

3-Phase Induction Motor Protection and Condition DETEC System using Pic18 F452 Microcontroller

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Abstract:- The GSM allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer based systems and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. This project controls the IM motor speed and direction using GSM (Global System for Mobile Communications). GSM is the most widely used high speed and easily accessible communication medium in the modern day world. The proposed system is simple and highly effective in terms of cost and efficiency. In this system, the direction and the speed of the IM motor can be controlled by GSM module SIM 800, over a remote location. It uses controller PIC16F877A to connect the project with AC Supply. At the same time speed of induction motor.

Induction motor is measured by infrared sensors placed near shaft of motor. The speed measured by infrared sensor and PIC16F877A microcontroller will be displayed on LCD display. The confirmed the theoretical estimates of the performance of the proposed system.

Key Words: PIC16F877A Microcontroller, 3-Phase IM, GSM Modem, Modern Sensors

1. INTRODUCTION

A large number of motors are being used for general purpose in our surrounding from house- hold equipment to machine tools in industrial facilities. Among all these motors Induction Motors are the most widely used motor for appliances, induction control, and automation; hence they are robust, reliable and durable.

Induction Motors are reliable, they are subjected to some undesirable stresses, causing faults resulting in failure. Failure of such Induction motor may cause plant shutdown, personal injuries and waste of raw material. However, induction motor faults can be detected in an initial stage in order to prevent the complete failure of an induction motor and unexpected production costs. The main reason for the motor faults is mechanical and electrical stresses. The induction motors are the most widely used ac motor due to its low cost, simple and extremely rugged construction, high reliability, high efficiency, reasonably good power factor, low maintenance cost and simple starting arrangement. The mechanical system in industries like paper mill, sugar industry and cement industries are driven by induction motors. Thus the values of current, voltage, temperature of winding and speed of motor become very important factor for driving the system.

There are various types of faults that are encountered during operation of induction motor. Like electrical faults such as over/under voltage, over load, phase reversing, unbalanced voltage and single phasing. The rotor winding failure, stator winding failure and bearing faults are most occurring mechanical faults. The vibration of machine, external moisture, contamination and ambient temperature also affect the induction motor performance. So, in order to improve efficiency of induction motor all these faults has to be taken care of by reliable protection scheme. However, the control of machines is very risky and difficult when machine is on continuous duty.

In order to overcome these problems, the microcontroller based fault detection and protection of induction motor is proposed. In this proposed system, the induction motor is monitored by using microcontroller which plays a major role. The presented methods monitor the operating induction motor continuously with the minimum interaction of human body. Microcontroller based protection is having advantages over computer and classical based protection.

1.1 Project Objectives

To study working of three phase induction motor, microcontroller PIC 18 F452, temperature sensor LM35, vibration sensor ADXL 335 and humidity sensor SY HS 230, GSM modem SIM 800. To collect the required components for the project, To develop a code for running the system and interfaced the system with PIC 18 F452 micro controller, To simulate and debug the code using mikroC_PRO_PIC_2017_Build.7.0.1 software ,To create PCB Layout and wiring diagram for the project, To develop a PCB which contains by mounting components, To test the system on various faults created in motor.

2.BLOCK DIAGRAM OF POROPOSED SYSTEM

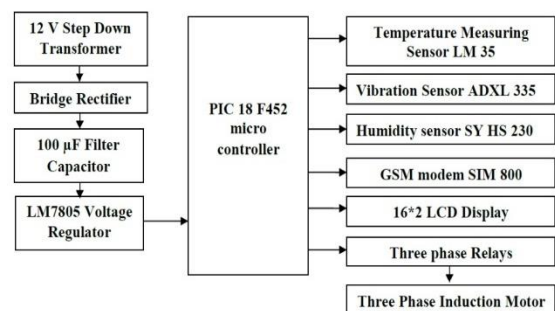


Fig1. GSM Based Three Phase Induction Motor Protection and Fault Detection System

In this figure single phase A.C. supply input 230 V 50 Hz is provided to primary winding of step down transformer. Secondary of transformer gives 12 V A.C. This transformer output is provided to bridge rectifier. Bridge rectifier gives 12 V D.C. which will be filtered by using 100 μ F filter capacitor. Output of filter is connected to regulator LM7805 which provide 5V constant D.C. voltage. This 5 V D.C. is provided to PIC 18 F452 micro controller. Microcontroller is further interfaced with 16*2 LCD display, GSM modem SIM 800, temperature Measuring Sensor LM 35, Vibration Sensor ADXL 335, Humidity sensor SY HS 230.

Three relays are connected in circuit which will further connect three phase induction motor.

