

IoT based Monitoring of Lathe Machine Motor in Metal Industry

Akshay D Kadu¹, Punit Fulzele², Vaibhav V Jiraphe³, Harshwardhan Mandhare⁴ and Kaustubh Dani⁵

^{1, 3-5} Yeshwantrao Chavan College of Engineering Nagpur, Dept. of Electrical Engineering, Nagpur, India

Email: akshaykadu001@gmail.com, vaibhav190620@gmail.com, harshwardhanmandhare04@gmail.com, kaustubhdani95@gmail.com

² Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Wardha, India
Email: punit001@gmail.com

Abstract—Optimized use of electrical energy is prime objective of various metalworking Industry. The problem definition for this work is considered from the industry located in Hingna MIDC, Nagpur, Maharashtra, India. It is conveyed that during operational hours most of the operator working on lathe machine keeps the motor of lathe machine in running condition even when they are not performing any metal job on the machine. Leads to wastage of electrical energy and increased electricity bill. As per the guidelines issued by bureau of energy efficiency industry should conserve the electrical energy in every energy conversion process. This research work deals with IoT based monitoring of lathe machine operator so as to cut down the idle running of the lathe machine which benefits in conservation of electrical energy and reduced electricity bill. This work is also extended to monitor the various parameters of electric motor. System design consists of low budget sensors and microcontroller. A open source Thing Speak IoT based cloud service is used for data analytics and data storage purpose. Experimental results reveal the effectiveness of implemented prototype.

Index Terms— Internet of Things, Energy Conservation, Induction Motor.

I. INTRODUCTION

Induction motors is commonly used in various Industries to achieve certain objective. This motor has several advantages such as robust, low cost, easy to operate and highly reliable. [1- 3] generally rotating machine required more attention and maintenance as compared to static electrical machine. Regular maintenance is carried out in industries of various auxiliaries installed. Predictive maintenance and preventive maintenance is regularly carried out in industries so as to reduce the down time of manufacturing process. Predictive maintenance is carried out by analysing the performance of machine. To judge the performance of machine data of certain set of motor parameter is required e.g. motor voltage, current, motor speed in rpm, temperature of winding, rotor eccentricity and motor assembly vibration. These values then compared with standard values if there is any deviation found in value accordingly maintenance of that machine is initiated. [4-5] conventionally predictive maintenance data is monitored by on site methods using analog or digital measuring instruments [6] now a days with the evolution of technology any data can be monitor remotely with the help of Internet of things [7].

Work is carried out in different dimensions regarding induction motor maintenance [8] discuss wireless sensor

network used in industries its design, working, architecture, development and hardware implementation. To monitor and control the induction motor connected in agricultural system is presented in [9] In this work implementation of IOT technology to monitor, to control and diagnose the condition of Induction motors by recording key operation indicators is carried out. Now day's smart meters are also installed to observe various electrical and mechanical parameters of the induction motor [10] deals with smart way of monitoring induction machine data by LoRa technique. But this technology suffers from disadvantage of very high installation cost. IoT based Health examination of Induction motor is proposed in [11] using GSM based technology, which is used to monitor health of electrical motor by measuring the parameters such as winding temperature, assembly vibration and current. It can be measured through the sensors, like accelerometer, current sensor and thermocouple. Submersible motor temperature and vibration data monitoring techniques detailed literature survey is carried out in [12] and various algorithms for problem diagnosis is presented. A low-cost design for real time monitoring of induction motor for predictive maintenance is presented in [13] it is based on Industrial IoT [IIOT] In this module only motor vibrations and temperature is monitored. After this comprehensive literature survey carried out work presented in this paper is unique and innovative. This works also tell us about the operator efficiency which can be utilized for analysis purpose.

Objective of this work is to find out idle time, no load time and load time of motor. Acquire motors current, speed and temperature information for the motor condition monitoring. Detect any faulty condition or abnormality of motor. Design and testing of prototype using an ATMEGA 328 PU microcontroller module. To apply Internet of Things (IoT) system for condition monitoring in electric motor.

This paper presents wireless monitoring of data using sensors and IoT technology. It is used to find out the working abnormality and maintenance of the machine. This paper is planned in following manner section I discuss the introduction and prior art related to methods of data acquisition of motor parameters. Section II deals with proposed technique of motor parameter acquisition and monitoring of workers efficiency Section III presents prototype design and experimental results. Section IV discussed conclusion and future scope of the work.

