Data Logging and Analysis Software For AC Motor Performance Analysis

Dr. N. Mahendran[1], B. Gomathi[2]
[1] CK College Of Engineering & Technology, Cuddalore
[2] Paavai College of Engineering, Namakkal.

Abstract- *Induction motors are commonly used in many industrial processes. Magnetic flux loss occurs due to heating of coil, when the load to the induction motor increases. As a result, efficiency decreases when it is used in industrial pumping process. In this paper, maintaining the efficiency and monitoring the motor performance is an important duty in industrial process. Induction Motor Efficiency monitoring System is implemented to estimate the efficiency of the motor. The existing system uses an IMEMS unit which does not hold any SD card. Time consumption of the process is more and there is no automation. In this proposed system, the system uses an IMEMS unit with an inbuilt memory card which can be directly stored the parameter values with necessary software for its working. By calculating the parameters, it can be carried out in two ways. They are spot analysis mode and continuous analysis mode. These analyses can be done by measuring the induction motor parameters. In spot analysis mode, the parameter values are identified by changing the load. In continuous analysis mode analysis, a delay is set for smart measurement of parameter values for a particular period of time interval. These analysis modes are used to measure the parameter values without the use of human force and external instruments. The coding is done in MATLAB and simulation results are obtained.*

Keywords- IMEMS, SAM, CAM.

I. INTRODUCTION

The induction motor is the most importantly used electrical machine. Almost 80% of the mechanical power used by industries is provided by induction motors because of its very easy and rugged construction, low cost, good operating characteristics, absence of commutator and good speed regulation. In three phase induction motor the power is transferred from stator to rotor winding through induction. The Induction motor is also called asynchronous motor as it runs at a speed other than the synchronous speed.

IMEMS is a cost effective induction motor efficiency monitoring system which is capable of monitoring the efficiency of induction motor on-site, on-line and in-situ without detaching the motor from the load and without measuring the output power or torque. These are hardware triggered four modes of operation in IMEMS are configuration mode, calibration mode, coefficients download mode, run mode[1]. The parameters calculated by the IMEMS are, input parameter, output parameter, motor losses, motor efficiency[2]. It is capable of monitoring the efficiency of the induction motor. Hardware triggered four modes of operation.

Induction motors are popularly used in the industry and there is a need to measure the efficiency and also to estimating the parameters of an induction motor. Manual reading may create many inaccurate values and problems. There is a need to store the values instead of manual noting to avoid the errors [3]. More accurate values are stored in a less time and software to be analysed for the future analysis.

II. EXISTING TECHNIQUE

The existing system uses an IMEMS unit with an inbuilt micro SD card which can be interfaced with a PC. The SD card has to be taken out from the IMEMS unit to view the data for future analysis by connecting it with the use of a SD card reader [4]. The system has only manual entry to store/record the data. Commonly used method of storing the parameters are done by capturing the values with the help of camera then stored as a perpetual memory and testimony as future use. The parameter values can also be noted with the use of human force[5]. The drawbacks of this existing system is time consumption is more[6], it creates an error and produces few inaccurate values of the parameters[7], external instruments are needed, no automation[8]. Some of the drawback of the existing technique is listed below.

- It creates an error and produces few inaccurate values of the parameters.
- Time consumption is more.
- External instruments are needed.
- There is no automation.

III. PROPOSED TECHNIQUE

The induction motors are commonly used for industrial applications. An induction motor is basically a transformer which converts Electrical energy into mechanical energy. . An Induction motor can be characterized by several

parameters and these parameters can be measured via various tests which are easy to perform and have to be acquired only once. Magnetic flux loss occurs due to heating of coil, when the load to the induction motor increases. As a result, efficiency decreases when it is used in industrial pumping process**.** In this project, efficiency of the motor is monitored to store the data and software to be analysed. The parameters define the efficiency of the system. When the parameter value change the efficiency of the system changes. When there is a fall in a parameter value the efficiency level drops. This drop in the efficiency level can be calculated using two techniques.

