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IOT Based Real Time Monitoring Of Induction Motor For Preventive Maintenance

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Abstract—The rapid development of technology currently revolves significantly around Internet of Things (IoT). Numbers of things are efficiently interconnected, especially in industrial automation which leads to condition and controlled monitoring to increase productivity. The aim of this project is to design and implementation of IOT technology to monitor and diagnose the condition of Induction motors. The proposed method comprises of an IoT based platform to collect and process the induction motor parameters. The data collected can be stored in the cloud platform and same can be accessed through the web page. And also timely alerts will be received for any violation in desired limits of parameters under monitoring, So that immediate action can be taken to avoid unwanted downtime of the motor that saves time and money. Advantages of this method includes continuous monitoring of the equipment, receiving alerts, and data availability for predictive maintenance.

I. INTRODUCTION

The most used machine in any section of the society including industries is Induction machine. Preferably three phase induction motors are used in industrial drives.

Besides their reliability, Induction motors are also subjected to many faults. The parts of induction motor that are most valueable to faults are bearing, stator winding, rotor bar and shaft. Different faults occurring in induction motors includes stator faults, Single phasing, bearing faults and winding faults. Considering factors for failure of industrial motors includes lubrication, motor ventilation, electrical factors, alignments and motor load that results in motor vibrations or motor temperature rise to critical levels.

Any small fault occurred in a motor will lead to complete motor failure if not addressed in time. So condition monitoring of induction motors is desirable to avoid downtime of any industry. Condition monitoring (CM) means monitoring of operating parameters of a machine in order to assists maintenance before any failure occurs. Condition monitoring of induction motors is important for their efficient and reliable operation, as it reduces maintenance cost, enhancing operating efficiency and decreasing the motor damage by predictive maintenance based on real time data. The health of an induction motor can be easily estimated by condition monitoring.

Condition monitoring overcomes the difficulties caused by the prior method of maintaining motors condition on time basis. Maintenance of motors on time basis may cause shutdowns that are unexpected. On the other hand condition monitoring will provide information not only on motor status and performance but also the type of maintenance required. Condition monitoring has got a great significance these days since it helps to predict equipment health, to optimize equipment performance and reduces maintenance cost.

There are various methods of condition monitoring viz. Signal processing, thermal monitoring, motor current signature analysis, vibration analysis etc. of induction motors. The proposed method of condition monitoring of induction motors using Internet of Things (IoT) will provide data on health condition and also the data can be accessed from any remote place. Parameters like vibration, bearing and winding temperatures, current are sensed by using various

sensors and are analyzed by a micro controller, to know the health condition of the induction motor.

The analyzed data is accessed or monitored from a remote place using a web application developed. Instant alerts can be received on web page, whenever there is a violation of prescribed limits of parameters.

II.MATERIALS

1. Arduino:

TheArduino Mega 2560 is a microcontroller board based on the ATmega2560. It include everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter.

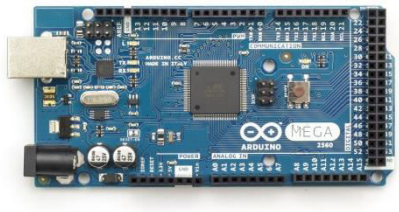

Fig. 1.Arduino Uno

2. ESP8266-12E (Node MCU 1.0 DevelopmentBoard):

It is an impressive, low cost Wi-Fi module which can be used for adding Wi-Fi functionality via a UART serial connection to the existing micro controller projects. Scripting language used by the Node MCU is Lua. Its operating voltage is 3.3v and has 11 digital input/output pins. The board has a flash memory of 4MB.

Fig. 2.ESP8266-12E board

3. Liquid crystal display

A typical LCD display consists of 16 pins that control various features of the screen. The Arduino microcontroller can output voltages of either 5 V or 3.3 V, so the LCD can be powered by wiring VSS and VDD to the ground and 5 V pins on the microcontroller. The LCD screen can operate in both 8-but mode and 4-bit.

To interface with the LCD in 4-bit mode the Arduino only needs to be connected to pins DB4-DB7, which will connected to digital output pins 5-2 respectively. Pin 15 as well as pin 16 on the LCD screen are used to power a backlight in the screen.

This makes text displayed in the screen easier to read in poorly lit environments and is optional. To power the Arduino a 9 V battery can be connected to the VIn and ground pins on the Arduino.

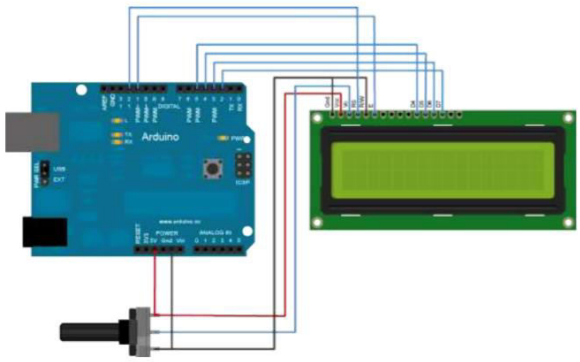

Fig. 3. Wiring schematic for LCD-Ardiuno interfacing

4. Sensors

1. Potential Transformer(PT)

It is a general purpose chassis mounting mains transformer. Transformer has 415 V primary windings and centertapped secondary winding. The Transformer act as step down transformer reducing AC - 415V to AC - 6V.The Transformer gives two outputs of 12V, 6V and 0V.

