Induction Motor Health Monitoring Based on IoT

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Abstract **–Nowadays the machine plays an important role in our day to day life. There are different types of motors are used in the industries. Mostly Induction Motor(IM) are used. The importance of IM is that it is low cost compared to other motors, ruggedness and the maintenance required for this type of motor is less. This paper presents a remote monitoring system for an IM based on Internet of Things (IOT) for better and economic data communication in industrial sectors. The transducers and different sensors such as Temperature (LM35), Vibration, Current and Voltage(V/g) are used to measure the data and gives Input(I/P) to the ATMEGA328 controller this data will be processed and displayed it on the LCD. These data are also updated in the cloud database. The system also presents the Automatic and show the data on LCD display and pass on cloud. Induction machine to avoid system failures. To make the system fast and user friendly it provides data on WIFI IOT application.**

Index Terms – Temperature Sensor, Vibration Sensor, Wi-Fi, ATMEGA328

I.INTRODUCTION

In industrial premises, mechanical and electromechanical systems are being driven. These drivers are controlled by motors itself. – Open loop controls or Closed loop controls. These prime movers are the most important / Critical for any operations in Industry. In Industry, any failure of the prime movers affects the most. Availability or Healthiness of the motor is always a big question. The planned maintenance is being done in some of the organized industry. Rest of the SMES do not maintain regularly for reliable operations of these motors because of non-availability of skilled manpower and irregularity of the business. Sometimes the Techno- economic feasibility of such SMES does not work out because of the competitive markets. Whereas, with the advent of Technology and better work outs, proper scheduling of maintenance and production is possible now a day. Now the industry has started looking into planned maintenance,

Preventive Maintenance, Predictive maintenance, Condition Monitoring, even Maintenance prevention has come into place. After going through the era of Preventive and Planned shutdowns, we started looking for on-line condition monitoring to plan for planned, predictive and preventive maintenance. Hence motor maintenance has become very handy. This is a further advancement of technology called IOT Based System for On Line Motor Health Monitoring. In these system, winding temperature is being measured along with these current and V/g is being measured and all these data is being updated in the TCP/IP protocol through Wi-Fi module. Nothing but the Wi-Fi module will create a hotspot region which is linked with the mobile network. So that the data available from the Arduino is transmitted to the TCP/IP through Wi-Fi. Based on the data available necessary maintenance ca be planned. In this study, I have used 3 types of sensors which are: proximity inductive sensor to measure the speed LM35 sensor to measure the winding temperature and CT Based Current and v/g sensor to measure the current drawn by the motor. Along with all these sensors i have used one Arduino microcontroller, one for doing common connections, Arduino IDE software, C programming language. All sensors were interfaced with MCU and sensed Analog signals from various parts of motor and MCU converted all signals into digital signals using programming on Arduino IDE.

II.OBJECTIVE AND SCOPE

The main objective is that reliability of the motor is to be increased by using the best product available. This work guarantees the condition of the IM which are utilized in assortment of mechanical fields. By knowing the reliability of the system abnormal conditions can easily been identified and it can be rectified easily. Most of the industries utilize IM, the economic data monitoring is required. Industrial production cost can be increased by frequently maintenance of the system so the fault occurrence will be less and motor cost can be protected. So here we are monitoring motor different condition and passing it on IOT cloud. We also interfacing LCD display for local monitoring and IOT system for remote monitoring in real time.

III.LITERATURE SURVEY

D. Shyamala, "IoT platform for condition monitoring of IM" [1], Productivity can be increased enormously by using different things which prompts to condition and controlled observing. Persistent observing of the gear, getting cautions and information accessibility for prescient upkeep. Engine is successfully and constantly checked by utilizing web area. Kunthong, Jakkrit, et al. " IoT-based monitoring the condition in electric vehicles : Part 1.", 2017 IEEE [2]. In electric vehicles, the engine drive condition for foothold was managed by applying the usage of a remote IoT. The structure and testing of the model utilizing an ESP8266 microcontroller module to get engine condition is introduced.
Prakash, Chetna, and Sanjeev Thakur. "Smart Shut – Down and Recovery Mechanism for Industrial Machin 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence), IEEE [3]. Each and every

motor need to be monitored in the industries inorder to have a predictive maintenance. The Back-up Machine is provided during the interruption this will helps to reduce the losses. Reliability can be increased. Şen, Mehmet, and Basri Kul. "IoT-based wireless IM monitoring. " Scientific Conference Electronics (ET), 2017 XXVI International. IEEE, 2017 [4], Along these lines, the creation procedure isn't blocked and the necessary support or supplanting can be performed with the least conceivable disturbance. This examination has given insights not exclusively to making numerical models yet in addition for empowering the CMS administrator to build up an engine upkeep plan. Xue, Xin, V. Sundararajan, and Wallace P. Brithinee. "The application of wireless sensor networks for monitoring the condition in 3Ø IM."*Electrical Insulation Conf*., Electrical Manufacturing Expo, 2007. IEEE, 2007 [5]. The most ordinary method used for identifying the faults in huge three-phase IM is to gauge the amount of current taken by the motor and examine the sign range. Based on this time taken by the companies to repair the machine will be reduced and guarantees that profitability doesn't endure.

