



# MULTI PARAMETER MONITORING AND PROTECTION SYSTEM FOR FAULT PREVENTION IN INDUCTION MOTOR

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## Abstract

**In this paper describes a condition based reporting techniques of a multi-machine System using GSM technology. In this present approach, a Microcontroller based hardware unit (MHU) has been developed to continuously measure the parameters for monitor and protect the running condition of motor against some faults such as higher/lower current, higher/lower voltage, higher/lower frequency, over temperature in winding, overloading of motor. In a machine monitoring system the motor is connected with one such MHU, which are also connected to a Global System for Mobile Communication (GSM) modem. The preliminary level of fault or abnormality in operation of machine is diagnosed by the respective MHU and the fault or abnormalities details are reported to the pre-assigned operator through an SMS service. In extreme case, the provision of machine shut down by a return SMS is also provided. Therefore monitoring and protection of the system are realized in real time.**

**Keywords - Sensors, Rectifier, Atmega Microcontroller, GSM, Induction Motor**

## 1. INTRODUCTION

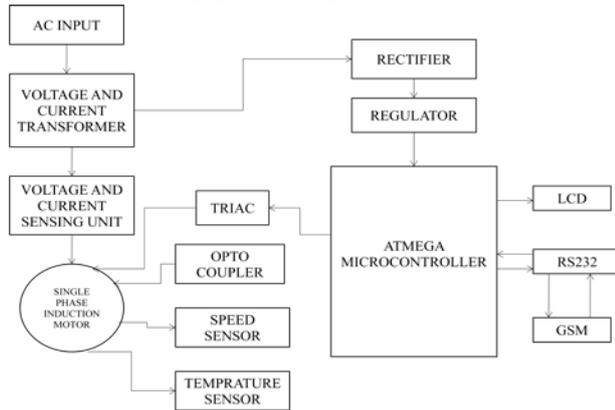
The proliferation of the 'more electric' concept in many areas of engineering is bringing about an increase in demand on reliability, power density and manufacturing efficiency of rotating electrical machines. To address this ever growing demand for new and reliable designs, electrical machines are increasingly required to be monitored in real-time with the data obtained being used for both model validation and prototype diagnostics. The latter helps to

identify potential modes of failure and thus ensures the drive's reliability, as requested by machine owners or end users.

If a conventional approach were to be adopted to achieve such multipoint, multi-parameter measurements, it would involve a drastic increase of component count thus reducing the overall reliability of the system in question. Further to this, due to the relatively large size of insulated conventional sensors, the resulting system will potentially occupy a spatial envelope larger than the drive itself. This work thus aims to address the above challenges, by replacing such conventional sensors with an integrated optical fibre-based, quasi-distributed, sensing system in electrical machines for real-time monitoring. Such a novel approach takes full advantage of the fibre sensors' reduced spatial envelope and immunity to electromagnetic interference.

One of the first efforts made in the direction of introducing an optical fibre sensor for motor and drive applications was to exploit Rayleigh backscattering in conjunction with a fibre having its outer cladding modified at intervals for a quasidistributed temperature measurement system using an optical time domain reflectometry (OTDR). Since then different optical sensing techniques were applied to monitor end-winding vibratory behaviour, stator housing vibration, thermal effects and torque, for instance. In a previous report, the authors introduced a stator wave and rotor speed tracking.

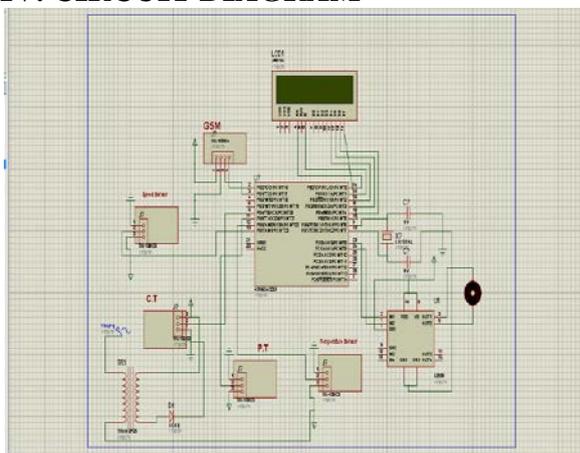
## II. PROPOSED SYSTEM



## III. WORKING EXPLANATION

- Motor fault diagnosis in dynamic condition is a typical multi-sensor data fusion problem.
- It involves the use of information collected from multiple sensors, such as speed, frequency, current, voltage, and temperature, to detect and identify motor faults.
- From the viewpoint of evidence theory, information obtained from each sensor can be considered as a piece of evidence, and as such.
- The multi-sensor based motor fault diagnosis can be viewed as the problem of evidence fusion.

## IV. CIRCUIT DIAGRAM



## VI. HARDWARE REQUIREMENT:

### A. ARDUINO UNO CONTROLLER

Arduino / Genuino Uno is a microcontroller board based on the Atmega328p. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal.

### B. LCD DISPLAY

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs).

### C. TEMPERATURE SENSOR

A thermistor is a type of resistor whose resistance varies with temperature. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting overcurrent protectors, and self-regulating heating elements.

### D. RS232

In telecommunications, RS-232 is a standard for serial binary data interconnection between a DTE (Data terminal equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports

### E. GSM (Global System for Mobile Communications)

GSM is a cellular network, which means that mobile phones connected to it, searching for cells in the immediate vicinity. There are five different cell sizes in a GSM network—macro, micro, pico, femto and umbrella cells. The coverage area of each cell varies according to the implementation environment.

### F. SUBSCRIBER IDENTITY MODULE (SIM)

One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets.

### G. RECTIFIER

Power Diodes can be connected together to form a full wave rectifier that convert AC voltage into pulsating DC voltage for use in power supplies

### H. VOLTAGE REGULATOR

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

### I. SOLID STATE RELAY

Solid State Relays are semiconductor equivalents of the electromechanical relay and can be used to control electrical loads without the use of moving parts

## J. IR SENSORS

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

## VII. ADVANTAGES

- Easy to identify the fault
- Display the fault
- Automatically ON/OFF system
- To protect and control the motor

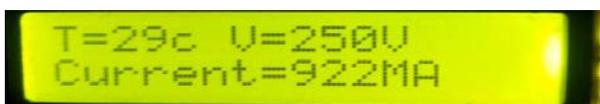
## VIII. RESULTS AND DISCUSSION



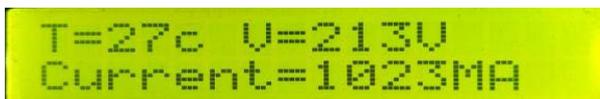
Under Over Temperature Message Display on LCD



Voltage is below 180V



Voltage is above 230V



Current is above 1000mA



Current is below 750mA



Condition OK LCD Display

## IX. CONCLUSION

By installing this system we are going to avoid the electrical machine getting into worst performance and faults during the operation of the machine can be rectified immediately so that it is helpful to increase the life of the machine and reduces the service charges with immediately clearing of the fault after its occurrence. This monitoring and protection system can be applied in industrial drives and machine and machine testing laboratories. This project is not restricted for electrical machines and also can be implemented for any type of machines with some small modifications.

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