



Design & Implementation for Power System Reliability by using Zig-Bee Technology on Induction Motor with Multiparameter Monitoring

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Abstract:

The conduct of Induction Motor direct in the midst of unpredictable states of issues and the potential results to break down these unordinary conditions have been a trying subject for some electrical machine authorities. The Current, voltage, Frequency, temperature, and speed data of the Induction Motor are basic for a drive system. The execution of an enlistment motor is straight forwardly impacted by whole focal qualities. On the other hand, controlling the machines in the midst of the strategy of creation continues being an unsafe operation in some branches of industry. In such cases, remote control and registering strategies turn with a broad response for discard these dangers. From now on, remote data correspondence is used as a piece of various enterprises. The Institute of Electrical and Electronics Engineers (IEEE) made 802.15.4 models and helped the era of Zig-Bee tradition and device that support this tradition. Along these lines, Zig-Bee reinforced device have negligible exertion, shrewd system topologies and are essentialness saving components. Along these lines, they have their place in step by step life and current associations in various ways. An impressive measure of device and machines can be controlled, and data can be gotten and sent meanwhile by Zig-Bee remote development. Thusly, system running can be expert with no load. The proposed watching system is attempted only for voltage, current, powers, control component, temperature and rate with the help of Zig-Bee and desktop PC/versatile workstation, yet this system can be changed in accordance with vibration, substance checking by adding a couple of sensors to system and taking off little change in the system structure. The proposed system can be connected for symptomatic testing and on line off site condition seeing of acceptance engine. Zigbee has a particularly promising future before it.

Keywords: Remote Controlling, Protection of Equipment, Graphical User Interface, Wireless Communication

I. INTRODUCTION

The remote monitoring system for three phase induction motor acknowledged utilizing Zig Bee convention, where wired correspondence is either more costly or unthinkable because of physical condition and human perils for sheltered and monetary information correspondence in industrial field. The point of this venture is to screen and secure the remote electrical parameter like voltage, current, power, temperature and send genuine esteems over remote system. A database is worked to execute web based checking and spare the motor parameter.

To actualize this a Zig Bee display is associated with program computerized flag controller which would transmit the information to ZigBee organizer which is associated with PC. Test setup demonstrate that the proposed system is less expensive and give higher precision and in addition safe and give visual conditions. Controlling of electrical machine used as a piece of various system and technique control, especially the induction machine, has ended up being basic because of its propriety in system design in industry and its various distinctive good conditions, for instance, nonessential, time, and affectability. Prevalent AC machine control systems are uncommonly fragile to machine parameters. Electrical parameters of the machine are used both as a piece of the logical model of machine and processing torque and flux portions. Parameters of an induction machine can be measured by a couple of trials like the darted rotor, purged tests.

II. SCOPE OF WORK

- ✓ Develop digital controller sub-system at remote location.
- ✓ Develop a serial communication system between master module and personal computer for user-friendly environment.
- ✓ Develop and configure wireless communication link between two operational arrangement using Zig-Bee devices.
- ✓ Develop the firmware for graphical user interface for acquiring input data process.
- ✓ Improve power system dynamic stability by reducing losses.
- ✓ Improve system accuracy by monitoring apparatus continuously.
- ✓ Protect the system/equipment from various faults.
- ✓ It avoid unexpected failure of industrial process.
- ✓ It records the data of various parameter of system continuously.