IV.RESEARCH METHODOLOGY

The below figure shows the Block diagram of the project

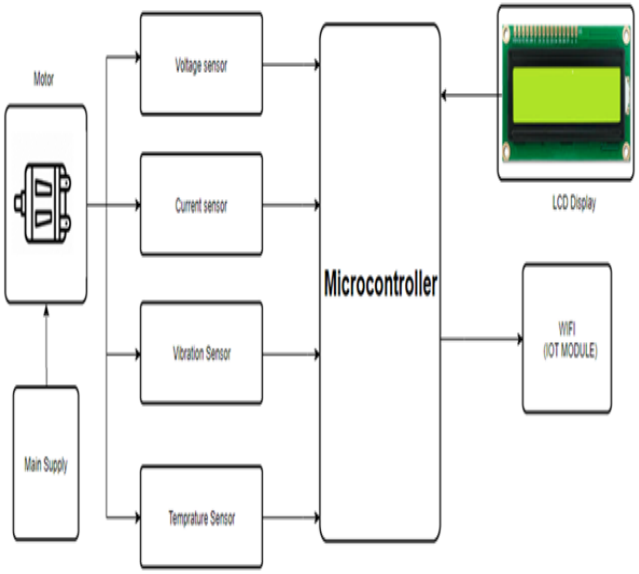

Fig 1: Block Diagram

In this project, Arduino which is used to sense various data coming from sensors, upload the same in IOT cloud and run the actuators. Temperature sensor LM35 is used to measure the change in temperature or monitor temperature of the ac motor, similarly voltage and current sensors are used to measure the over voltage or any fluctuations. LCD display is used display the Sensor values, so there can be a visual monitoring of sensor data. With the aid of esp8266 WIFI module, all the data is uploaded in thingspeak cloud and later monitored using thingspeak app installed in smart phone. If any fault coming, we are controlling using by automatic switch off with help of relay. And once fault will start automatically.

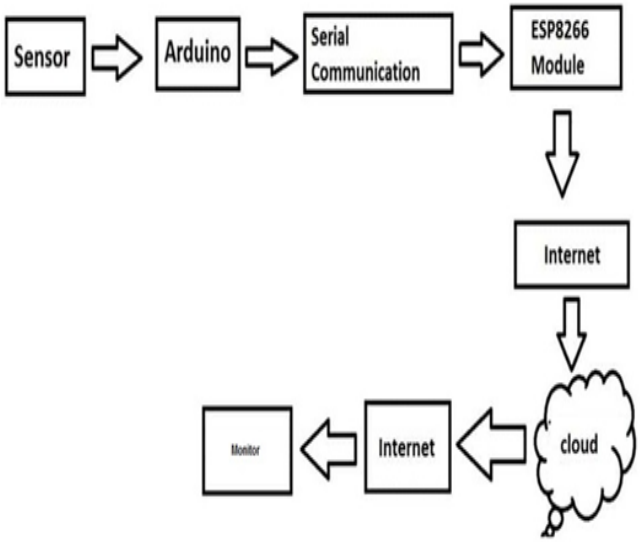

Fig 2: IOT process Diagram

By using right control scheme, APF can additionally enhance device power factor. Thus, by means of the effect of active power filter, voltage assets see the nonlinear load virtually as resistor.