They are

- Spot analysis mode
- Continuous analysis mode

Mainly these techniques are used to find the parameter values of an induction motor.

IV. DESCRIPTION OF THE SCHEME

The system uses an IMEMS unit with an inbuilt memory card which can be directly interfaced with a PC with necessary software for its working. The values of spot analysis mode and continuous analysis mode are measured and logged on to the micro SD card[9]. This can be used for future analysis. In spot analysis mode, the parameter values are identified by changing the load and values are logged on to the micro SD card present in the IMEMS unit. In continuous mode, a delay is set for smart measurement of parameter values for a particular period of time. Here the load is not varied manually to identify the parameter values. The coding is done using MATLAB and the program is loaded into the IMEMS unit. The spot analysis mode and continuous analysis mode parameter values are stored in the micro SD card of IMEMS unit[10]. The software for interfacing the PC and IMEMS unit are defined first. Using the values of spot analysis mode and continuous analysis mode the machines can be serviced for their efficient working.

In spot analysis mode, the parameter values are identified by changing the load and values are logged on to the micro SD card present in the IMEMS unit.

In continuous mode, a delay is set for smart measurement of parameter values for a particular period of time. Here the load is not varied manually to identify the parameter values.

These modes are used to determine the values of the parameter and the programming is done using MATLAB which shows the values in text format. Some of the parameters are torque, speed, stator current, rotor current, flux etc.

The computer based development of those two methods shown in Figure 1.

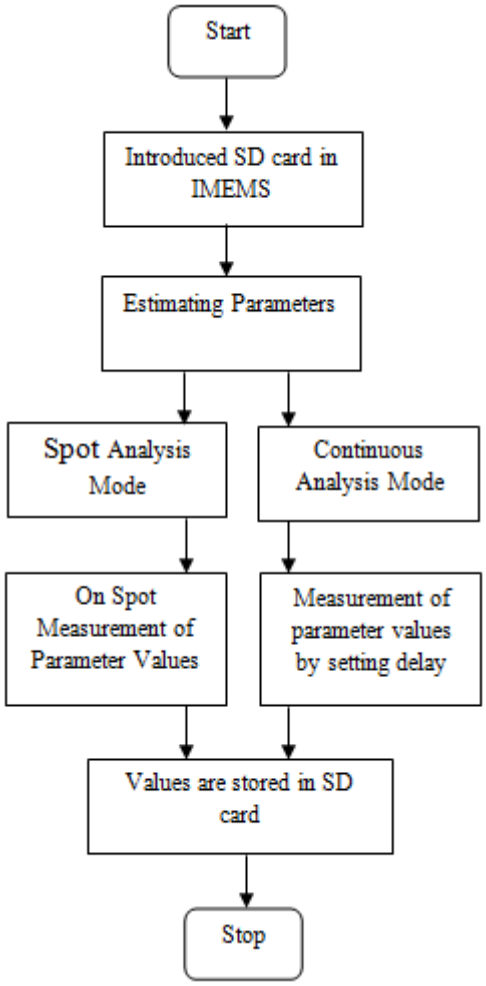

Figure 1: Spot and Continuous analysis mode flow chart

This flow diagram gives the analysis technique of an induction motor. Here it shows the process of work done in the proposed system. Initially IMEMS is introduced which has inbuilt micro SD card. Next step is to estimating the parameters such as speed, torque, stator current rotor current etc. Then introducing two techniques are spot analysis mode and continuous analysis mode. The spot analysis mode and continuous analysis mode parameter values are stored in the micro SD card of IMEMS unit. The software for interfacing the pc and IMEMS unit are defined first. Using the values of spot analysis mode and continuous analysis mode the machines can be serviced for their efficient working.