2.Current Transformer:

Current transformer is used to convert high current to low current.It is connected in series with the induction motor.It is working on the principle of electromagnetic induction. Transformer used has 1 ampere of current at primary which is converted into 1 miliampere at the secondary.

3.Temperature sensor:

For measuring winding temperatures a temperature sensor called LM 35 is used and is shown in Fig.3. The LM 35 is a precision temperature sensor and can be easily calibrated. It has a linear output. It operates over 55°C to 150°C range.It has three pins namely Vcc,output and ground pins.

4. Vibration sensor:

The vibration sensor or accelerometer used is ADXL 335 which is a small, thin, low power and 3 axis accelerometer containing signal conditioned voltage outputs. It measures both static and dynamic accelerations. The dynamic acceleration resulting from motion, shock or vibrations is measured in here.

III.BLOCK DIAGRAM AND EXPLANATION

Fig.5 shows the entire picture of the work. The objective of condition monitoring of induction motor is achieved by continuously recording the considered parameters using various sensors. LM 35 temperature sensors are used to record winding temperatures, current transformer is used for current , and a Voltage sensing circuit to measure voltage. All the sensors are connected to Arduino micro controller board which is to be installed at the motor site. The sensors will sense the parameters and are analyzed by the micro controller board according to the instruction coded. The data sensed by different sensors can be seen on the serial monitor of Arduino IDE.

The collected data can be stored on the IoT platform using Node mcuwi-fi module. Using serial communication between the micro controller and the node mcu board the data is initially transferred to Node mcu board which can be seen on the serial monitor.

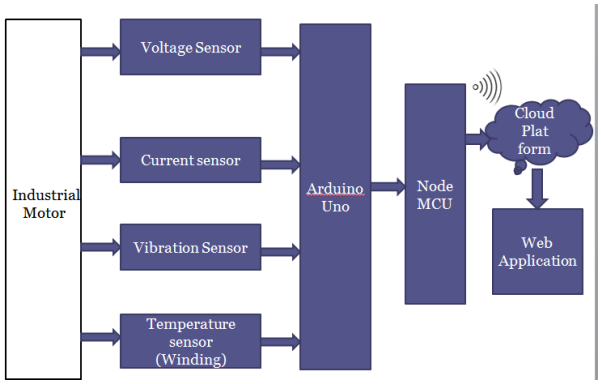

Fig 5 Block Diagram

Then using wi-fi functionality the data available at node mcu is uploaded to Thingspeak cloud platform. In order to upload the data to Thingspeak platform, an account is to be created in it and then a new channel is to be created. While creating a channel number of fields is to be selected depending on the number of parameters under monitoring. Each field is assigned with one parameter which is represented in the graphical form.

A web application is developed for continuous monitoring of parameters. Instant alert will be received on the web page for any abnormal operation of motor.

IV. FINAL RESULT

By connecting Node MCU to the Arduino we can upload the motor data to the web. Using the Wi-Fi connectivity, the data is uploaded to cloud platform and each parameter is represented in the form of graphs as shown in the Fig. below

V. CONCLUSION

In this paper Industrial motor is effectively and continuously monitored by using different sensors and the obtained data is stored in the cloud platform and is accessed from different locations using web application developed. The health of the motor is assessed by analysing the continuous parameter data obtained. In addition to continuous condition monitoring, receiving of timely alerts, storage of recorded voluminous data for future use and data monitoring from any different location, are added advantages of this method.

REFERENCES

[1] http://electrical.sunilsaharan.in/2013/01/induction-machines-advantagesconstruction-applications.html

[2] Alvaro Jose Bazurto, Enrique CiroQuispe, RosauraCastrillon Mendoza, "Causes and Failures Classification of Industrial Electric Motor," IEEE ANDESCON ,2016 DOI:10.1109/ANDESCON.2016.7836190.

[3] S. S. Goundar, M. R. Pillai, K. A. Mamun, F.R.Islam, R. Deo, "Real Time Condition Monitoring System for Industrial Motors," 2nd AsiaPacific World Congress on Computer Science and Engineering (APWC on CSE), 2015, DOI:10.1109/APWCCSE.2015.7476232.

[4] ChilakaRanga, Ashwani Kumar Chandel,"Advanced Tool Based Condition Monitoring of Induction Machines by Using LabVIEW–A Review," IEEE UP Section Conference on Electrical Computer and Electronics (UPCON),2015,DOI:10.1109/UPCON.2015.7456693.