This system has two modes of operation. In first mode motor will turn on when user sends SMS 1# to sim card placed in GSM module. Motor will turn off when user sends SMS 2# to sim card placed in GSM module.

In second mode motor will turn on by first mode and user can observe that the motor will automatically turn off and sends SMS to user in following cases.

1). If temperature goes below 5 degree Celsius and above 55 degree Celsius.

2). If high vibration detected by motor

3). If humidity of motor goes above below 0 degree Celsius and above 60 degree Celsius

4). If imaginary input voltage of anyone phase goes below 170V and above 240V.

In each case motor will send the SMS of turn off condition to user. When parameter arrives its optimum value motor will automatically starts and send SMS of motor on condition to user.

2.1 PIC16F877A Microcontroller

This powerful (200 nanosecond instruction execution) yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into a 40 package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices.

2.2 SIM 800 GSM Module

This hardware is designed for global market, SIM800 is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM800 features GPRS multi-slot class 12/class 10 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

2.3 SOFTWARE

mikroC PRO for PIC 8.2 is a full-featured ANSI C compiler for PIC devices from Microchip. It is the best solution for developing code for PIC devices. It features intuitive IDE, powerful compiler with advanced optimizations, lots of hardware and software libraries, and additional tools that will help you in your work. Compiler comes with comprehensive Help file and lots of ready-to-use examples designed to get you started in no time. Compiler license includes free upgrades and a product

lifetime tech support, so you can rely on our help while developing.

3. EXPERIMENTAL SETUP

Top view of this project 12V step-down transformer, bridge rectifier, capacitor, LM7805 Voltage regulators create dc power supply and it is given to the both GSM Module and 16*2 LCD displays interfaced with PIC16F877A microcontroller and motor is connected to the relays through three phase mains supply.

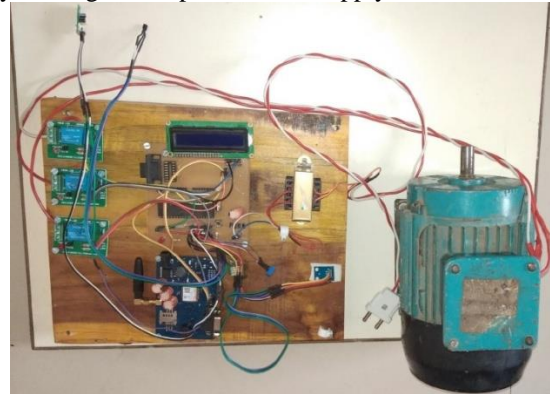


Fig3.Experimental Setup of proposed system

Range of Parameters used

S.No	Name of Parameter	Max Exceptable value	Min Exceptable value
1	Input Voltage	240V	170V
2	Vibration	30 Degree g	
3	Temperature	60Degree C	7Degree C
4	Humidity	60%RH	30%RH