IV. RESULT AND DISCUSSION

This explains the simulation about the data logging in both the spot analysis mode and continuous analysis mode. The simulation is carried out using MATLAB R2013a. It is used to write the program coding for estimating the parameters. The Matlab simulink software is used to construct the circuit for both SAM and CAM. All components required for the design is interconnected and simulation is obtained. The simulation of the system is discussed.

The parameter values are identified by changing the load and values are displayed in the below Figure 2. For each and every millisecond of logging the data output will be obtained and converted into text format without the manual operation.

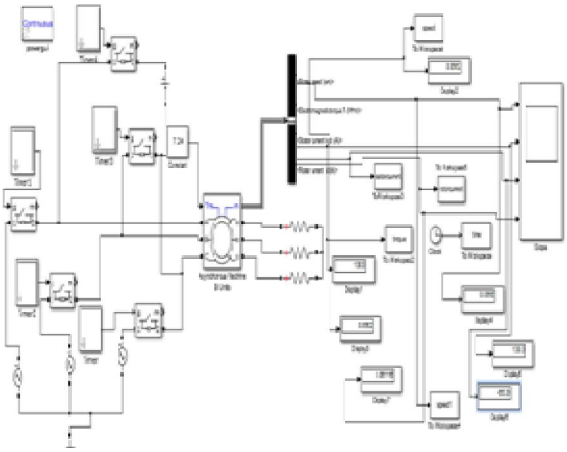

Figure 2: MATLAB Simulation of Spot analysis mode

The simulation result has been executed after running the simulink software, which is obtained in the main file. This figure describes the representation of parameter values for a time of 9ms. The values of the parameters are shown in the figure which also displayed in it. It shows the variation for every millisecond. Some of the values are listed below.

- Speed- 0.0562
- Electromagnetic torque -0.0616
- Stator current- 65.39
- Rotor current -0.0562.

A delay is set for automatic measurement of parameter values for a particular period of time. Here the load is not varied manually to identify the parameter values. The parameter values are identified by changing the load and values are displayed in the below Figure 3.

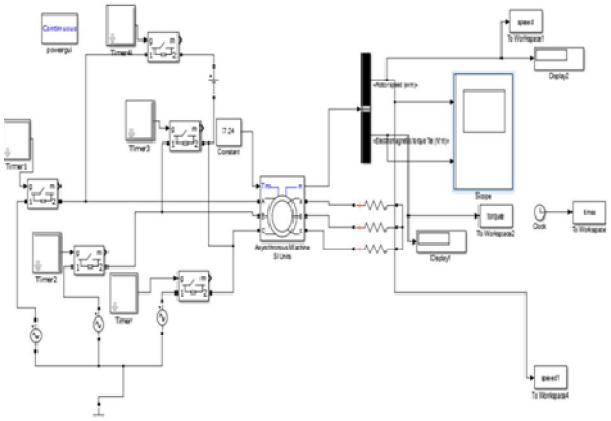

Figure 3: MATLAB Simulation Continuous analysis mode

V. RESULTS

The simulation result is obtained using the MATLAB. Simulation result for speed, stator current, stator current_b and rotor current is displayed in the below Figure 5.7. It shows the result for the simulink software which is shown. It is mainly used to store and estimate the efficiency of the motor. It needs a constant voltage to run an induction motor. So here set the constant voltage as 7, total time as 100 milliseconds, delay as 20ms and 1ms for an on spot measurement. It slightly increases and reaches the total time and maintains it as constant and it decrease when the load is in condition zero. The values of the parameters are stored and the graph is obtained with the accurate values of the parameter.

