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IOT BASED INDUCTION MOTOR FAULT DETECTION USING SENSORS WITH REMOTE ACCESS

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Abstract:

Precise control of AC motors requires the use of feedback from certain state variables. Hard-to-measure variables such as electromagnetic torque or fluxes are most often estimated from other, easy-to-measure (stator current, DC voltage) values. In addition, e.g. in direct rotor flux oriented control (DRFOC) of induction motor (IM), the use of feedbacks from the value of the stator current is also required. Current sensors are not reliable and their fault can lead to the need to switch the closed-loop drive structure to an open loop control structure. Various damage types were found, such as internal short-circuit , broken rotor bar , bearing inner ring failure, bearing outer ring failure, ball failure, cage failure, and eccentricity. As for fault diagnosis of an induction motor, the literature has also indicated that approximately 30% of motor breakdowns are related to stators, 10% to rotors, 40% to bearings, and 20% to other components . A great deal of research proposes how to classify the damage types, such as stator breakdowns, and have employed various approaches , including magnetic pendulous oscillation, motor current signature analysis, instantaneous active and reactive power signature analyses, and total harmonic voltage.

Keywords: Induction Motor, DRFOC, Current sensors.

1. PROPOSED SYSTEM:

In this proposed system our application is given for Fault detection and control strategy of induction motor. It has microcontroller to coordinate the proposed control mechanism. This system consists of Relays, stepdown transformer, LCD display, IOT module, sensors such as voltage, current, temperature and vibration. The Microcontroller is used with programming code which drives the whole system is conformity with their characteristics. LM -35 is a temperature sensor which is used to determine the present temperature of the motor. Same way bearing fault and rotary fault is identified using a separate sensing circuit. All these analog sensors are connected to the analog input pins of PIC16F887 microcontroller. 16*2 Liquid crystal display is used to display all the sensor currency values. When an abnormalities in sensors are detected automatically the stops Motor. Node MCU is an IOT module which is used to upload all the values in a specific website called Thing speak. All the values uploaded regularly and are updated in graphical representation. Language Embedded C is used to write the coding with the

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help of PIC C compiler. All sensed data process through microcontroller and shows on the display and IOT module and also serial monitor of the laptop/phone displays the output. Those measurements can be used to detect imbalances or other issues in the asset and predict the future breakdowns.