III. PRAPOSED SYSTEM

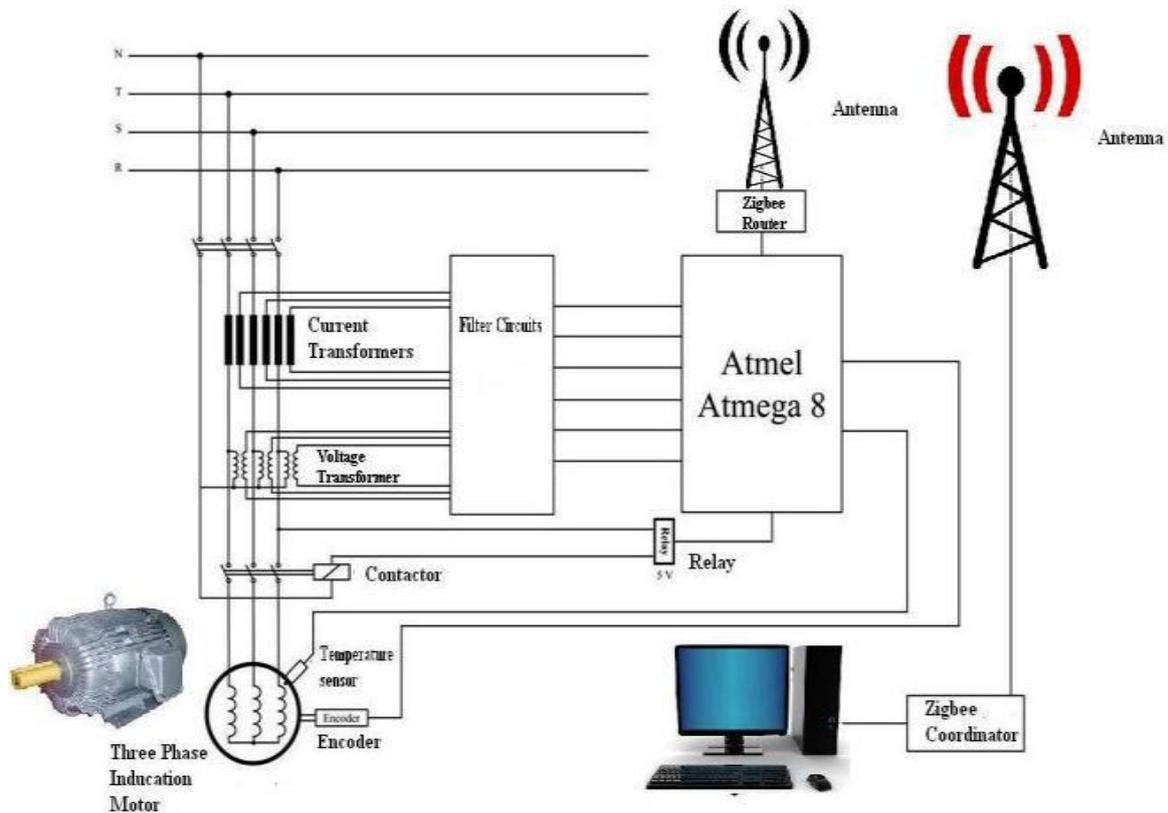


Figure.1. Diagram of Proposed System

A powerful wireless monitoring system has been developed for an induction motor and it can also be implemented to other linear electrical load. A general block diagram of the proposed system is shown in Figure.1 the system can be examined in two main categories as hardware and software.

IV. ZIGBEE/IEEE 802.15.4 - GENERAL CHARACTERISTICS:

- 1) Dual PHY (2.4GHz and 868/915 MHz) , Data rates of 250 kbps (@2.4 GHz), 40 kbps (@ 915 MHz), and 20 kbps (@868 MHz) , Optimized for low duty-cycle applications (<0.1%) ,CSMA-CA channel access.
- 2) Yields high throughput and low latency for low duty cycle devices like sensors and controls
- 3) Low power (battery life multi-month to years)
- 4) Multiple topologies: star, peer-to-peer, mesh
- 5) Addressing space of up to:18,450,000,000,000,000,000 devices (64 bit IEEE address) and 65,535 networks
- 6) Optional guaranteed time slot for applications requiring low latency
- 7) Fully hand-shaked protocol for transfer reliability
- 8) Range: 50m typical (5-500m based on environment)

C) Advantages of ZigBee

It is ready to wind up the worldwide control/sensor system standard. It has been intended to give the accompanying elements:

- 1) Low power utilization, basically executed.
- 2) Users anticipate that batteries will last numerous months to years! Think about that as a common single family house has around 6 smoke/CO identifiers. On the off chance that the batteries for everyone just kept going six months, the mortgage holder would supplant batteries consistently.

3) Bluetooth has a wide range of modes and states relying on your inactivity and force necessities, for example, sniff, park, hold, dynamic, and so on.; ZigBee/IEEE 802.15.4 has dynamic (transmit/get) or rest. Application programming needs to concentrate on the application, not on which power mode is ideal for every part of operation.