II. WIRELESS MOTOR PARAMETER ESTIMATION

The most used machine in any section of the society including industries is Induction machine, so IM are "Workhorse of Industries". Induction motor is used to perform various tasks in industries such as lathes, mills, routers and grinders. Machine operator handles these machines to perform above mention task. Due to carelessness of machine operator Industry have to bear losses. Any small fault occurred in a motor will led to complete motor failure if not addressed in time so condition monitoring of IM is desirable to avoid downtime of any industry. This project deals with improvement in production efficiency and condition monitoring of Industrial motors

A. System Design

System as shown in the fig.1 which consists of motor assembly which is fed by three phase power supply using starter and contactor.

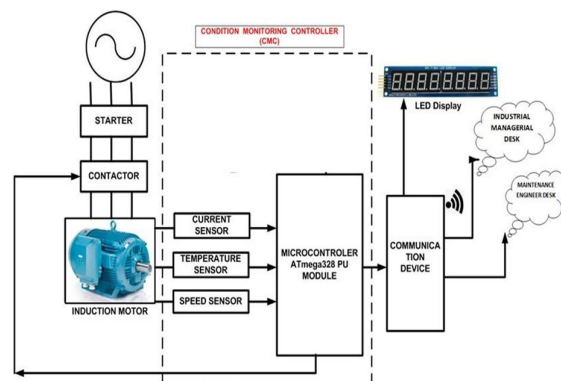


Fig.1 Block diagram of IoT based monitoring of motor

Basically, to fetch various parameters of motor in this work various sensor are used such as to get the value of current a series connected current sensor is used to obtain the data of temperature of winding temperature sensor

and to get the rotation –per minute data speed sensor is used. This data is fed to microcontroller circuit analog pins. Microcontroller process that data to digital output pins. Communication device is connected to the digital pins of microcontroller which is used to transfer this data to cloud. After that this data is used by Industrial managerial desk or maintenance engineer.

B. Methodology

To achieve the above-mentioned objective following methodology is discussed in which first step is inspect the site and type of motor is used in this work induction motor is used but this method can be implemented for any other electric motor. Selection of parameters to be required from motor end and accordingly selection of sensors is carried out there are various sensor available in market sensor should be selected on the basis of cost, accuracy and its compatibility with the microcontroller generally sensor is fed by DC power supply for that DC supply source is required. After this step location identification on motor assembly placement of sensor generally, voltage sensors are placed inside motor assembly near to the winding which must temperature resistant.

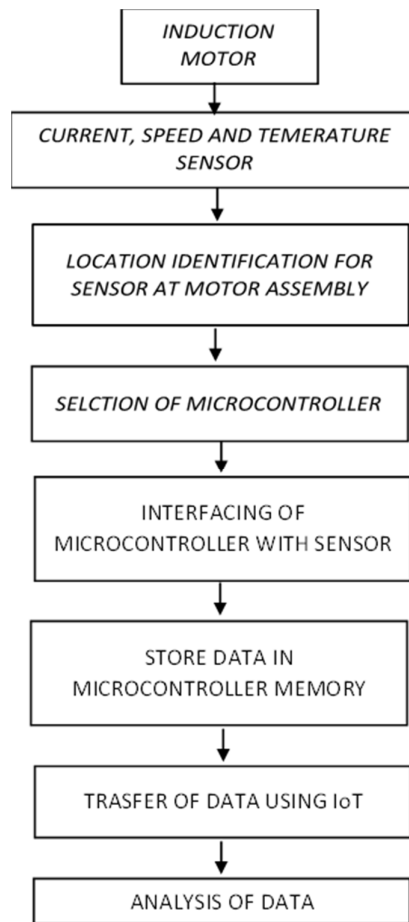


Fig.2 Flow chart of methodology

Microcontroller selection depends on number of input output pins required then interfacing of microcontroller with sensor and programming of microcontroller finally data get transferto the cloud with the help of Internet of thing technology.

III. HARDWARE IMPLEMENTATION

The proposed monitoring system discusses various scope and application at industrial level. It also describes the future possibilities along with the use of various technologies.