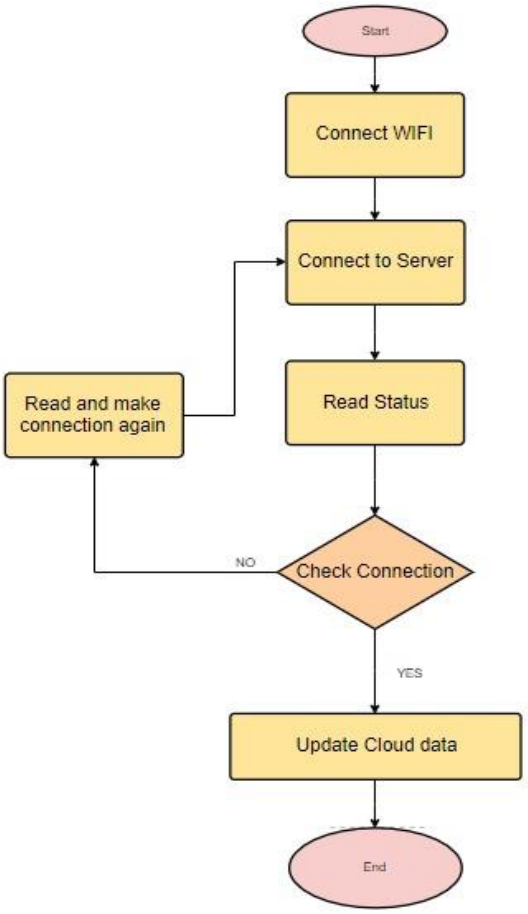

Fig 3: Flowchart

V.SYSTEM HARDWARE

The following are the components that are used in the system and it is explained as follows:

ARDUINO:

There are different types of Arduino boards are available. A few of the boards appear to be somewhat unique from the one underneath, however most Arduinos share most of these parts for all intents and purpose:

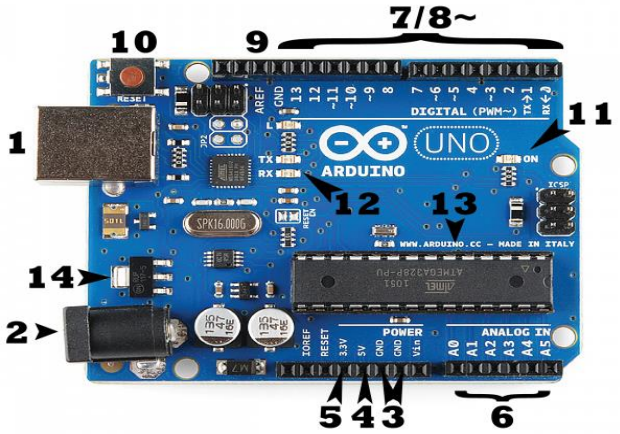

Fig 4: Arduino Board

The microcontroller used in the board is ATmega328P.It consists of total 28 pins in that 14 pins are digital and 6 pins are of analog so that the remaining pins are Vin, GND, etc… and it consists of a 16Mhz quartz crystal, and a power jack for the supply to the Arduino. It contains everything expected to help the microcontroller; essentially interface it to a PC with a Dumping cable or power supply to start.

Table1: Specifications

Microcontroller	ATmega328P
Operating Voltage	5v
Input voltage	7-12v
Input voltage limit	6-20v
Digital I/O Pins	6
Analogue input Pins	6
DC current per I/O pins	20 mA
DC current for 3.3v Pin	50 mA
Flash Memory	Of which o.5KB is used
SRAM	2 KB
EEPROM	1KB
Clock Speed	16MHz
Length	68.6mm
Width	53.4nm
Weight	25g

ZMCT103C CURRENT SENSOR MODULE

Fig 5: Current Sensor

The module is designed using the ZMCT series of small size high-precision micro CT and high-precision operational amplifier circuits for more accurate sampling and proper signal compensation. It is best solution for the signal acquisition of AC current within 5A range. The corresponding output voltage analog AC signal can be adjusted using the potentiometer. You can adjust the amplification ratio and the amplification range

(0-100 times), but the max voltage at the output will not more than half of VCC applied voltage.

ZMCT103C AC current Sensor is the suitable for the cause of the DIY project and industrial application, where the AC current can be measured accurately with the help of current transformer. This module is most suitable to measure the AC current up to 5Amps.

SW-420 VIBRATION SENSOR

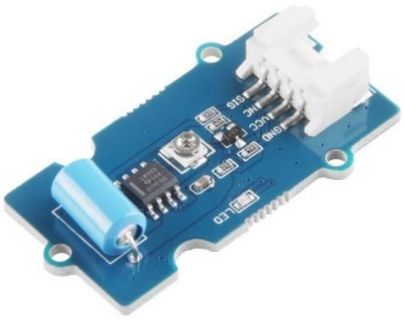

Fig 6: Vibration Sensor

The SW-420 VIBRATION SENSOR is a highly affectability non-directional sensor. When the device is steady, the circuit is in the on condition and the Output is showing the high command. When the vibration happens, the circuit will be quickly detached and Output shows low. Simultaneously, you can likewise modify the affectability as indicated by your own needs.

LCD:

Liquid Crystal display(LCD) is used for displaying purpose. The LCD used is of 16*2 i.e. it contains 32 characters in a single display in which 16 columns and 2 rows are present. The LCD used is of alpha numeric.

