WIRELESS CONTROL OF AC MOTOR USING ZIGBEE

Mr. D. Santhosh kumar[1],*Ms.K.Sumathi*[2] , *Ms.K.Varsha*[3], *Ms.K.Sangeetha*[4].

[1]Electrical and Electronics Engineering, Assistant Professor, Vivekanandha College of Engineering for Women, Tiruchengode, Namakkal, India

[2] Electrical and Electronics Engineering, UG scholar, Vivekanandha College of Engineering for Women, Tiruchengode, Namakkal, India

Abstract:- Now a days it's very common to use automation in industries. Ac motors are the nerve of many industries. Hence, the automatiobn is much needed for accuracy and reliable operation. this project proposes an system on wireless control and monitoring different parameters of induction motors based on zigbee technology. Due to this, there will be safe data transfer communication in industrial field where the other mode of data transfer communication is more expensive than zigbee or impossible due to some physical conditions. On this design, there will be a set of transducer and sensor monitors the parameters of Induction motor and transmit its data through zigbee. An Arduino based system is used for collecting and storing data and accordingly generating control signal to stop or start the AC machine wireless through computer interface developed with Zigbee.

This Techniques has different sensors to monitor and measure different parameters of induction motor and the data is transmitted to control room i.e, drive using zigbee wireless protocol. The overall control like starting and stopping of motor can be done with zigbee that is already interfaced with computer. It also protects motor against some faults such as over current, over heating in winding,under /over voltage, data acquisition system saves all received parameters data of motor in the database.

KeyTerms: Induction motor(IM), Zigbee, Arduino, Current Sensor, Temperature Sensor, voltage sensor, Pc.

II. INTRODUCTION

Induction motors are mostly Preferred in all Industries. The reason for using industrial motor is because, they are self- starting, economical and reliable. Although they have sufficient features, and simple structure they undergoes several stresses which creates faults which finally ends in failure. To treat these conditions several controlling in motors are needed.

For a reliable operation of motors, they are several data's which plays a major role to control its operation. The data's like current, voltage, temperature and speed decides the performance of Induction motors and drive systems. These parameters directly affects these Lmotors efficiency and reliability. However, while using Induction motor in Industries, there will be continuous process of motor for these production. On that time if any faults occurs it becomes risky and also very operation to control the motors. The only way for controlling these hazards was to monitor these parameters. It's impossible to monitor these parameters for 24x7 by humans. So, wireless communication technique for transforming data's from machine to drive is needed, which is used in most of industries.

There are different ways in monitoring Induction motor which was been discovered by many reviewers and researchers. Although, we have different methods in monitoring and controlling Induction motors, still we faces critical problem in Industries, this is because the problem in Induction motors should be found at initial stages. So, that we can rectify it before it creates a large fault. For detection of fault we need fast emerging technology. It should withstand its monitoring and control for all initial faults and also unexpected faults.

Still in most of industries and automation applications, the traditional methods are used i.e, wired technology. Although wired technology operations are designed to meet several hard situations sometimes it creates failures at last. But wired technology was also designed in same way the only difference is that it doesn't have any physical connections. So, that the data communications in wireless manner will be fast as it's compared to wired technology.

In some existing system, there are different methods has been introduced for monitoring, detecting mechanical stresses, controlling temperature in Induction motor. But they didn't fulfill all the controlling and also has some disadvantages, the methodology used will be costlier.

Our proposed system will overcome these defects as we used different protocols like voltage sensors, current sensors, temperature sensors for automatic controlling and interfacing we have used Arduino. In Desktop computer the C programming were done to design the interface and finally communication. We have used Zigbee methodology which was more efficient then other methods and also cost efficient.

This paper was organized as Section II Wireless Methodology, Section III Proposed System, Section IV results, and this paper is finally concluded with Section V.

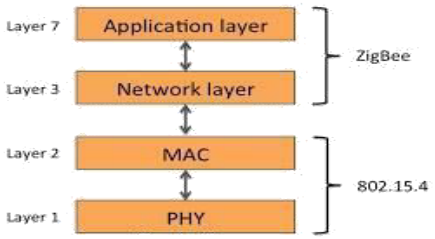
II. WIRELESS METHODOLOGY

For wireless methodology the zigbee protocol was used. Zigbee plays as an transmitter between receiver between Drive and Induction motor.On **IEEE 802.15.4** standard for wireless personal area networks (WPANs), it is used for communication of zigbee between control and sensor network and it is the product from Zigbee alliance. This IEEE standard mainly defines the communication between physical and Media Access Control (MAC) layers to manage the different devices with low-data rates.

