FAR-FLUNG MONITORING & FORTIFICATION OF INDUSTRIAL HIGH TENSION MOTORS USING IOT TECHNOLOGY

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ABSTRACT

This work elucidates the remote monitoring of industrial High Tension Motors using Internet of things and protection of the same during the malfunctioning. High Tension Motors are one in which widely used in mining, Oil industries etc., which gets operated in 3.3KV, 6.6KV and 11KV. This work is brought up to monitor the state of High Tension Motors in Industries because, if in case of fault occurrence, leads to the failure of High Tension Motors which in turn affects the routine functionalities of the industry which finally leads to the heavier loss. To avoid such critical situation, this work has been made which monitors the parameters such as actual current, voltage, temperature, speed and vibration of High Tension motors continuously. Here Internet of Things Technology is used in this system of work for the purpose of monitoring. Also in this system, during malfunctioning (i.e) abnormal variations in the parameters, the high tension motor will be protected by turning off the motor.

KEYWORDS: High Tension Motors, Internet of Things, Current, Voltage, Temperature, Speed And Vibration

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1.INTRODUCTION

Motors are one in which plays an important functions in domestic and in industrial applications. For the effective performance and the higher efficiency, the motors have to monitored and maintained regularly. Low Tension and High Tension Motors are mostly used in Industries. The range of Low Tension Motors would be 230 V, 415 V and 690 V similarly 3.3 KV, 6.6 KV and 11 KV are the ranges of High Tension Motors as discussed earlier. Here in this work, the monitoring of High Tension Motor is done using IOT Technology. IOT Technology in industries can also be termed as Industrial Digitalization. Internet of Thing is the interrelated system which interconnects computing devices, mechanical devices and the digital machines with unique identifiers for transferring data in the network by neglecting human and computer alliances. Now coming to this work, IOT Technology monitors the Industrial operated High Tension Motors using the mobile application.

During the regular operation of High Tension Motors in the industry leads to some maintenance issues which have to be cleared within a short span. Such occurrence of issues has to be monitored, cleared and avoided. If it fails to happen, the minimal issue creates a maximal loss due to the failure in the functioning of the High Tension motors in the industry. Here in this work voltage, current, speed, vibration and the temperature are the parameters to be monitored.

Vibrations of the High Tension motor should be within the permissible limit, if it exceeds, it leads to the

critical situation and it can't be handled. The temperature of the machine should be within its tolerable limit, or else, there occurs the insulation failure in stator and the rotor windings of the motor which even leads to the explosion of the motor. So in order to avoid such perilous circumstances, the vigor of High Tension motor is to be monitored continuously. So that the motor operates in good condition.

Here in this work, the temperature, pressure, vibration, voltage and current values were sensed and analyzed with the reference value by using arduino. The arduino used in this system is arduino UNO. This arduino UNO feeds the analyzed data's into the cloud server. The user can obtain the data in their mobile from the cloud using the mobile application to know the exact status of motor. If any of the sensor senses the abnormal value of the corresponding parameter, the arduino gives out the signal to relay to turn off the motor.

2.OVERVIEW OF THE SYSTEM

The main objective of this system is to improve the reliability of the High Tension Motor by using the IOT technology. This system continuously monitors the status of High Tension Motor. By ensuring the reliability of the system, abnormal states can be easily identified and avoided. In this system, monitoring and control of High Tension Motors is done using Internet of things technology which reduces man power. This system also stores the parameters as digital data throughout the run time of the same.

Fig.1. shows the block diagram of Far-flung monitoring of industrial High Tension motors using Internet of Things. In this system, different types of sensors such as temperature sensor, current sensor, voltage sensor, vibration sensor and speed sensor is used to measure the temperature, current, voltage, vibration and speed respectively.

The sensed parameters are fed to arduino in which the arduino feeds all these data's to the cloud. The data in the cloud can be taken by using the mobile application called blynk. The data's can also be viewed in the LCD display which is connected with the arduino.

Figure 1: Block Diagram of the HT Motor Monitoring System

3.SYSTEM DESIGN & HARDWARE DESCRIPTION

The fig. 2. shows the system design of Monitoring of industrial High Tension motor using Internet of Things. Here the arduino UNO is microcontroller used to program the sensors to perform its specific functions. The sensors sense the exact parameters of the machine and feeds to the arduino. arduino displays the parameters in the LCD display and also feeds to

cloud server through the ESP8266 wifi module.

The parameter data's of the motor fed in the cloud can be received in the mobile phone using the Blynk application. The parameters of the High Tension motor can be viewed from any place through this system. If there is any abnormal variation in the parameter values, arduino is coded to turn off the high tension motor through the relay, which protects the motor from the damage.

Figure 2: Design of HT Motor Monitoring System

Now let us discuss the hardware constituents of the Monitoring system of Industrial High Tension Motors using IOT Technology.

a) Arduino

Arduino used in this system is arduino UNO. It is the flash chip board which suits all the types of users. Microcontroller is the main part in the arduino and the controller used is atmega controller. There are 14 digital pins and 6 analog pins. 6 of the 14 pins are the PWM pins.

Figure 3: Arduino UNO

The arduino can be energized by giving DC supply of 5V or 12V. Arduino plays a significant role in operating the sensors which is connected with it. The arduino should be programmed to control the any of the device which is connected with it. The arduino is coded by using IDE software which is the open source software. The arduino consists of a separate ports to connect laptop for coding, controlling, etc. Arduino uses serial communication. The arduino UNO is shown in the Fig.3.

b) Wi-Fi Module

Wi-Fi (i.e) wireless fidelity is the technology of wireless communication which provides a hotspot to connect the collaborating module. The wifi module used here is ESP 8266. This module is one of the best suited module to use along with the IOT technology. This is the system on chip module which consists of integrated TCP/IP protocol stack whereas it helps the controller to access the wifi network.

