

DC MOTOR CONDITION MONITORING USING ARTIFICIAL NEURAL NETWORK

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ABSTRACT

Electrical motors especially DC motor plays very important role in the industry in heavy machining industry, where starting torque plays very important role. The use of DC motor is done in a maximum way, to avail advantages of high starting torque, preferably in crane applications. The improper maintenance of industrial motors is very much necessary to avoid the production loss. In this paper artificial neural network control (ANNC) based technique is proposed for analysis of vibration, power consumption etc. In last decade ANN based controllers even for non linear systems. The test results analyzed for steady as well as dynamic conditions. From the obtained results it is said that ANN controller is more than PI, PID controller.

KEYWORDS: Condition Monitoring of DC Motor, Artificial Neural Network etc.

INTRODUCTION

For electrical motor protection many devices are used, right from electromechanical devices, various intelligent devices and in today's context IoT devices. Using integrated circuit without intelligent device may protect the motor from over current, under voltage. By using digital or numerical control computer based condition monitoring is replacing traditional condition monitoring. It is been observed that condition monitoring of electrical motors will reduce the cost of maintenance and reduction in production outage time. The main of the condition monitoring is to catastrophic failure of the equipments. In the condition monitoring schedule maintenance need not to be done or machine replacement based on historical maintenance is not necessary. In order to succeed in category of condition based maintenance which is having accurate means of assessment of condition and diagnosis of fault. Condition monitoring is done when the machinery is running so that fault analysis becomes easy. Traditionally motor current signature analysis or vibration signature analysis techniques are used. Online condition monitoring is done and this data is fed to computer for analysis and data acquisition. Fig.1. shows the typical block diagram of the general approach of condition monitoring.

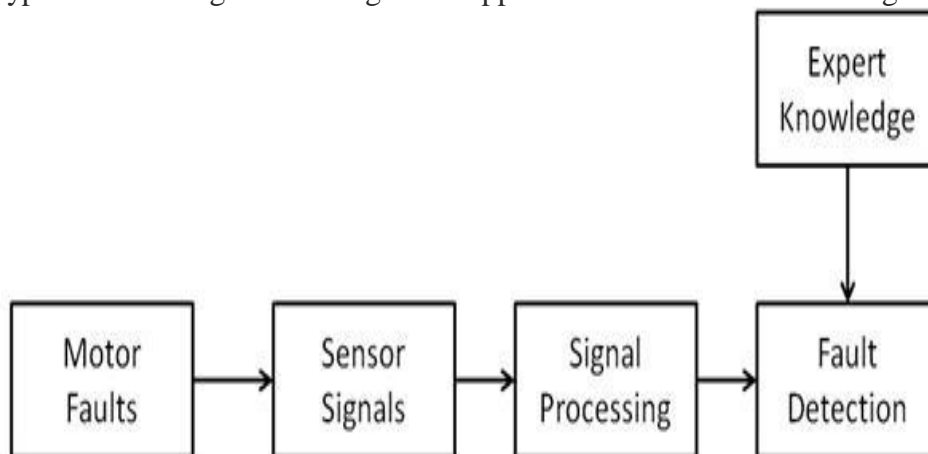


Fig.1. Architecture of on-line condition monitoring process.

COMMUNICATION PROTOCOL

There are various wireless communication protocol available in current era. Wifi, ZigBee, 3G, 4G and 5G will be commercially available soon. The developed wireless communication technologies are capable of handling large data and greater transmission rate. If the number of devices connected to system then system performance may get slower. IEEE 8.2.15.4 standard developed working protocols for zigbee communication. Zigbee is becoming very popular as it consumes very low power. To take advantage of very low power advantage zigbee networks are mostly employed in residential and industrial applications. Another advantage of having zigbee communication is it not only transfers the data but it also helps in controlling device. In the literature many methods are listed for monitoring and detection of mechanical faults. In conventional technique used for conditional monitoring is based on uses of temperature relays, over voltage and over current relays and few electromagnetic switches and contactors. It conventional techniques are compared with computer based methods, less sensitivity and efficiency as it includes many mechanical components. Other major disadvantage is lots of maintenance cost is involved for the system itself.