4) Even mains fueled gear should be aware of vitality. Consider a future home with 100 remote control/sensor device, Case 1: 802.11 Rx power is 667 mW (dependably on)@ 100 devices/home and 50,000 homes/city = 3.33 megawatts Case 2: 802.15.4 Rx power is 30mW (dependably on)@ 100 device/home and 50,000 homes/city = 150 kilowatts Case 3: 802.15.4 force cycled at .1% (commonplace obligation cycle) = 150 watts. ZigBee device will be more biological than its ancestors sparing megawatts at it full arrangement.

5) Low cost (device, establishment, support) Minimal effort to the clients implies low device cost, low establishment cost and low upkeep. ZigBee device permit batteries to last up to years utilizing essential cells (ease) with no chargers (ease and simple establishment). ZigBee's straightforwardness takes into consideration natural setup and repetition of system device gives low upkeep.

6) High thickness of hubs per system ZigBee's utilization of the IEEE 802.15.4 PHY and MAC permits systems to handle any number of device. This property is basic for huge sensor exhibits and control systems.

7) Simple convention, worldwide usage ZigBee's convention code stack is assessed to be around 1/4th of Bluetooth's or 802.11's as appeared in figure 1 and table 1. Effortlessness is crucial to cost, interoperability, and support. The IEEE 802.15.4 PHY received by ZigBee has been intended for the 868 MHz band in Europe, the 915 MHz band in N America, Australia, and so on; and the 2.4 GHz band is currently perceived to be a worldwide band acknowledged in all nations.

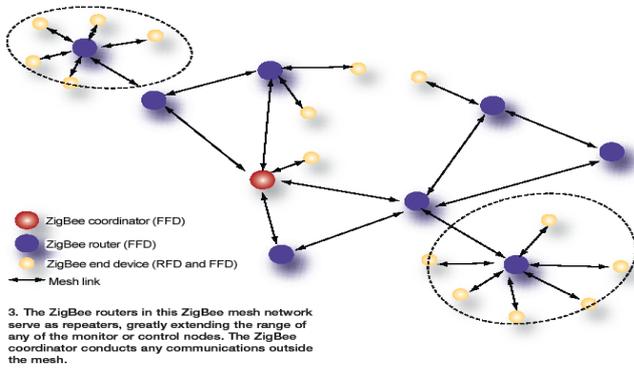


Figure 2. Topology Types for Wireless Sensor Networks & Its Security

ZigBee executes two extra security layers over the 802.15.4 one: the Network and Application security layers. All the security courses of action rely upon the AES 128b encryption count so the hardware configuration previously passed on for the association level (MAC layer) is as yet authentic. There are three sorts of Keys: expert, association and system keys.

1) Master Keys: They are pre-presented in each center point. Their ability is to keep mystery the Link Keys exchange between two center points in the Key Establishment Procedure (SKKE).

2) Link Keys: They are unique between each combine of centers. These keys are regulated by the Application level. They are used to encode every one of the information between each two devices, in this manner more memory resources are required in each contraption.

3) Network key: It is a unique 128b key shared among each one of the devices in the system. It is delivered by the Trust Center and recouped at different between times. Each center point needs to get the Network Key with a particular true objective to join the system.

4) Once the trust center changes the Network Key, the better and brighter one is spread through the system using the old Network Key. At the point when this new key is updated in a contraption, its Frame Counter (find in the past territories) is instated to zero. This Trust Center is normally the Coordinator, nevertheless, it can be a given device.

5) It needs to affirm and acknowledge each device which attempts to join the system. We have had the ability to separate both IEEE 802.15.4 and ZigBee security tradition stacks on the sensor organize Wasp bit in view of the truth they support two assorted "stick to stick" idealize handsets as showed up. The XBee OEM 802.15.4 completes the IEEE tradition over the free scale chipset organize. Of course the ZigBee stack has been focused on using the XBee ZB handset which uses de Ember chipset plan. Exactly when security of MAC layer housings is hungered for, ZigBee uses MAC layer security to secure MAC summon, guide, and attestation plots. ZigBee may secure messages transmitted over a single hop using secured MAC data plots, however for multi-bob illuminating ZigBee relies on upper layers, (for instance, the NWK layer) for security.