The WPANs of these type of zigbee's operate at 868 MHz, 902-928MHz and 2.4 GHz frequencies. It is best suited for periodic as well as intermediate two way transmission of data between sensors and controllers at the date rate of 250 kbps is. It has three types of network mesh, tree, star network for these topology connections. The number of routers, coordinators, and end devices depends on the type of network used.

Features of Zigbee module:

- Cost efficient.
- The maximum data rate for a Zigbee device is 250Kbps because it has low data rate. ❖ Reliable.
- It can ends upto 65000 nodes in a network.
- It automatically establish it desired network..
- It uses very small packets when has compared to Bluetooth and WIFI.



Zigbee specifies itself with three different devices. They are Zigbee Coordinator(ZC), Zigbee Router(RC), Zigbee End devices(ZED).

ZIGBEE COORDINATOR (ZC):

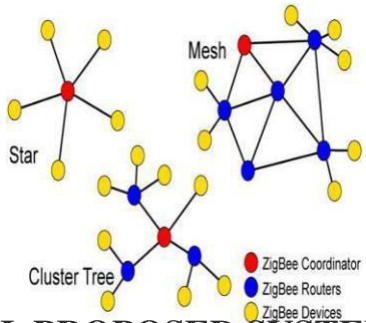
Zigbee coordinator is one of the devices in Zigbee. It was used for channel selection. It assign an ID for the network. It allocates unique address to each devices and also it initiates and transfer messages to network.

ZIGBEE ROUTER (ZR):

Zigbee Router act as intermediate nodes between the coordinator and the end devices. It router traffic between different nodes. It receives and stores messages intended for their children.

ZIGBEE END DEVICE (ZED):

Zigbee End devices contains just enough information to talk to the parent node. They may sleep which make end devices more suitable choices for battery operated devices. All traffic to an end devices is first routed to its parent.



III. PROPOSED SYSTEM

A block diagram of proposed is shown below. The proposed system can be examined in two main categories as hardware and software. The functions of the each part of the system are described in the following sections in detail.

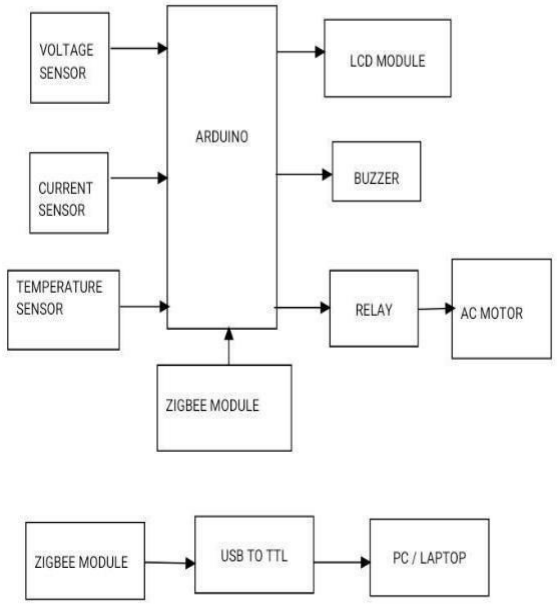


Fig.1: Block Diagram of Proposed System.

A) Hardware

The system consists of a 3 hp/1440 rpm, T.E.F.C. type three-phase induction motor, two voltage transformers with transformation ratio of 230/3 V, two current sensors based on hall effect having Maximum Primary current:25 A, Secondary Voltage (Vo): 2.5 ±0.625,frequency: DC- 25kHz, accuracy: 0.1%. Third phase voltage and current is calculated by the digital signal controller algorithm A digital temperature sensor for motor winding temperature measuring, a 16bit digital signal controller dsPIC30F4013 by Microchip and finally communication.

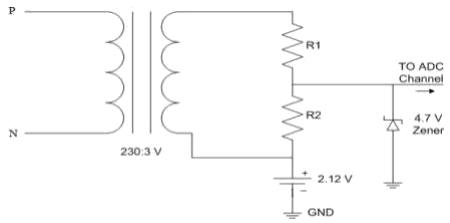


Fig.2: Current Measuring Circuit.