Table 1: Comparison of different communication protocol

Protocols	ZigBee	Bluetooth	Wi-Fi
IEEE	802.15.4	802.15.1	802.11 a/b/g
Power Consumption	Very Low	Low	Medium
No. of nodes	65000+	7	12
Throughput Max	250 kb/s	1mb/s	11-54/s
Range	100m	10m	300m

EXPERIMENTAL SETUP

The implemented concept is to deal with advancement in condition monitoring of electrical motor and diagnosis of the fault. To serve for better condition monitoring understanding and real time analysis of motors is necessary. The real time control graphs will lead to classification of different faults. A typical process of condition monitoring of electrical motor has four major blocks data acquisition, analysis of signal, fault detection and further processing. The developed system is tested for condition monitoring of dc series motor of 12V and 48V DC motor and if we want to increase torque of motor we can use gearbox. In traditional technique like vibration signature analysis and motor current signature analysis the analysis from obtained graph is operator dependent. In this project a unique approach for condition monitoring of electric motor is developed using hybrid intelligent techniques using artificial neural network. To accomplish task of wireless transmission radio frequency technique for developing a prototype, it is advice to use Zigbee communication technique for industrial control as it has good data handling capacity over a long distance. Training of ANN is accomplished by extracting the feature of motor parameters. The extracted features with all domains of frequency are used to train the ANN to obtain correct fault analysis. From the obtained results in table 1 it can be commented that developed system works will and produced more accurate fault diagnosis. Fig.2. complete architecture of machine data acquisition system in detail which monitors four parameters, voltage, current, vibration and temperature and its interface through PIC controller. Fig.2. shows the hardware set up of implemented system.