Fig 7: LCD

IOT MODULE:

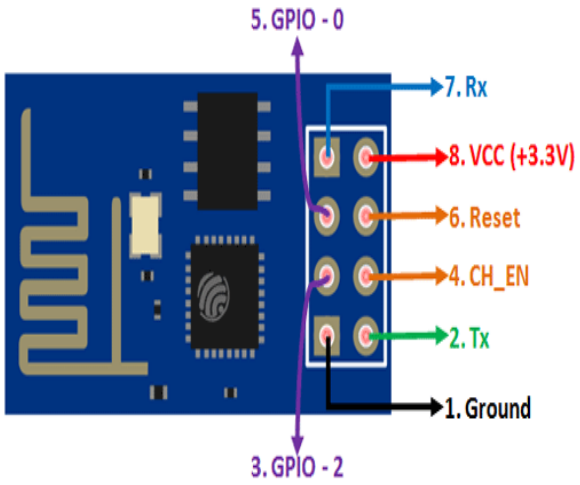

Fig 8: Wi-Fi Module

An Esp8266 is the name given to the Wi-Fi module which is having an operating voltage of 3.3V. The maximum voltage that we can provide to the Wi-Fi module is 3.6V. The Esp8266 Wi-Fi consists of total 8 pins in which one is the supply pin which is given from an Arduino board or by some means of external power supply and the diagonal pin will be GND. In order to transmit any data, we require RX and TX pin as we can observe in the above figure. And the remaining pins are Reset and Enable pin. In order to control the voltage LM317 can be used so that based on the requirement it can be adjusted. The circuit diagram of ESP8266 Wi-Fi is shown below:

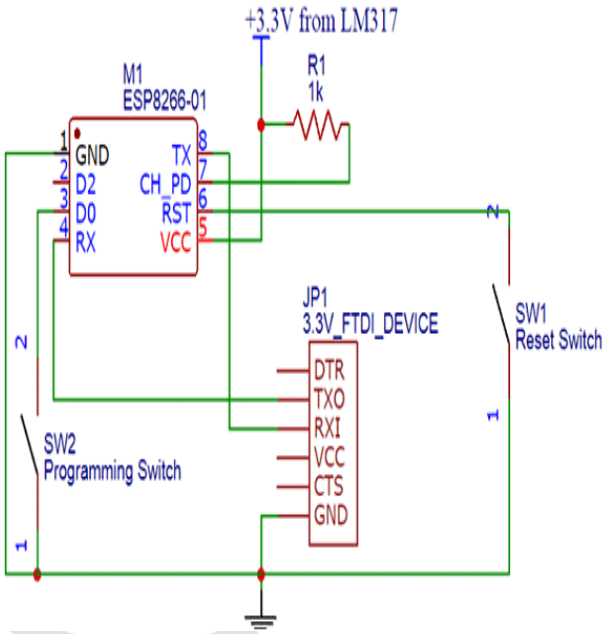

Fig.8 Interfacing Circuit Diagram

VI. RESULTS:

For experimental purpose Industrial Motors are used. The motors ratings is 22V AC I/P. Sensors such as (Temperature, Vibration, Current and V/g Sensors) are used and they have positioned at the respective places. The data which is coming from the sensors are given as an I/P to the ATMEGA328 Microcontroller and the value is compared with threshold value. If the value is more than the threshold value, the specific function will perform. The below shows the table and graphs of sensors.

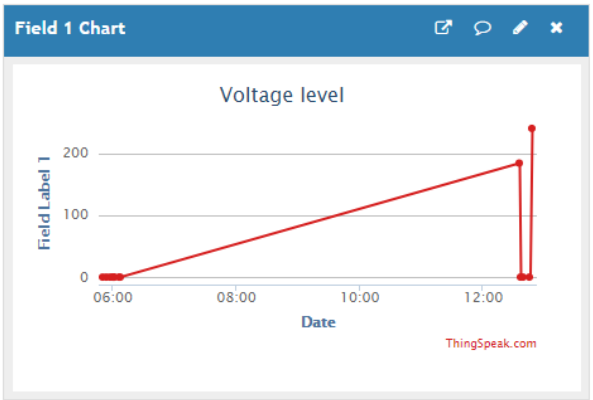

Fig.9:- Reference ThingSpeak Graph of Voltage vs Time

Table 2 : 1-Ø *IM Ratings*

Voltage	235V
Current	180mA
Rpm	7000
Temperature	30.79
Humidity	83

VII.CONCLUSION:

In this Project IOT based concepts have been utilized for monitoring the failure of the system. The framework has been intended to consolidate different boundary estimations continuously, improving the deliciousness of various issues. Here the Values are compared with the conventional methods which used only two sensors i.e. vibration or Temperature and the readings are recorded for different sensors namely Temperature, Vibration, current and V/g. The IoT concept has been presented here for monitoring the motor remotely. The proposed system still be extended by adding other sensors based on the requirements. The system has a high autonomy, Installation will be easy and maintenance cost will be less. The results shows the system is feasible..

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