V. EFFECT OF INDUCTION MOTOR ON POWER SYSTEM

This paper reports preparatory after effects of an endeavor to distinguish conditions under which Induction motors can decidedly affect the steadiness of a power system. This work likewise explores the impact of utilizing a dynamic model to speak to the conduct of expansive enlistment motor in control system transient dependability contemplates. The impact of induction motor on the transient dependability of energy system is considered utilizing both a dynamic load demonstrate and a steady impedance stack display and the outcomes are looked at. The work recognizes some of those conditions under which the nearness of a substantial acceptance motor can have certain beneficial outcome on the transient steadiness of the system. It examines the impact of a few factors, for example, proximity of the motor to the fault, and the type of induction motor load. The work additionally features the significance of utilizing a dynamic model to speak to enlistment engine conduct in transient soundness considers. The fault occurs in induction motor affect on dynamic stability of power system. in industries more drive system connected in system and they are continuously running, that why continuous parameter is monitoring and recording to remains the system in stable condition.

VI. RESULTS AND DISCUSSION

The system developed has been tested experimentally and found successful in monitoring the parameters & fault detection. The test rig used in the present project consists of a three-phase IM, three voltage divider circuits connected to each phase of IM, three current transducers with output voltage between 0-5V connected to three phases of IM, a temperature sensor, with an output voltage linearly proportional to the Centigrade temperature, an IR sensor with digital output which is proportional to speed for measuring the rotor speed, Microchip PIC18F4550 digital signal controller. The 'initialization and configuration' phase consists of configure vendor ID and device ID, ZigBee based user remote control detection phase; configure infra-red profile steps.