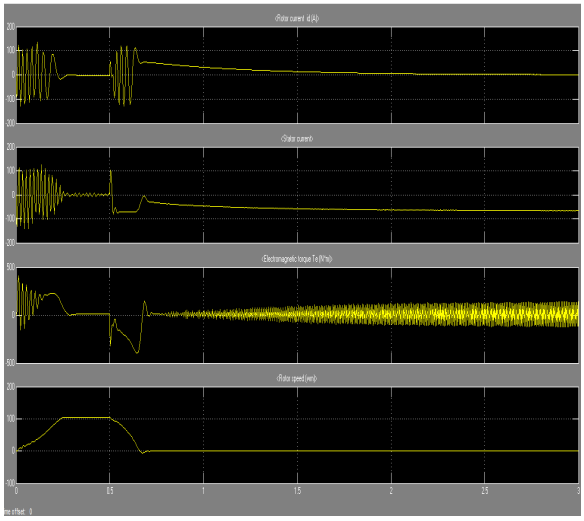

Figure 4: Spot and continuous mode analysis using MATLAB Simulink

The result of the system is explained in this chapter. An idea based on the development of the system, values of the parameters and output can be arrived. The coding is done using the MATLAB in the simulink software.

V. CONCLUSIONS

The induction motor performance analyzer is designed to develop the entire system using MATLAB software. This software is used to simulate and store the induction motor parameter values. Here the coding is developed in order to work for an on spot measurement and setting delay and IMEMS are used for calculating the parameter. The Spot analysis mode values are identified by changing the load and Continuous analysis mode values are identified by setting delay. These analysis modes are used to measure the parameter values. The coding is done in MATLAB and simulation results are obtained. In future, visual basics 6 may be used as a programming tool to implement the life cycle assessment technique. Since a delay of longer duration of six months to one year is set and parameter values are to be calculated and it is named life cycle assessment. Finally, implementation of the project will be carried out in the ARM CORTEX m4 vision.

REFERENCES

[1] Abel C. Lima-Filho, Ruan D. Gomes, Marc´eu O. Adissi, T´assio Alessandro Borges da Silva, Francisco A. Belo, and Marco A. Spohn. “Embedded System Integrated Into A Wsn for online dynamic torque and efficiency of an induction motor” IEEE/ASME TRANSACTIONS ON MECHATRONICS, VOL. 17, NO. 3, JUNE 2012.

[2] T. Fahringer, M. Gerndt, B. Mohr, F. Wolf, G. Riley, J. L. Traff, “Knowledge Specification for Automatic Performance Analysis” APART Technical Report, Revised Version, August 22, 2001.

[3] T. Fahringer and C. Seragiotto, “Automatic Search for Performance Problems in Parallel and Distributed Programs by Using Multi-Experiment Analysis”, December 2002.

[4] I. Foster, C. Kesselman, J. Nick, and S. Tuecke. Grid Services for Distributed System Integration. IEEE Computer, June 2002.

[5] D.A. Reed, R. A. Aydt, R. J. Noe, P.C. Roth, K. A. Schields, B. W. Schwartz, and L. F. Tavera. “Scalable Performance Analysis: The Pablo Performance Analysis Environment.” IEEE Computer Society, October1993.

[6] D. U. Saikiran "Design of Data Acquisition And Control System For Industrial Purpose", International Journal of Innovative Research in Computer Science & Technology (IJIRCST) ISSN: 2347-5552, Volume-3, Issue-2, March 2015.

[7] Subhransu padhee, “Data logging and supervisory control using labview” Proceeding of the 2011 IEEE Students' Technology Symposium 14-16 January, 2011, IIT Kharagpur.

[8] H.-L. Truong, Thomas Fahringer, Data Logging and Analysis Software for online performance monitoring", Amsterdam, The Netherlands, February 14 -16, 2005.

[9] J. S. Vetter and D. A. Reed, " Data logging performance for Real-time Performance Monitoring, Adaptive Control, and Interactive Steering of Computational Grids," The International Journal of High Performance Computing Applications, March 2000, Volume 14, No. 4, pp. 357-366.

[10] F. Wolf, B. Mohr. “Implementation of Electronic Data Log Automatic Performance Analysis” Research Centre Juelich, Germany, August 2001.