2. BLOCK DIAGRAM

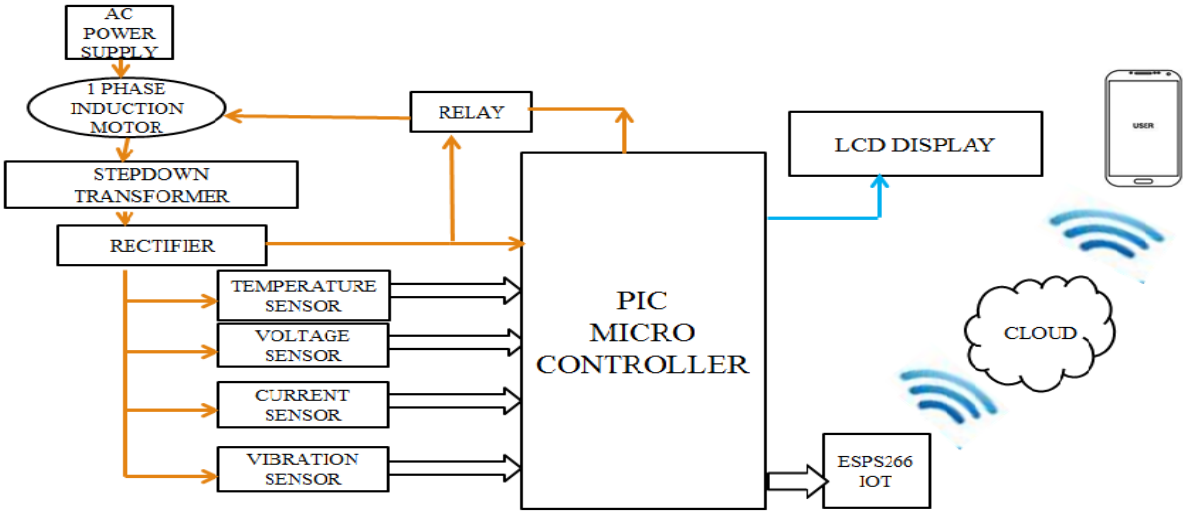

Fig1.3 Block Diagram

HARDWARE REQUIREMENTS

A. STEP DOWN TRANSFORMER (12V,1A)
B. VOLTAGE REGULATOR(7805)
C. RECTIFIER
D. NODE MODULE (ESP8266) , LCD DISPLAY (2X16)
E. RELAY (12V)
F. 1 PHASE INDUCTION MOTOR (100 W)
G. CURRENT SENSOR (WCS 2705)
H. TEMPERATURE SENSOR (LM35)
I. VIBRATION SENSOR
J. VOLTAGE SENSOR
K. MICROCONTROLLER(PIC 16F887 BOARD WITH IC)

A. STEP DOWN TRANSFORMER (12V,1A)

A step-down transformer is a type of transformer that converts the high voltage (HV) and low current from the primary side of the transformer to the low voltage (LV) and high current value on the secondary side of the transformer. The reverse of this is known as a step up transformer. Just as transformers can step down the voltage – going from a higher primary side voltage to a lower secondary side voltage – they

can also step up the voltage, going from a lower primary side voltage to a higher secondary side voltage. These are known as step-up transformers.

B.VOLTAGE REGULATOR (7805):

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.

C. RECTIFIER:

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. Rectifiers are used inside the power supplies of virtually all electronic equipment. AC/DC power supplies may be broadly divided into linear power supplies and switched-mode power supplies. In such power supplies, the rectifier will be in series following the transformer, and be followed by a smoothing filter and possibly a voltage regulator.

D. LED DISPLAY (2*16),NODE MODULE(ESP 8266)

Liquid crystal displays (LCDs) are a commonly used to display data in devices such as calculators, microwave ovens, and many other electronic devices. LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. Node MCU is a low-cost open source IOT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espress if Systems, and hardware which was based on the ESP-12 module. An IOT module is a small electronic device embedded in objects, machines, and things connected to wireless networks and sends and receives data.

E. RELAY (12V)

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized.

F. 1 PHASE INDUCTION MOTOR (100 W)

A single phase induction motor consists of a single phase winding on the stator and cage winding on the rotor. When a 1 phase supply is connected to the stator winding, a pulsating magnetic field is produced. In the pulsating field, the rotor does not rotate due to inertia.

G. CURRENT SENSOR (WCS 2705)

A current sensor is a device that detects and converts current easily to measurable output voltage, which is proportional to the current through the measured path. There are a wide variety of sensors, and each sensor is suitable for a specific current range and environmental condition.

H. TEMPERATURE SENSOR (LM35)

A temperature sensor is a device used to measure temperature. Temperature sensors work by providing readings via electrical signals. Sensors are composed of two metals that generate an electrical voltage or resistance when a temperature change occurs by measuring the voltage across the diode terminals. When the voltage increases, the temperature also increases.

I. VIBRATION SENSOR

This module features an adjustable potentiometer, a vibration sensor, and LM393 comparator chip to give an adjustable digital output based on the amount of vibration. The potentiometer can be adjusted to both increase and decrease the sensitivity to the desired amount. The module outputs a logic level high (VCC) when it is triggered and a low (GND) when it isn't. Additionally there is an onboard LED that turns on when the module is triggered.

Features:

1. The default state of the switch is close

2. Digital output Supply voltage:3.3V-5V

J. VOLTAGE SENSOR

Voltage sensors are wireless tools that can be attached to any number of assets, machinery or equipment. They provide 24/7 monitoring, constantly watching for voltage data that could indicate a problem. Low voltage may signal a potential issue, while other assets may be in danger when voltage is too high.