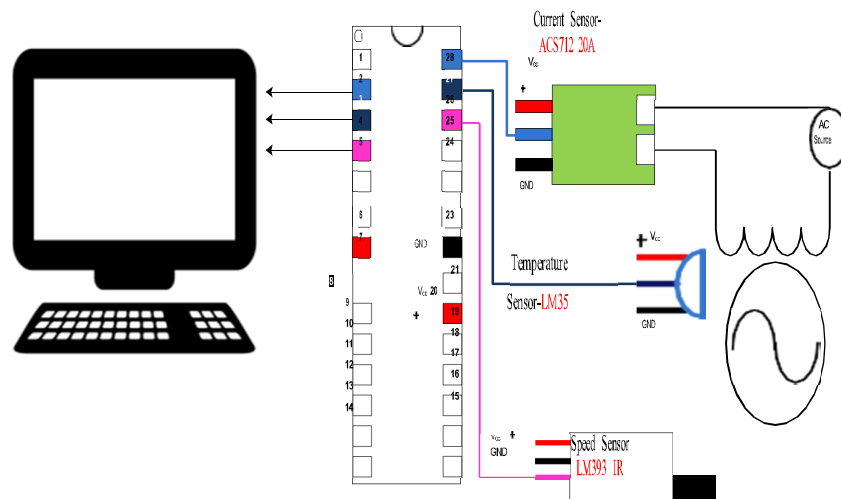


Fig.3 Flow chart of methodology

Fig 3 shows the pin diagram for the connection of Current sensor is connected to the pin no 38, temperature sensor is connected to pin no 37 and speed sensor connected to pin no 36 of the microcontroller. which are the analog input pins of the microcontroller.



While that of wifi module ESP8266 is connected to the digital output pins of the microcontroller.

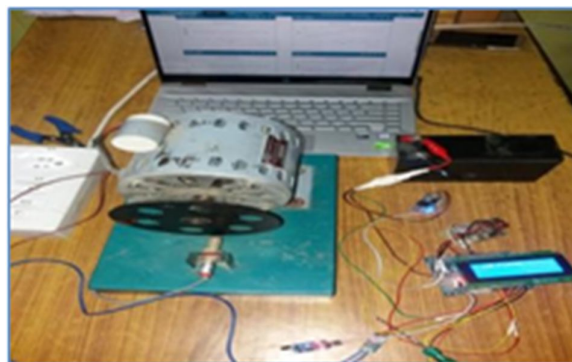


Fig no.4 shows the hardware implementation circuit



Fig.8 Thing Speak platform temperature sensor output display

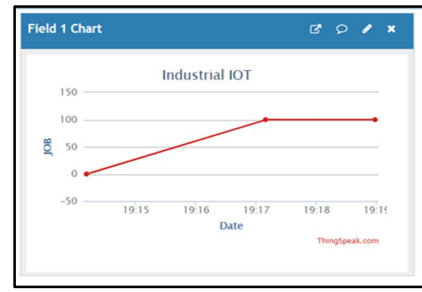


Fig.9 Thing Speak platform JOB timing (Load) output display

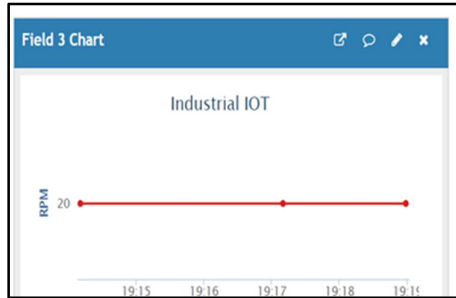


Fig.10 Thing Speak platform speed in RPM display

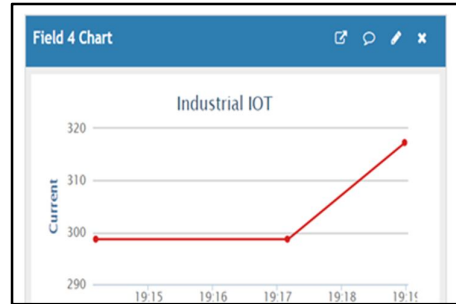


Fig.11 Thing Speak platform current in RPM display

Fig 8 to 11 shows the result of thing speak platform which shows the output in graph forms which is easy for data analysis purpose.



Fig.12 Thing Speak platform load is placed on motor Indication

An additional feature is also provided with this is if a load is placed on motor, then it will show green indication to the user as shown in fig. 10.

IV. CONCLUSIONS

The authors can conclude on the topic discussed and proposed. Future enhancement can also be briefed here. This work presents the concept of condition monitoring of motor using sensor technology. Current sensor, temperature sensor and speed sensor successfully interface with ATMEGA 328 PU module. The monitoring of the motor system presents the measurement of different parameters namely temperature, speed and current consumption stored in controller memory. The various accuracies presented in this thesis are subject to the number and type of input parameters selected. The presented results can be further verified by taking different set of parameters of motor

A real-time system can be developed based on this study wherein the motor data can be acquired and fed into intelligent system simultaneously. The intelligent system would evaluate the condition of the motor and issue appropriate command accordingly. The proposed approach has been verified only with the single motor set the

approach may be applied to motors of other design parameters and the result can be analysed . The proposed work can be extended for considering the presence of a combination of two faults occurring simultaneously.

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