Two signals for voltages, two signals for currents are used as input to the A/D module of the DSC and one signal for temperature is used as digital input to DSC. Fig. 5 and fig. 6 shows the current measuring and voltage measuring circuit respectively whose output is given to the ADC channels of the digital signal controller.

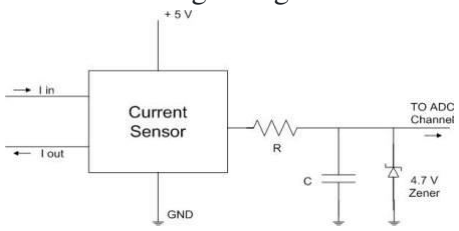


Fig.3: Voltage Measuring Circuit.

B) Software

The system software developed in C Programming that works under Windows operating system and has a highly flexible programming structure with database support. The parameters of the motor collected from the system transferred to the Zigbee coordinator via the Zigbee router; and then, they have been transferred to the computer over the RS232 protocol. Graphical User Interface used to display received data on the screen to perform controlling commands and to storage data receive throughout the Zigbee system.

IV. TEST&RESULTS

Five implementation photographs of the proposed system are depicted in fig. 9 to fig. 13. The fig. 9 shows the overview of the proposed system indicating the power supply, starter, monitoring unit and induction motor. Fig. 10 illustrates the voltage, current sensing boards, Power supply for digital signal controller and Zigbee Transmitter. Fig. 11 illustrates the connection of Zigbee Receiver with personal computer through RS232. Fig. 12 and fig. 13 are showing the result on LCD display under load condition. Finally fig. 13 shows the parameters on the graphical interface indicating the same result obtained as on the LCD display. All the data are stored in the local disk of computer as an excel file as on table 1.

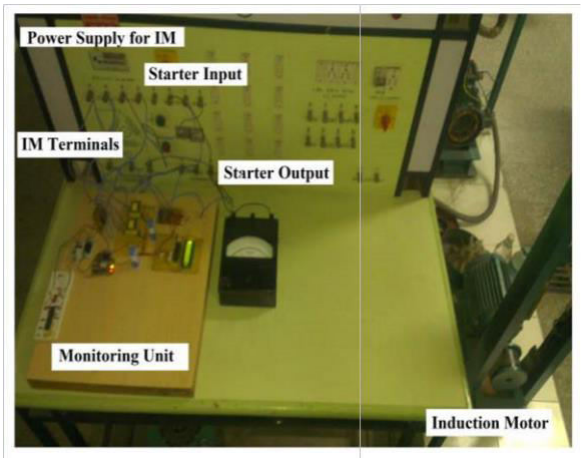


Fig. 4: overview of the proposed system.

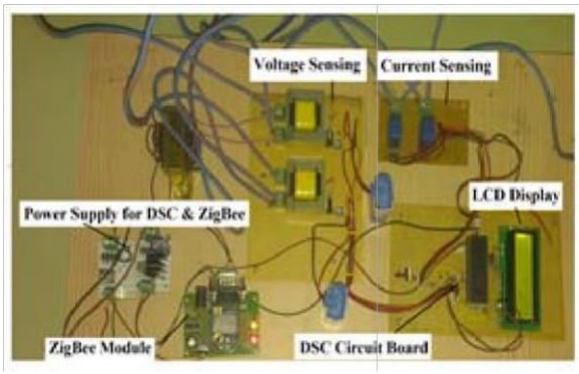


Fig. 5: Components Used

V. CONCLUSION

This proposed research work is designed and implemented in Electrical Machine Laboratory of Electrical Engineering Department at KKWIEE&R; Nasik (India).The system developed has been tested experimentally and found successful in monitoring the parameters.

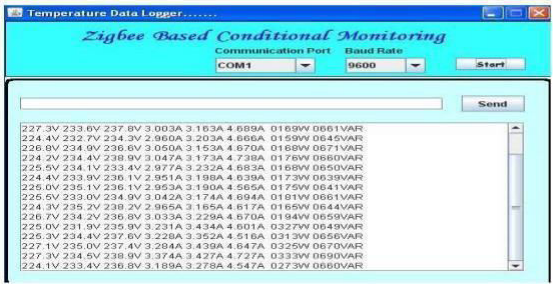


Fig.6: A view of the Results on Home Page.