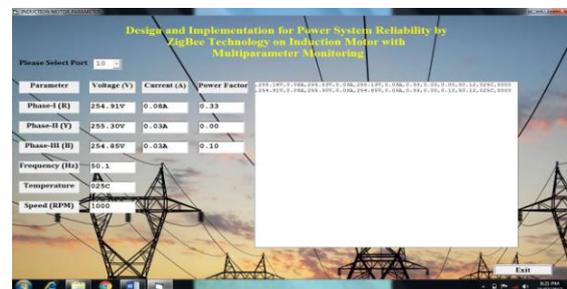
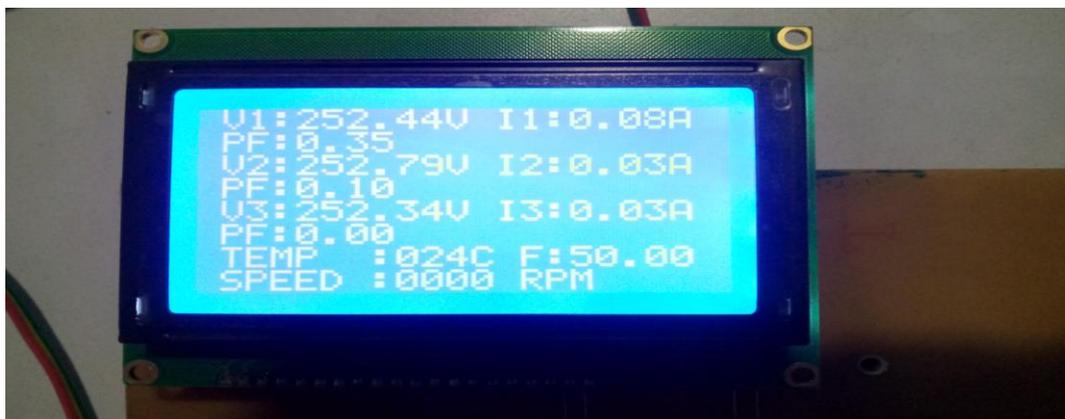
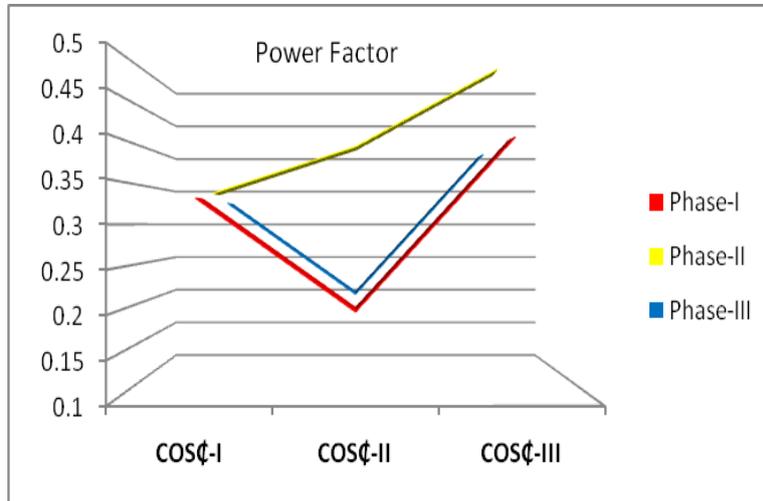
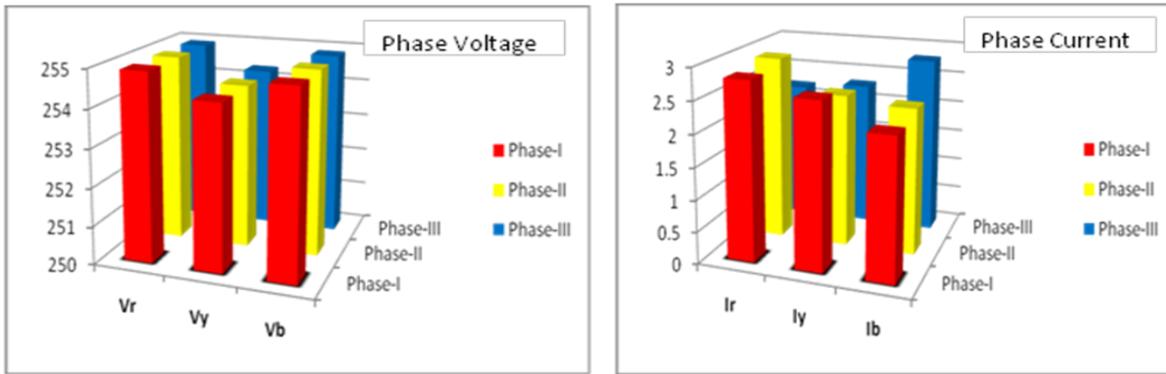


Figure 3. A view of the Results on Home Page

After completing configuration step, the software directly displays the phase voltages, the phase currents, the rotor speed and the motor temperature on the interface automatically. After having all these data, all parameters are controlled considering their tolerance values.

Table 1. Reading on Meter

| Phase | Vr | Vy | Vb | Ir | Iy | Ib | COSC-I | COSC-II | COSC-III |
|-----------|--------|-------|--------|-----|-----|-----|--------|---------|----------|
| Phase-I | 254.91 | 254.3 | 254.85 | 2.8 | 2.6 | 2.2 | 0.33 | 0.2 | 0.4 |
| Phase-II | 254.91 | 254.3 | 254.85 | 2.9 | 2.4 | 2.3 | 0.34 | 0.4 | 0.5 |
| Phase-III | 254.91 | 254.3 | 254.85 | 2.2 | 2.3 | 2.8 | 0.33 | 0.2 | 0.4 |



The program continues to run while these data are in the pre-defined limits. If there is no value to read, the program re-continues to read and calculate the signals until reading new voltages, currents, powers and temperature values (V_r , V_y , V_b , I_r , I_y , I_b , W , VAR , N and T_c). Once the required settings are done, the button called "Start" is clicked on using the Main Menu, an RF connection is established between the coordinator ZigBee and the router ZigBee. If the connection is established successfully, LED on the ZigBee continuously glows which indicates that the system is ready to use. The motor parameters can be transferred to the computer every second by clicking on the button called "Get Parameters". These received values are displayed in their own areas called value and graphic on the interface. All data can be stored in the local disk of the computer as an Excel file. To close the program, the button called "Off" should be clicked and then the button called "disconnect" should be clicked to disconnect the network. Finally, the button called "close the program" can be used to close the interface screen as well as to completely exit the system.

