, the price of the motor itself is trivial compared to the cost of unscheduled shutdowns of the process. Both high and low voltages can cause premature motor failure, as well as voltage imbalance. So the best life and most efficient operation occur when motors are operated at voltages close to the nameplate ratings. Monitoring of ac motor provides not only reducing the cost of the electricity bill, but also extending the life of the electrical motors while preventing unexpected failures. Since in view of this, it is necessary to monitor the voltage, current and temperature of motor. This project brings the concept to monitor the above parameters.

II. BLOCK DIAGRAM

In the three phase induction motor parameter monitoring the block diagram of three phase induction motor parameter monitoring is shown above figure. There are three PT(potential transformer) and one CT(current transformer) are used having rating of 300V input, 5V output and 10A input, 0.1A output respectively. These three PT’s is directly connected to the three voltage sensors. These voltage sensor and temperature sensor is connected to the 8-bit ADC. The 8-bit ADC is bidirectional configured with an 8-bit microcontroller 89S52 also connected to the dry sensor. The 8-bit ADC is bidirectional configured with the microcontroller 89S52 and this microcontroller is bidirectional configured with the 16×2 LCD display. When there is fault occurs in any of the phase or any reason that time the microcontroller 89S52 read the program of fault and give the command to the relay to trip the relay driver as shown in fig. above CT sense the fault and these relay driver gives the signal to the three phase contractor to isolate the motor from faulty section or to save the motor from various abnormal condition’s.

Monitors and measures all three phase voltages. Readings of voltage, current (1 phase), Temperature are displayed on LCD display. Monitoring of ac motor is necessary for operating efficiently. There are many undesirable things that happen to electric motors and other electrical equipment as a result of operating a power system in an over voltage manner. Operating a motor beyond its nominal range of its voltage requirements will reduce its efficiency and cause premature failure. The economic loss from premature motor failure can be devastating. In most
cases, the price of the motor itself is trivial compared to the cost of unscheduled shutdowns of the process. Both high and low voltages can cause premature motor failure, as well as voltage imbalance. So the best life and most efficient operation occur when motors are operated at voltages close to the nameplate ratings. Monitoring of ac motor provides not only reducing the cost of the electricity bill, but also extending the life of the electrical motors while preventing unexpected failures.

IV. COMPONENTS DESCRIPTION

A. Temperature sensor

The LM124 series consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can bemeore easily implemented in single power supply systems. For example, the LM124series can be directly operated off of the standard +5V power supply voltage which isused in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

B. ADC0808/ADC0809

The ADC0808 and ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor-compatible control logic. The 8-bit A/D converter uses successive approximations the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8 single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs. The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications. For 16-channel multiplexer with common output (sample/hold port) see ADC0816 data sheet. (See AN-247 for more information.)

C. 8-Bit Microcontrollers

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel’s high density nonvolatile memory technology and is compatible with the industry standard 80C51 and 80C52 instruction set and pinout. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly flexible and cost-effective solution to many embedded control applications.

D. Pin Diagram

![Fig. 2: Pin Diagram](image)

The AT89C52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, three 16-bit timer/counters, six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89C52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt.

E. 16x2 Characters LCD

![Fig. 3: (16x2) Characters LCD](image)

1) Features

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- +5V power supply (Also available for +3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for +3V power supply

F. Current Transformer

A current transformer (CT) is used for measurement of alternating electric currents. Current transformers, together with voltage (or potential) transformers (VT or PT), are known as instrument transformers. When current in a circuit is too high to apply directly to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers are commonly used in metering and protective relays in the electrical power industry.
Nichia LEDs are the most popular, high quality and reliable light emitting diodes to buy on the market since many years. Skilled eyes quickly recognize the solid lead frame, clear edges and unique dome. These high performance LED for highest demands are convincing by features like long lifetime, true colours and processing quality. Perfected manufacturing sequences guarantee a steady top production standard up to the last detail that no second manufacturer provides that way. Applications with Nichia LEDs maybe more cost intensive than applications with low budget LEDs of course but a lot more reliable and brilliant, too. If it is not a low cost project and your name stands for the quality you are making the best choice with these LEDs. Regularly released life time tables and manifold selection possibilities proof that Nichia is no manufacturer who rounds up datasheet values or delivers bad selected products.

A. System Structure

The design aims are detecting the faults then monitoring and controlling the motor from these faults. First find out tolerable limit values of voltage, current, speed, temperature. Then these parameters are measured and are compared to this tolerable limit value. The three phase inverter is used to convert DC voltage obtained from rectifier into AC. The gating signals for MOSFET are generated using microcontroller PIC18F4431. When parameters are out of range by using microcontroller programming and PWM inverter we protect the motor from faults. Here we use CT for current measurement, LM35 for temperature measurement and IR sensor for speed measurement.

B. Current And Voltage Measurement

Rectifier and PWM Inverter generates PWM signals which are converted into AC using three phase inverter. The AC voltage and current are measured using Microcontroller. The current transformer and voltage transformer are used for current and voltage measurement. The data is then fed into PIC microcontroller to control the motor.

C. Temperature Measurement

Temperature sensor is used to measure the temperature of the motor. The sensor is connected to PIC microcontroller. The temperature data is then used to control the motor.

D. System Architecture

The system architecture consists of three parts: rectifier and inverter, current and voltage measurement, and temperature measurement. The rectifier and inverter are used to convert the AC supply into PWM signals. The current and voltage measurement is done using current transformer and voltage transformer. The temperature measurement is done using temperature sensor. The data from these parts is then fed into the PIC microcontroller to control the motor.

E. LED

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Fig. 7: Temperature Display on LCD

B. Voltage
If supply voltage of motor is less than 200 volt then fault under voltage is detected and motor stop running (PWM stop).

Fig. 8: Under voltage display on LCD
If supply voltage of motor is garter than 480 volt then fault under voltage is detected and motor stop running (PWM stop).

Fig. 9: Over voltage display on LCD

C. Phase
If all phases are in proper condition then motor run properly and display phase ok LCD.

Fig. 10: All phases are ok
- If R phase of Induction Motor is open Then signal phase problem is detected and motor stop running.
- If R phase of Induction Motor is open Then signal phase problem is detected and motor stop running.

Fig. 11: R phase display on LCD
If Y phase of Induction Motor is open then single phase problem is detected and motor stop to running

Fig. 12: Y phase display on LCD
If B phase of Induction Motor is open then single phase problem is detected and motor stop to running.

Fig. 13: B phase display on LCD

VII. CONCLUSION
In this project we have study the condition monitoring of all three phases parameter of induction motor. Monitoring of ac motor provides not only reducing the cost of the electricity bill, but also extending the life of the electrical motors while preventing unexpected failures. Since in view of this, it is necessary to monitor the voltage, current and temperature of motor. This project brings the concept to monitor the above parameters.

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