K. MICROCONTROLLER (PIC 16F887 BOARD WITH IC)

PIC microcontrollers (Programmable Interface Controllers) are electronic circuits that can be programmed to carry out a vast range of tasks. They are found in most electronic devices such as alarm systems, computer control systems, phones, in fact almost any electronic device. PIC Microcontrollers are relatively cheap and can be bought as pre-built circuits or as kits that can be assembled by the user.

3. SIMULATION RESULT:

3.1 CLOUD SERVER

3.1.1 INTRODUCTION

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A cloud server is a pooled, centralized server resource that is hosted and delivered over a network typically the Internet and accessed on demand by multiple users. Cloud servers can perform all the

same functions of a traditional physical server, delivering processing power, storages. Cloud servers can be located anywhere in the world and deliver services remotely through a cloud computing environment .In contrast, traditional dedicated server hardware is typically set up on premises for exclusive use by one organization.

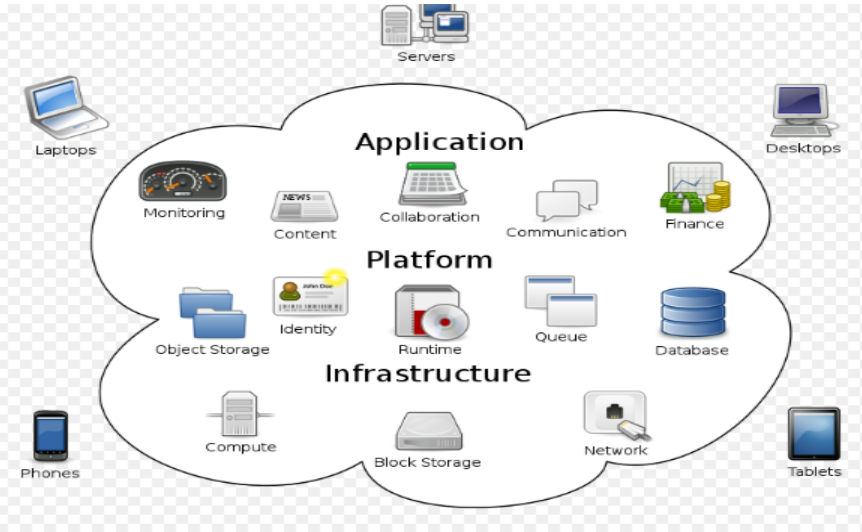

Fig3.1.1 Block Diagram

3.1.2 SOFTWARE REQUIREMENTS

A. CCS C FOR PIC MICROCONTROLLER
B. ARDUINO IDE FOR NODE MCU
C. THINGS SPEAK
D. PICK KIT 2

A. CCS C FOR PIC MICROCONTROLLER

CCS stands for Custom Computer Services, a Microchip PIC Microcontroller Tool Solutions company. Micro C and CCS C are the best compilers for beginners as they includes a lot of built in libraries which enable us to program a PIC Microcontroller without the deep knowledge of its internal architecture.

B.ARDUINO IDE FOR NODE MCU

Explore a step-by-step guide to setup for Arduino programming;

- Download & install the Arduino environment (IDE)
- Launch the Arduino IDE
- If needed, install the drivers Connect the board to your computer via theUSB cable
- Select your board
- Select your serial port
- Open the blink example
- Upload the program

C. THINGS SPEAK

Thing Speak is an IOT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. Thing Speak provides instant visualizations of data posted by your devices to Thing Speak. With the ability to execute MATLAB code in Thing Speak you can perform online analysis and processing of the data as it comes in. Thing Speak is often used for prototyping and proof of concept IOT systems that require analytics.

D. PICKIT 2

The PICkit 2 Development Programmer/Debugger (PG164120) is a lowcost development tool with an easy to use interface for programming and debugging Microchip's Flash families of microcontrollers.The full featured Windows programming interface supports baseline (PIC10F, PIC12F5xx, PIC16F5xx),midrange (PIC12F6xx, PIC16F), PIC18F, PIC24, dsPIC30, dsPIC33, and PIC32 families of 8-bit, 16-bit, and 32-bit microcontrollers, and many Microchip Serial EEPROM products. With Microchip's powerful MPLAB Integrated Development Environment (IDE) the PICkit 2 enables in-circuit debugging on most PIC microcontrollers. In-Circuit-Debugging runs, halts and single steps the program while the PIC microcontroller is embedded in the application. When halted at a breakpoint, the file registers can be examined and modified.

