Zig Bee Based Monitoring System for Electrical Machines

K. Fathima, K. Shanmugavalli

Abstract— Electrical machines plays an important role, the use of medium-sized electric machines burned every year around about 16%. In addition, because of electrical failure, damage caused by accident's even at home appliances as well as factory production cause the indirect economic losses even more greater. Detailed analysis of motor operation and fault conditions due to over voltage, load, etc can be solved by the usage of the current performance of microcontroller, zigbee and sensors embedded –to analyze the general motor protection devices, by improving the software to hardware to achieve best utilization of the machines. The normal conditions are to be stored in the database when the results occur abnormal the differences between the values are to be calculated accurately and the fault occurrences are rectified itself.

Index Terms— zigbee, sensors, monitoring system

I. INTRODUCTION

Motor protection devices, have a number of drawbacks, not the protection of a good motor, very difficult to promote. Using of integrated circuits without CPU produce the motor fault detector, although the current overrun and lack phase fault can be judged, current increase mainly as a criterion, the protection of the principle of a rough, the actual motor failure are the time and ambient temperature function of the electrical current., causing the accident.

At the same time, fault conditions cannot store data records and cannot be set in accordance with the actual load current, therefore not accurate, reliable and without visual convenience when used, is not conducive to the exclusion of failure, often refusing to move, severe burning motor. With the digital computer, electronic technology, the rapid development of integrated circuits, computer monitoring and control system to replace the traditional monitoring and control system is ripe. The focus in most industry is shifting from scheduled maintenance to the predictive maintenance by constantly observing and predicting the machine condition in advance. Most industrial motors are being monitored which either provide warning signals or shut down the system before any catastrophic failure occurs. Though they are able to prevent permanent damage to the machine, they can neither predict the usable life of the equipment nor provide the severity level of the problem. This resulted in the need of an advance system called Cost effective wireless health monitoring system.

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II. RELATED WORK

Traditionally, monitoring system is realized in wired systems formed by communication cables. Most recent research has investigated the fault detection technique primarily based on the Motor Vibrations. The cost of installation and maintenance are difficult and expensive especially when the equipments are not at the same location. To overcome these restrictions, using wireless sensor networks for monitoring is proposed in this paper. Although the fault detection by means of analysis of the Vibration is quite simple, the main drawback is that the employed technique is only suitable for steady state operation. Since the Motor Protection is also based on various other parameters. To overcome these restrictions, using wireless sensor networks for monitoring is proposed in this paper.

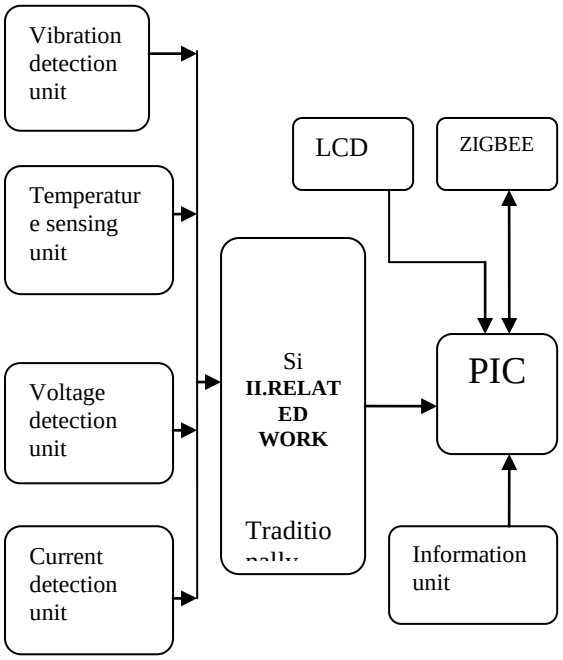

Figure 1.Motor unit

The current signal of a single phase of the stator current and a vibration signal from a vibration sensor located at the machine bearing cap will serve as the baseline data. The vibration sensor is then removed after installation. It is assumed that any externally induced vibrations, i.e., mechanical vibrations, the origin of which is external to the motor, will be frequencies which are not changing in time. The condition monitoring system will then compare the stator current signal measured over time with the baseline current signal to determine if an increase in its harmonic components has occurred.

Again, it is important to note that the location of the harmonic component is not changing in almost any practical installation.

Furthermore, this work is intended to verify that measuring the displacement of the air gap (i.e., the current harmonic magnitudes) is a sufficient means of approximating the displacement of the stator frame and, thus, indicates changes in the overall vibration level of the machine. Simply, the method calculates vibration motion arbitrarily, further current alone cannot be taken as input and feedback for performance analysis and health monitoring of motors analyzed on their ability to detect induction motor operation abnormalities. The detection of electrical abnormalities through vibration analysis is more beneficial when compared to MSA, as it is non electrical contact Wireless Health monitoring system for induction motor. This paper proposes and develops a ZigBee based wireless sensor network for health monitoring of induction motors. The vibration signals obtained from monitoring system are processed with signal processing techniques. In order to predict the level of severity of rotor imbalance, the vibration detection techniques were used.

Wireless sensor network is a new control network that integrates sensor, wireless communication and distributed intelligent processing technology. Zig Bee is a new wireless networking technology with low power, low cost and short time-delay characteristics The system can be used to collect reliable electric current and temperature parameters, current of motor overload, overrun, leakage, unbalanced, All the parameters of motor health like Vibration, current, voltage, proper Phasing were measured and calculated for determining a variety of intelligent fault and fault happened at or before the alarm system.