VII. APPLICATIONS OF ZIGBEE TECHNOLOGY



Industrial Automation: In assembling and creation enterprises, a correspondence interface constantly screens different parameters and basic supplies. Subsequently Zigbee significantly decrease this correspondence cost and additionally upgrades the control procedure for more noteworthy dependability.

Home Automation: Zigbee is consummately suited for controlling home apparatuses remotely as a lighting system control, machine control, heating and cooling system control, security gear operations and control, reconnaissance.

Smart Metering: Zigbee remote operations in savvy metering incorporate vitality utilization reaction, evaluating support, security over power robbery, and so on.

Smart Grid Monitoring: Zigbee operations in this smart network include remote temperature checking, fault finding, reactive power administration.

This is about a concise depiction of Zigbee innovation's design, operations modes, setups and applications. We trust that we have given you enough substance on this title, for you to comprehend it better. We are pioneers in creating Zigbee based activities. For additionally help and specialized help, you can get in touch with us by remarking underneath.

VIII. CONCLUSION

A parameter observing system for induction motor in view of Zig-Bee convention is produced and tried effectively. The system created is competent to perform such operations as running the motor like phase currents, phase voltages, Phase powers, wiring temperature & speed. These qualities can be exchanged to the host PC. The accompanying conclusion can be drawn from the outcomes got.

1. The proposed system is valuable to complete remote checking of induction motor in little and medium scale enterprises which will reduce cost of wiring.
2. The execution of the induction motor can be recorded and if there should be an occurrence of faulty condition the protection is likewise given.
3. The proposed system is savvy as compared to ordinary system.

This system can be altered to vibration, mugginess and concoction observing by adding a few sensors to system and rolling out little improvement in the program structure. The proposed system can be stretched out for demonstrative and testing reason. The system might be valuable to schools that have professional, specialized, and modern training. Likewise controlling of traction motor by utilizing remote strategy.

V. REFERENCES

- [1]. ZigBee Alliance, ZigBee Specification. Version 1.0 ZigBee Document 053474r06, December 14th, 2004.
- [2]. William Stalling, —Wireless Communication and Networks, Fourth Edition, Pearson Publication Limited, 2004, Pp 39-118.
- [3]. 802.15.4, Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LRWPANs).
- [4]. Sheng-Fu Su, The Design and Implementation of the ZigBee Protocol Driver in Linux, White Paper dated 26 July 2005.
- [5]. Jacob Munk-Stander, Implementing a ZigBee Protocol Stack and Light Sensor in TinyOS, White Paper dated October 2005.
- [6]. Freescale Semiconductor, ZigBee Implementer's Guide; Document Number: F8W-2004-0007, May 23, 2005

[7]. Weiser, M. (1991). The Computer for the 21st Century. *Scientific America*, September 1991, 94-104. Journal of Theoretical and Applied Information Technology © 2005 - 2009 JATIT.

[8]. Pister K. S. J., Kahn J. M., and Boser B. E. (1999). Smart dust: Wireless networks of millimeter-scale sensor nodes. In 1999 UCB Electronics Research Laboratory Research Summary

[9]. IEEE 802 Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks, IEEE Computer Society, 2003.

[10]. *ZigBee Specification v1.0*, ZigBee Alliance, December 14th, 2004. [15] Tanenbaum, A. S., Gamage, C., & Crispo, B. (2006). Taking sensor networks from the lab to the jungle. *Computer*, 39(8), 98-100.

[11]Kohvakka, M., Kuorilehto, M., Hännikäinen, M., & Hännikäinen, T. D. (2006). Performance analysis of IEEE 802.15.4 and ZigBee for large-scale wireless sensor network applications.

[12]. Navnath M Ghogare & Harpreet Singh, "Induction Motor Fault Detection & Multiparameter Monitoring Analysis by using Zig Bee Technology", *International Journal of Engineering Science & Computing*, Volume 6 Issue No. 6 June 2016, ISSN (PRINT) 2250-1371, ISSN (ONLINE) 2321-3361