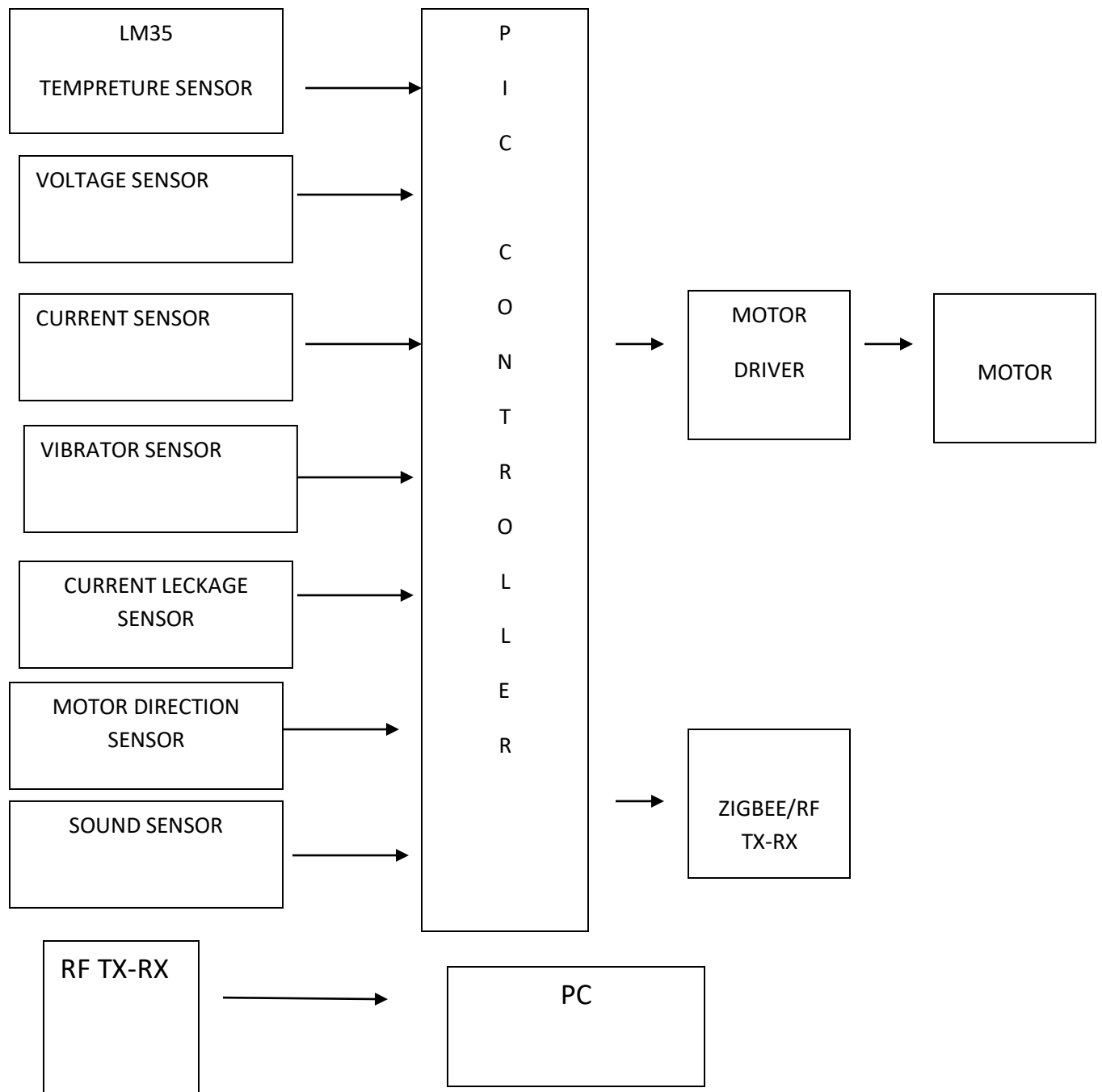


Fig. 2. Machine Data Acquisition System

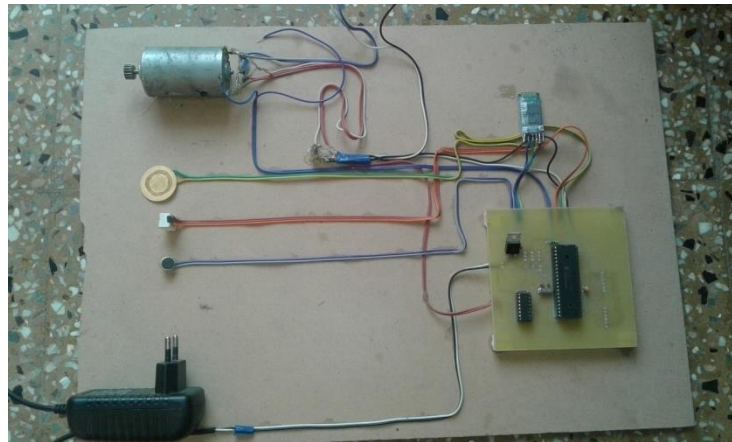


Fig. 3. Hardware setup

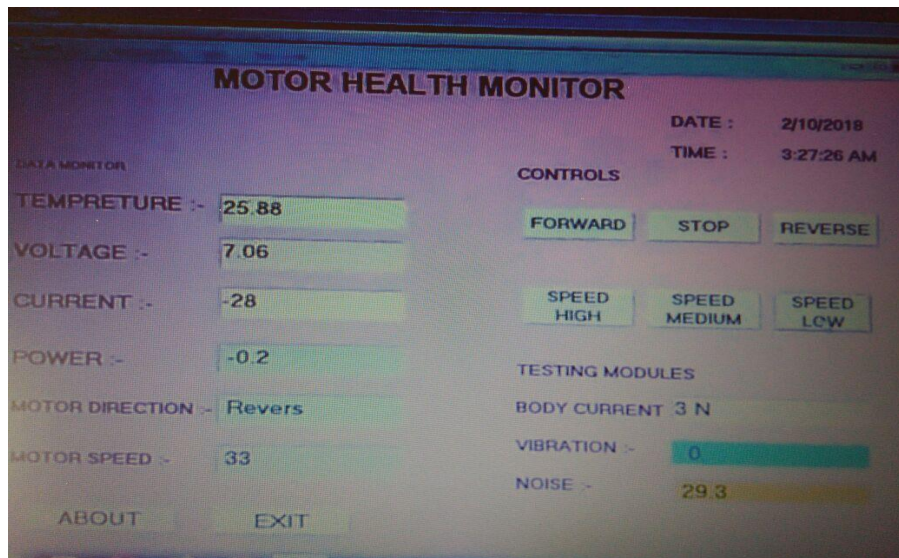


Fig. 4. Screen layout of developed software

Table 1: Results for 12V DC motor

12V DC DEMO MOTOR							
Speed	Temperature	Voltage	Current (ma)	Power	Motor Speed	Vibration	Noise
High	25.88	11.1	230	2.56	887	0.5	29.6
Medium	26.37	7.5	28	0.2	61	6	29.3
Low	25.39	7.37	28	0.2	33	6	29.3

CONCLUSION

In market various fault condition technique are available can be used for analysis of condition monitoring of the motor. There are theoretical model as well, by using mathematical tools and simulating we can know temperature. In practice, to implement condition monitoring system numerous external peripheral systems are required. The practical system implemented in this paper uses of ANN rules are framed and programming done using visual basic configured with real time hardware. The system implemented produces good results and uses radio frequency transmission as a wireless technology for real time condition monitoring of the motor. The developed system can be implemented on a large size motors without any modification.

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