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IoT-BASED MONITORING OF INDUCTION MOTOR PERFORMANCE

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Abstract -*Now-a-days induction motor plays an important role in industrial application because it is simple and rugged in construction and also it can operate in any environmental condition and the cost of the induction motor is low. This paper presents monitoring of induction motor's performance using app created by using MIT app inventor. The sensor observes electrical parameter such as voltage and current as well as non-electrical parameters such as temperature and speed respectively. MIT app inventor has a component named Tiny DB which stores the data in database located directly on the android device. When the parameter exceeds the specified range, a notification is sent to the app through which we can turn ON or turn OFF the motor. This method helps to increase the efficiency of the induction motor and also reduces the occurrence of the fault.*

Key Words*: *Induction Motor, MIT app inventor, Temperature, Speed, Current, Voltage

1. INTRODUCTION

In an industrial environment, induction motor is most widely used since it has more advantages. Apart from this, there are other factors which make induction motors well suited to industrial usage, like robust in construction, low maintenance cost, high starting torque, efficiency and reliability than other motors used in industries. 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. Monitoring the electrical and non-electrical parameters of the induction motor became more important these days since it helps to predict the motor performance and reduces maintenance cost. When induction motor operates at full load winding temperature increases tremendously this leads to decrease in efficiency due to heat dissipation. Increase in frequency or no-load operation leads to increase in speed. Over current flow leads to many losses. So, these parameters should be monitored frequentlyAnd thus, it is essential to monitor the performance of the motor without changing its operation. Here the system is integrating embedded system with wireless network during this technique, different sensors are connected with the motor and the values are extracted using Arduino and Node MCU. To ensure the reliable operation of induction motors this technique is used. In this system both the monitoring and controlling are done automatically. Internet of things is the recent trending development to control and monitor the motor. The reliability of motor is increased by continuous monitoring of electrical and mechanical parameters. If any abnormal value of electrical and mechanical factors is detected, the motor is controlled automatically (i.e.) motor is suddenly turned off to reduce the fault occurred at that moment. The followed methodology was to monitor the various parameters like voltage current, temperature of induction motor in real time using various sensors. To calculate speed and temperature, IR SENSOR MODULE and LM35 sensors are used. To read the values from the sensor we have an idea to display the values in mobile APP which we are going to develop. In addition to that we are displaying the graphical representation of current and voltage for every 5 seconds so that we can monitor the flow of current and voltage. App is created using MIT APP INVENTOR. This wireless sensor network monitoring of induction motor is even used for high range of motors. Where a smart switch was proposed. Smart switch was a data logger that is used to monitor operation condition and automatically.We are also going to set a notification if any regularity is found. The wireless monitoring for induction motor is safe and cheaper communication in industrial field. This wireless system is cheaper when compared to wired communication. The induction motor can be started and stopped wireless due to the computer interface developed with Arduino. By using this system, we can protect the motor against some faults such as over current, higher/lower voltage, over temperature in windings, overloading of motor.

2. LITERATURE REVIEW

Simoes et al. [1] has evaluated the literature concentrated with problems related to the different kinds of performances of manufacturing organizations. By viewing this extensive literature review, several faults in both practical and theoretical performance parameters are noted and discussed. This literature review is summarized by illustrating a conceptual architecture of the evolution of manufacturing performance measures and measurements in an institutional level of context. Fredriksson et al. [2] point out the problems of implementing reactive, preventive guessing and total economical maintenance for Volvo trucks. The authors made a maintenance department analysis, which is a tool for benchmarking and developed the customer focused model. Ashayeri et al. [3] given a IoT based planning system for the maintenance of various applications. The authors described a planning tool which was designed to manage a preventive and corrective maintenance environment.

3. SOFTWARE

3.1. FIREBASE

Firebase is used for developing app, cloud messaging, storing data in database in real-time, storing data in other computer or in server. It is a platform offered by Google which can be used as a backend storage. Firebase can be said as cloud-based database. It is the most stable and fastest real-time databases. In this, we are using a firebase as a real-real time database and then integrate firebase with MIT app inventor2.

3.2. MIT APP INVENTOR

MIT app inventor is a developed by Google which is based on web application integration. It uses a graphical user interface which allows the users to drag and drop visual objects to create an application that can run on mobile devices. Inventor also supports the use of cloud data via firebase(Real time database).It has two blocks namely designer editor(fig-1)and blocks editor(fig-1).The designer editor design the app's user interface by arranging both ON and OFF screen components which is wanted to be displayed in the app to the user. The component pieces are dragged and dropped in the screen which is interfaced to develop the program. The block editor helps to program the app's behavior by putting the blocks together. Blocks with respective functions are available; each device of the system has its respective blocks for its own functions.