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3.2 HARDWARE SIMULATION RESULT OUTPUT

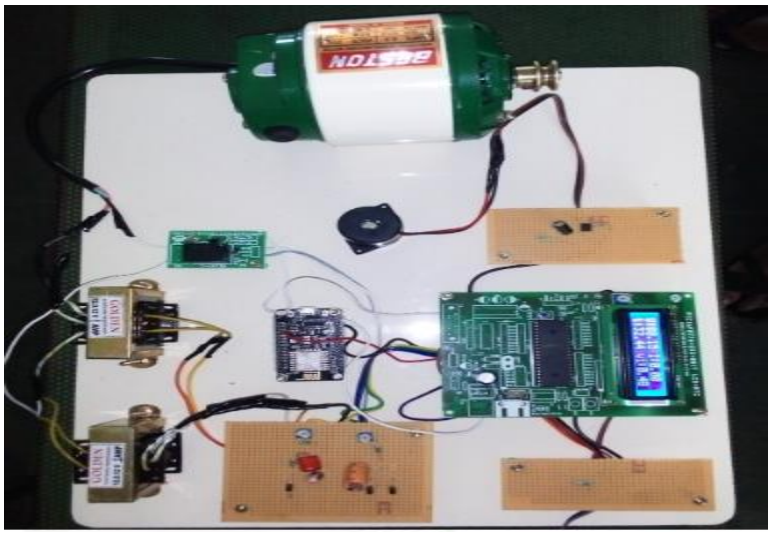

Fig 3.2 HARDWARE OUTPUT

3.3 SOFTWARE SIMULATION RESULT OUTPUT

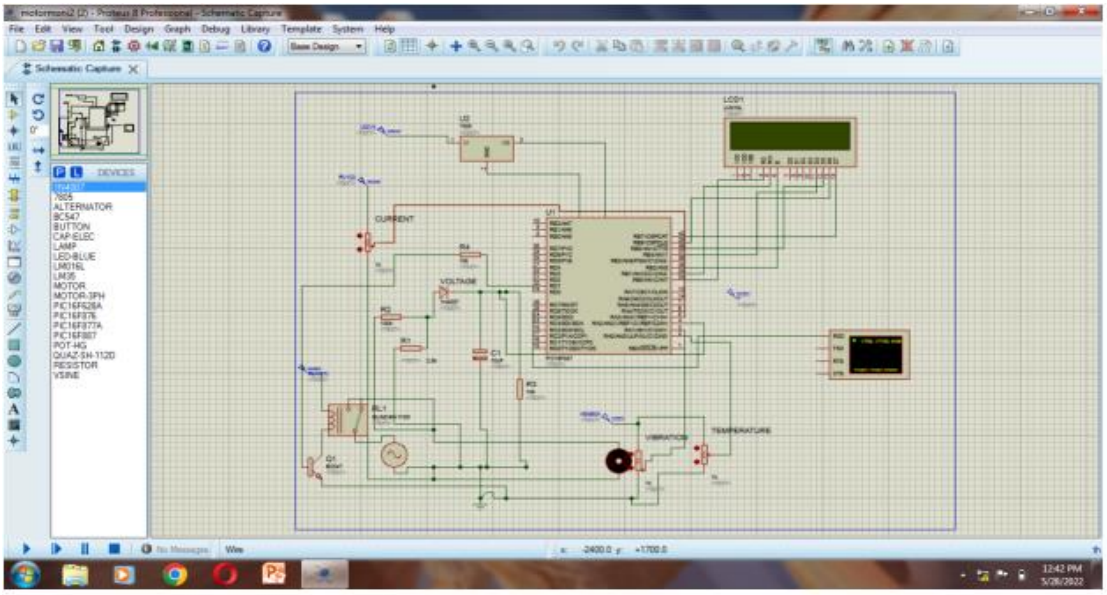

Fig 3.3 SOFTWARE OUTPUT

CONCLUSION:

The objective of this paper was to develop a novel and feasible technique of condition monitoring of critical machines used in daily life. Electrical Induction motor being the backbone of the industries and other service sectors form an integral link of the whole system and thus its reliable functioning is a must. This paper successfully achieved the target of integrating the monitoring process with IoT technology. Here motor monitored from remote places will result in better manpower utilization and labor efficiency. It offers major benefits to both, the individual users as well in industry in terms of reliability, efficiency and cost saving. This technique could be further implemented in industries for major cost savings and avoiding major downtime of critical equipment. Data acquisition is an important step that that helps use this data to further gain more insights about the machine. Condition monitoring techniques can further be integrated with neural networks to predict the remaining life of the components. It can used to classify the faults in case of unsupervised data sets which is common in the induction motor faults. Data acquisition is a key step for predictive maintenance and as well as to detect faults. Thus, developing an independent and economical

REFERENCES

[1] S.K.Sethiya “Condition Based maintenance(CBM)” , irsme vol1. 2012

[2] S. Devendiran, Dr. K. Manivannan “Vibration Based Condition Monitoring and Fault Diagnosis Technologies For Bearing and Gear Components-A Review” International Journal of Applied Engineering Research ISSN 0973-4562 Volume 11, Number 6 (2016) pp 3966-3975

[3] Adrian D. Nembharda, Jyoti K. Sinhaa, A. J. Pinkertonb, K. ELBHBAHA “Fault Diagnosis of rotating machines using vibration and bearing temperature mesaurements” Diagnostyka, Vol. 14, No. 3 (2013)

[4] G. Suresh Babu, Dr. V. Chittaranjan Das, “Condition Monitoring and vibration analysis of boiler feed pump”,International Journal of Scientific and Research Publications, Volume 3, Issue 6, June 2013

[5] Khadim Moin Siddiqui, Kuldeep Sahay, V.K.Giri, “Health Monitoring and Fault Diagnosis in Induction Motor- A Review”,IJAREEIE Vol. 3,
Issue 1, January 2014

[6] Jinia Datta(Das), Soumyajit Datta, Sumana Chowdhuri and Jitendranath Bera, “Condition based reporting of multi-machine monitoring system using GSM”, IJSRP, Volume 2, Issue 6, June 2012

[7] N. B. Shaikh, Prof. S. S Dhamal, S. S. Hadpe, K. P.Varade, “Online Off- Site Condition Monitoring Of Three Phase Induction Motor by Using GSM Technology”, IJETAE

[8] Chen YR. Modern signal processing technology in the application of vibration diagnosis of

internal combustion engine Ph.D. thesis, Wuhan University of Technolog Jayaswalt P, Wadhwani AK. Application of artificial neural networks, fuzzy logic and wavelet transform in fault diagnosis via vibration signal analysis: A review. Australian Journal of Mechanical Engineering 2009; 7: 157-172.y, 1998.

[9] Krause PC (1986) Analysis of electric machinery. Mc-Graw Hill, New York

[10] Sen PC (1989) Principles of electric machines and power electronics. Willey, New York

[11] Say MG (2002) The performance and design of alternating current machines. M/S Pitman, London. ISBN 81-239-1027-4

[12] Kothari DP, Nagrath IJ (2010) Electric machines. Tata McGraw Hill Education Pvt. Ltd., New Delhi. ISBN-13 978-0-07-069967-0

[13] Motor Reliability Working Group (1985) Report of large motor reliability survey of industrial and commercial installations Part I, and II. IEEE Trans Ind Appl IA-21(4):853–872

[14] Thorsen OV, Dalva M (1995) A survey of faults on induction motors in offshore oil industry, petrochemical industry, gas terminals, and oil refineries. IEEE Trans Ind Appl 31(5):1186–1196

[15] Thomson WT, Gilmore RJ (2003) Motor current signature analysis to detect faults in induction motor drives-fundamentals, data interpretation, and industrial case histories. In: Proceedings of the thirty-second turbomachinery symposium, pp 145–156