	A	B	C	D	E	F	G	H
1	Vrn	Vyn	Vbn	Ir	Iy	Ib	W	Var
2	227.3V	233.6V	237.8V	3.003A	3.163A	4.689A	0169W	0661VAR
3	224.4V	232.7V	234.3V	2.960A	3.203A	4.666A	0159W	0645VAR
4	226.8V	234.9V	236.6V	3.050A	3.153A	4.670A	0168W	0671VAR
5	224.2V	234.4V	238.9V	3.047A	3.173A	4.738A	0176W	0660VAR
6	225.5V	234.1V	233.4V	2.977A	3.232A	4.683A	0168W	0650VAR
7	224.4V	233.9V	236.1V	2.951A	3.198A	4.639A	0173W	0639VAR
8	225.0V	235.1V	236.1V	2.953A	3.190A	4.565A	0175W	0641VAR
9	225.5V	233.0V	234.9V	3.042A	3.174A	4.694A	0181W	0661VAR
10	224.3V	235.2V	238.2V	2.965A	3.165A	4.617A	0165W	0644VAR
11	226.7V	234.2V	236.9V	3.033A	3.229A	4.670A	0194W	0659VAR

Table 1: Data stored in excel Format.

During the experimental tests, no problem has been observed either communicating the ZigBee to the computer, or integrating the hardware units used for monitoring the induction motor.

The system developed can be used for not only industrial applications but also for educational purposes; it means, the system may be useful to colleges that have vocational, technical, and industrial education. Instructors can use the system presented as a supporting teaching tool, and it can be adapted in experimental researches successfully. Also, the performance of the induction motor can be recorded and in case of bad condition the protection is also provided by starter. Finally the proposed system is cost effective as compared to other ones.

The proposed system is tested only for voltage, current, powers, temperature with the help of ZigBee and desktop pc/laptop, but this system can be modified for speed, vibration, humidity, chemical parameters monitoring by adding some sensors to system and making small changes in the program structure.

VI. REFERENCES

1]"Intelligent Microprocessor Based Devices Provides Advanced Motor Protection.", *IEEE Conference record of annual pulp and paper industry technicalConference,* Piscataway, NJ, USA, 1996, pp. 176-1 84

[2] Ramazan Bayindir, Ibrahim Sefa, ˙Ilhami Colak, and Askin Bektas "Fault Detection and

Protection of Induction Motors Using Sensors", IEEE transactions on energy conversion, vol.

23, no. 3, september 2008.

[3] Cohen,V. and Leitert, K.h., "Motor Protection and Starting", *PCIMEurope Issue 1/1997, pp.28-32* .

[4] FARAG, S.F. AND JHAVERI, MIKE, "A PLC based monitoring and control of power factor of a three phase induction motors", MSc Thesis, *Gazi University,Institute of Science and Technology*, Ankara (2009).

[5] Chengbo YU, Yanfei LIU, Cheng WANG.: Research on ZigBee Wireless Sensors Network Based on ModBus Protocol, *Wireless Sensor Network, 2009, 1, 1-60.*

[6] Vongsagon Boonsawat, Jurarat Ekchamanonta, Kulwadee Bumrungkhet, and Somsak Kittipiyakul: XBee Wireless Sensor Networks for Temperature Monitoring, Industrial Applications Conference, 661-667, Sept 2007.

[7] Cunkq, M., "Protection of Asynchronous Motors Aided PC by means of Microcontroller", *Spring Seminar on ElectronicsTechnology*,978–1–4244–7850–7/2010/$26.00 ©2010.

[8] Zhu XQ., Wang JM., "The research of a wireless network based on zigbee" *Journal of Electronic Technology*, 1:129-132 (2006).

[9] Siddique, A., Yadava, G. S., Singh, B. A.,"Review of stator fault monitoring techniques of induction motors." *IEEE Transactions on Energy Conversion*, 20 (1): 106-114 (2005).

[10] CUNKQ, M., "A PLC based application for induction motor protection", *Journal of Polytechnic*, 10 (2): 117 (2007).

[11] Siddique, A., Yadava, G. S., Singh, B. A.,"automatic speed control of ac drive and monitoring".piscataway, NJ, USA, 1996, pp. 176-1