Fig-1: Designer editor

4. REMOTE MONITORING AND CONTROLLING

Data obtained at that moment monitored in server. The server application provides the remote monitoring of acquired data. The program set up in the Node MCU is used in processing the data continuously and send the processed to the server. By using firebase, the data is seen from remote locations. If any abnormal condition is noted and then it is controlled from the remote locations (i.e. turning ON and turning OFF of the motor to detect and prevent severe faults)

5. BLOCK DIAGRAM

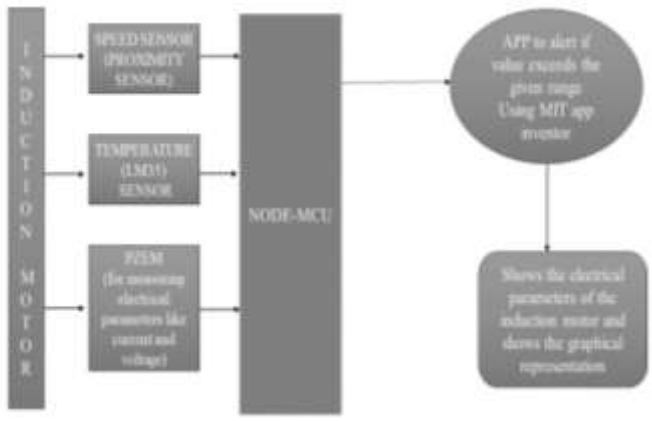

Fig 2: Overall block diagram

6. COMPONENTS DESCRIPTION:

6.1Node MCU:

Node MCU is an open source, light weight, high-level, multi-paradigm IoT platform developed for ESP8266 Wi-Fi chip. By interrupting functionality with ESP8266 chip, Node MCU software comes with ESP8266 Development board/kit i.e. Node MCU Development board (Fig 3). Node MCU is open source platform and so their hardware design is open and easy to edit/modify/build. Node MCU Kit consists of chip with ESP8266 Wi-Fi. Espressif Systems with TCP/IP protocol developed ESP8266 which is a low-cost Wi-Fi chip. Node MCU Dev Kit has both Analog and Digital pins on its board. It supports serial communication protocols i.e. UART, SPI, I2C etc. Node MCU can be connected with serial devices by using such serial protocols.

Fig3: Node MCU

6.2Condition monitoring sensors:

6.2.1LM35 sensor:

LM35 sensor (Fig 4) is a temperature measuring device having an analog output voltage proportional to the temperature. It provides output voltage in Centigrade (Celsius). External calibration circuitry is not needed in LM35 sensor. The sensitivity of LM35 sensor is given by 10 mV/degree Celsius. As temperature increases, output voltage also increases. (E.g. 250 mV means 25°C). LM35 sensor is a 3-terminal sensor used to measure temperature ranging from -55 °C to 150 °C. The value of temperature obtained in LM35 is more accurate than thermistor.

Fig4: LM35sensor

6.2.2 IR INFRARED OBSTACLE AVOIDANCE SENSOR

Module (Fig 5) has a pair of infrared transmitting and receiving tubes. When the transmitted light waves are reflected back, this is received by the receiver tube. The onboard comparator circuitry is used for processing and the green indicator LED gets ready for the operation. The module consists of three pins such as V_{cc}, GND and an OUTPUT pin on its tail. It works properly in the range from 3.3 to 5V. Upon obstacle, the output pin provides a digital signal (a low-level signal). The preset done on onboard helps to fine tune the range of operation, effective distance range is from 2cm to 80cm.

Fig5: IR sensor

6.3 PZEM module:

PZEM-004T(Fig6) is best for the purpose of the DIY project, where we need to measure the voltage, current, power, energy, frequency, Power factor (frequency and PF is extra added in the new version) using Arduino/ESP8266/Raspberry Pi like open source platform. In many electrical industrial applications, engineer directly deals with measurements with basic requirements such as high galvanic isolation, displaying parameters, direct communication with computer, data acquisition and storage with subsequent viewing or copying to thecomputer.

Fig6: PZEM module

7. METHODOGY

The power supply is ON, the node MCU(ESP8266) and all the interface components get the required supply. Sensor unit senses the corresponding motor parameters and feed to the Node MCU reads the data from the various sensors by creating the corresponding code and analyses according to the given instructions. Then sends the sensor information from Node MCU(ESP8266) to two servers namely, Blynk server and firebase server. Fire base is a real time database management. Blynk server is to represent the graph (Electrical parameters and time) Blynk server is used and also user Id, password and auth token is created automatically. To display the stored values of various parameters in the app which uses the firebase database. To turn ON and OFF the motor URL code must be copied in the app. Then, URL code is generated by copying the auth token in the firebase server. The app is created by MIT APP INVENTOR2 which is an open source platform.

8. RESULT

In this work, each sensor is tested individually and implemented. In the running condition of the motor, the sensed value is displayed continuously in serial monitor, in app and also in firebase website graphically which is correctly interfaced. The motor is tested for abnormal condition, the information of the sensor is displays in App and serial monitor are given below Fig-7(screen on)

Fig 7: Screen ON

9. CONCLUSION

The Internet of Things provides predictive maintenance approach for various applications. The army of connected sensors, monitoring every aspect of manufacturing from the production process to the associated machinery, provides real time insights into a site's operational effectiveness and equipment condition. The proposed system can be easily upgraded to add other sensors on the sensing node for the measurement of other parameters if required. The system easy to implement, requires low maintenance cost and has a high autonomy.

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