The power supply is automatically cut off to prevent electrical damage and troubleshooting in time to remind the user. The motor unit has the PIC16f877a with CPU where the data from the voltage and current sampling and signal processing unit is been received by mutual inductance current output and mutual inductance voltage output.

Temperature sensing circuit and transform circuit using vibration fault data storage to the PIC microcontroller. Zigbee receiver is been connected to the PIC and the LCD display for data displaying. The motor fault control circuit and also the fault data storage.

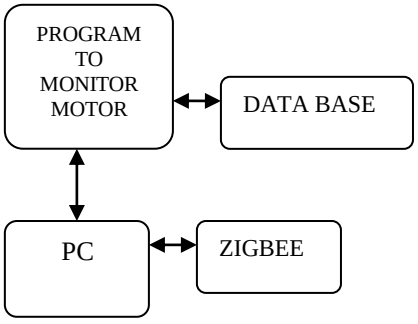

Figure 2.Monitor unit

III. ZIGBEE MODULE

IEEE802.15.4 standard defines the protocol and interconnection of devices via radio communication in a personal area network (PAN). It operates in the ISM (Industrial, Science and Medical) radio bands, at 868 MHz in Europe, 915 MHz in the USA and 2.4 GHz worldwide. The purpose is to provide a standard for ultra-low complexity, Ultra-low cost, ultra-low power consumption, and low data rate wireless connectivity. The system frame work for health monitoring system based on wireless sensor network is made up of data collection nodes and PAN network coordinator.

The data collection nodes can carry out desired functions such as detecting the vibration signals, signal quantizing, simple processing, and the IEEE802.15.4 Standard package framing to transmit data to the PAN network coordinator. In addition, they can also receive data frames from other nodes, and then adding multi-hop information, package framing, and then transmit the new data frames to the network coordination in the same manner.

Once receive the data, the PAN network coordinator will upload the receiving data to computer for further processing and analysis.

A) CURRENT TRANSFORMER:

A current transformer senses the current in induction motor and converts into corresponding Voltage signal. The current transformer output (through signal condition circuit) is given to input (Analog) port pin of Microcontroller .Here we use PIC 16F877A, it have Inbuilt of A/D Converter.

B) POTENTIAL TRANSFORMER

Similarly Potential transformer step down the line voltage to 5V Peak. Voltage signal is given to input (Analog) pin of PIC16F877A.

Example:

If Potential transformer output is given to input AD0 (Channel 1) of PIC Controller means we have to Call Set_adc_channel (0), then read_adc ();

In Main function:

```
Int z;
Set_adc_channel (0);
Delay_ms (100);
Z=read_adc ();
```

Here Variable Z have the Digital output of Potential Transformer

IV. SENSORS

A)TEMPERATURE SENSOR LM35

These sensors use a solid-state technique to determine the temperature. The fact as temperature increases, the voltage across a diode increases at a known rate.Usually, a temperature sensor converts the temperature into an equivalent voltage output IC LM35 is such a sensor. Here we describe a simple temperature measurement and display system based on LM35 sensor and PIC16F877A microcontroller. The temperature in degrees Celsius is displayed on a 16×2 LCD. Fig. 3 shows the functional block diagram of the PIC16F877A-based temperature monitoring system.

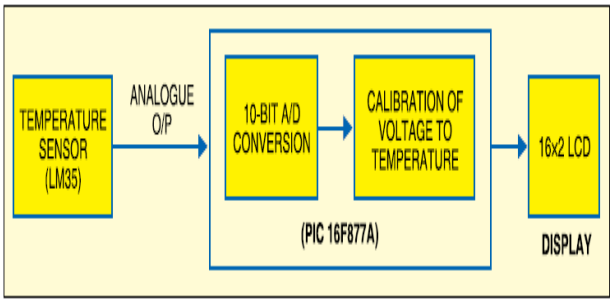

Figure.3 .shows the circuit of the temperature monitoring system

B)VIBRATION SENSOR

The Vibration Sensor can be mounted on the grinding machine either by use of the magnetic mount provided, or by permanent stud mount. The magnetic mount should be used during initial system start up, until a good permanent location is found on the grinding machine for the sensor. The sensor can then be permanently stud mounted at that location. When stud mounting the sensor, a machined flat should be supplied at the mounting location on the machine

SIGNAL CONDITIONING UNIT

In both Current & voltage transformers outputs will be Alternative Current (AC). Microcontroller unit is working under DC, so we must need to convert AC to DC. For that purpose we use bridge rectifier and variable resistor. This setup is called as Signal conditioning circuit.

IV. CONCLUSION

Through various fault conditions analysis of the course motor running, and using of mathematical models and simulate the process of motor temperature. Full advantage of the single-chip system resources realize intelligent motor protection and form a fully functional, practical intelligent performance monitoring system with a small number of Peripheral devices. Thermal model of low voltage motor is also establish, achieve a variety of motor fault General protection, as well as monitoring the operation of the motor. After testing the various parts of the hardware, the system can achieve the required accuracy of the monitoring, stable Operation, the use of effective, are in line with the target-site requirements to ensure reliable operation of the system, the promote a certain value.

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