Table1. Range used for system

Results of Proposed system

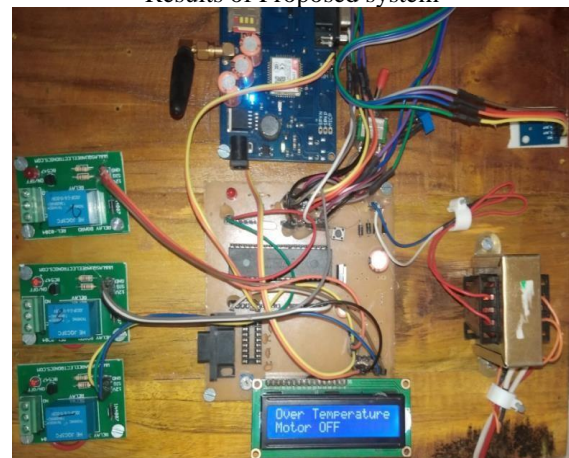


Fig.3.1 Motor OFF due to over vibration

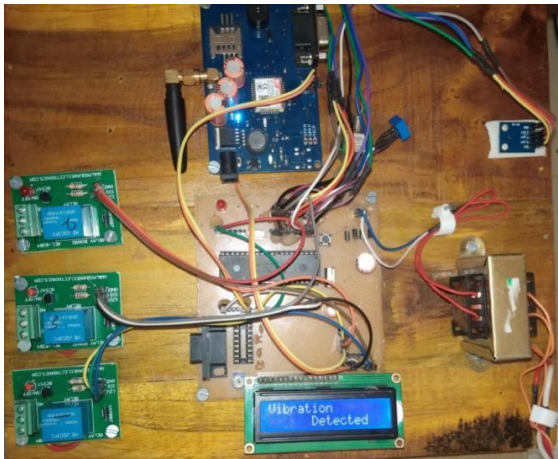


Fig3.2 Motor OFF due to Over Humidity

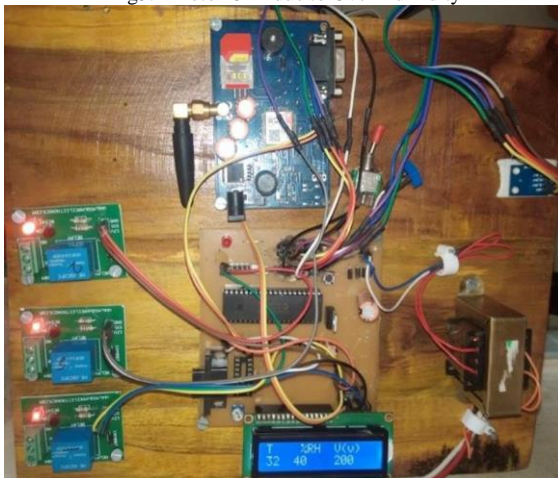


Fig3.3 SMS of Humidity Change Condition

CONCLUSION AND FUTURE SCOPE

Fault in one motor can cause so much loss in terms of production and time. Hence we are giving this option of monitoring faults by using sensors. If sensor values get exceeds, we can cut off supply of motor. It will help to protect motor from these faults and hence production cost and time can be reduced.

This project has prepared fault detection and controlling circuit for three phase induction motor. This circuit can switch on and off the motor through SMS by any mobile. Also GSM module and LCD display interfaced with motor. Hence every start and stop condition of motor will sent to user as well as displayed on LCD module. User can change the parameters like humidity, temperature, vibration and input voltage of the motor. On changing any parameter motor will stop and respective SMS will be sent to user mobile and displayed on LCD.

Protection of three phase induction motor from over/ under voltage, vibration, temperature, humidity provides the smooth running of motor which also improves its lifetime and efficiency. To make induction motor run efficiently and to protect it from various faults, four different sensing circuits have been designed along with PIC system. Infrared sensor can be used to measure the speed of shaft.

REFERENCES

- [1] Malik AbadulrazzaqAlsaedi.- Fault Diagnosis of Three-Phase Induction Motor: A Reviewl. Optics. Special Issue: Applied Optics and Signal Processing. Vol. 4, No. 1-1, 2015, pp. 1-8.
- [2] S. AsslySteffy, B. Mangaiyarkarasi, S.Sherin Jasper, K.Priyanka, K.Soorya An Improvement in Winding Protection of Three Phase Induction Machine Using Solid State Relaysl. International Journal of Advanced Research in Computer and Communication Engineering, Vol. 3, Issue 2, February 2014.
- [3] P.E. Elavenil , Dr. R. Kalaivani —Speed Monitoring And Protection Of Motor Using Zigbee Communicationl .International Journal of Scientific Research Engineering & Technology (IJSRET) Volume 2 Issue 11, February 2014.
- [4] Ms. PatilSmitaJaywant, Mr. PatilSachinSambhaji and Ms. PatilPragati Deepak —Fault Detection and Correction of 3-phase Induction Motorl. International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 3, Issue 8, August 2014.
- [5] SumitNarwade, Prasad Kulkarni and C. Y. Patil —Fault Detection of Induction Motor Using Current and Vibration Monitoringl. International Journal of Advanced Computer Volume-3 Number-4 Issue-13December- 2013.
- [6] K. K. Pandey, P. H. Zope, S. R. Suralkar, —Review on Fault Diagnosis in Three-Phase Induction Motor. International Journal of Computer Applications (IJCA) 2012.
- [7] Oscar Poncelas, Javier A. Rosero, JordiCusidó, Member, IEEE, —Motor Fault Detection Using a Rogowski Sensor without an Integratorl. IEEE Transactions On Industrial Electronics, Vol. 56, No. 10, October 2009.
- [8] RamazanBayindir, Ibrahim Sefa, IlhamiColak and AskinBektas —Fault Detection and Protection of Induction Motors Using Sensorsl. IEEE Transactions on Energy Conversion, Vol. 23, No. 3, September 2008.
- [9] NeelamMehala, RatnaDahiya —Motor Current Signature Analysis and its Applications In Induction Motor Fault Diagnosisl International Journal Of Systems Applications, Engineering and Development Volume 2, Issue 1,2007.
- [10] A.S.K. Khan, Tawifik S. Radwan, M.AzizurRahman —Real Time Implementation of Wavelet Packet Based Diagnosis and Protection of Three Phase Induction Motorl IEEE Transaction on Energy Conversion. Vol.22.no.3 September 2007.