This wifi module is preloaded in firmware with 9600 baud rate. This wifi module consumes 3.3 V to energize it. The module consists of 8 pins and they are RX, TX, RESET, VCC, CH-EN CPIO-0,1. This wifi module is programmed by IDE software of arduino. This ESP8266 module is very cheap. The ESP2866 wifi module is shown in fig.4.

Figure 4: ESP2866 Module

c) Sensors

Here, the sensors are used to sense the voltage, current, temperature, speed and the vibrations. Let it be discussed in detail.

Current Sensor: This sensor is used to detect the actual current of the High Tension motor. This sensor senses the current and generates the signal proportional to the same. The sensed value is displayed in the LCD display, sent to the user through internet and also stored for the further analysis.

Voltage Sensor: This sensor is used to detect the actual voltage of the High Tension motor. It operates in wide range and the output would be sine or the pulse train. The voltage sensor is shown in fig.5.

Figure 5: Voltage Sensor

Temperature Sensor: Thermocouple is used as the temperature sensor. Thermocouple is made by connecting two wires different materials. It gives out the voltage value which is dependent on temperature. The temperature sensor is shown in fig.6.

Figure 6: Temprature Sensor

Speed Sensor: As the name suggests, this sensor senses the speed of the high tension motor. Common type is the 2 channel sensor which scans a toothed wheel on the motor shaft. This speed sensor consists of 2 sensors and it works together. Fig.7.

shows the speed sensor.

Figure 7: Speed Sensor

Vibration Sensor: It is also called as the piezoelectric sensor uses piezoelectric electric effect to measure acceleration, pressure, force (i.e) strain. Fig.8. shows the vibrational sensor.

Figure 8: Vibrational Sensor

d) Contractor

Contractor is the electrically controlled switch which is coupled with the relay to trip the motor. During any abnormal state, contractor functions. It is also used to suppress the heavy currents in the motor. Fig.9. shows the contractor.

Figure 9: Contractor

e) Relays

Relay is used as electrically operating switch to turn ON and OFF of the switch of the high tension motors. The output signal from the relay is given to the high tension motor.

Figure 10: Relays

Relay takes low current and voltage to triggers the switch. Here the relay is used to protect the high tension motor

from the damage if there in any huge variations in the parametrs sensed. Relays are shown in fig.10.

f) LCD Display

LCD display is used to display the actual value of speed, vibration, current, voltage and temperature sensed by the sensors through arduino. The arduino coded to functionalize the LCD display. The display used here is 16*2 display. The LCD has 16 pins in which is connected with the arduino. The LCD display is shown in fig,11.

Figure 11: LCD Display

4.SOFTWARE DESIGN & BLYNK APPLICATION

The sensors will function only when it is coded in the arduino. To code arduino IDE software is used. There will be different codes for different sensors.

Blynk is the android application which is used to receive the data from the cloud server and display in the mobile for the user. This application is the open source application. This application provides widgets to the users. The blynk screen is shown in fig.11.

Figure 11: Blynk screen

This application displays the parameters of the high tension motors which is sensed by the different sensors. The widget box of blynk application is shown in fig.12.

Figure 12: Widget box in blynk app

5.IMPLEMENTATION & ANALYSIS

The high tension motor is energized and it is made to operate. The sensors used to sense the speed, vibration, temprature, voltage and current starts to perform it function. The status of all these parameters are displayed in the LCD display and the sensed data will be given to arduino the sensors used. the arduino feds the data in the cloud server through the 8266 wifi module.

Here in this system, Blynk application is used to monitor the status of the motor. If the paramaters exceeds its permissible values, the intimation will be given to the user through this mobile application and the relay used in this system turns OFF the high tension motor to protect from the damage.

The implementation of this concept is done in a DC motor for fabricating the demonstartion kit. The hardware kit is shown in fig.13.

Figure 13: Hardware Kit

6.RESULT

As per earlier confab, this system uses IOT Technology and the arduino to monitor the High Tension motors and protects the motor by turning OFF the same during the larger variation in parameters sensed by different sensors sensing their corresponding parameters. LCD display is also used along with this system to display the parameters at the spot. As said before, the implementation in done in the DC machine, during the operation the system performs effectively by giving the exact voltage, current, speed, temperature and vibration of the same which has cross checked using the measuring devices. The main advantage of this system is that, it is very simple in construction and takes very less accessing time to display the parameters through the IOT technology. The output obtained to the user through the blynk application in the mobile phone is shown in the fig. 14.

Figure 14: Parameters of motor in mobile through the blynk application

7.CONCLUSIONS

This system is brought to monitor the High Tension motor and protect it from the larger accidents during the malfunctions. As per the plot, the system perform effectively in monitoring as wells as protecting the high tension machines in the industry. This system uses IOT technology to get the status of the motor at any spot. As known, IOT is one of the best suited technology for all the remote sensing systems. Arduino is used to link the IOT technology and the high tension motor. All the parameters are sensed by the sensors used in the system with the help of arduino. The relay in the system performs well by turning OFF the motor during the malfunctions sensed through the parameter variation. This system is seen more efficient, less operational time and cost effective during the time of implementation.

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