Review On Implimentation Of Wirless Sensor Network For Monitoring Electrical and Mechanical Fault in Three Phase Induction Motor

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Abstract—the system proposed in this paper aims monitoring the electrical and mechanical fault of induction motor by employed (WSN) wireless sensor network. Induction motor especially three phase induction motor plays vital role in the industry due to their advantages over other electrical motor .therefore there is strong demand for their safe and reliable operation .if any fault and failure occurs in the motor it can lead to excessive downtimes and generate grate losses in terms of revenue and maintenance. Therefore early fault detection is needed for the protection of motor. The monitoring of induction motor is increasing due to its potential to reduce operation costs and enhance the reliability of operation and improve service to the customers.

Keywords*-induction motor,WSN(wireless sensor network).*

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I.INTRODUCTION

In an industrial environment, mechanical systems driven by electric motors are used in most production processes, accounting for more than two-thirds of industry electricity consumption. Regarding the type of motors usually employed, about 90% are three-phase ac induction based [1], mainly due to its cost effectiveness and mechanical robustness [2].Various faults occur in induction motor:

A variety of faults occur within the three phase induction motor during the course of normal operation. These faults can lead to a potentially catastrophic failure if undetected. Consequently, a Varity of condition monitoring technique have been developed for analysis of abnormal conditions. The common internal faults can be mainly categorized into two groups:

• Electrical faults • Mechanical faults

Electrical faults**:** The following electrical faults are very common in three phase induction motor while operating in industries.

Mechanical faults: Common mechanical faults found in three phase induction motor are Air gap eccentricity, this can be Static eccentricity, Dynamic eccentricity and mixed eccentricity, Bearing faults and Load faults.

As per the report of department of energy USA, nearly 66% of total electrical energy has been utilized by electric motor specially induction type. Energy is most impotent factor because of increased cost of energy. An evaluation of the

Energy usage condition of the industrial plant is required to improve energy efficiency, [1]. Traditionally, energy

Evaluationin industrial plants is realized in wired systems formed by communication cables and various types of sensors [2]-[3].

The installation and maintenance of these cables and sensors are usually much more expensive than the cost of the sensors themselves. The deployment of large numbers of these sensors and actuators has resulted in the development of wireless sensor networks [4]. Unique characteristics such as a sensor-rich environment, flexibility, high fidelity, self-organization, rapid deployment, and inherent intelligent capability make WSNs the ideal structure for low cost energy usage evaluation, which is important to industrial plant managers in making planning decisions. United

States Department of Energy (DOE) expected that WSNs in industry could improve overall efficiency by 11% to 18% in addition to reducing industrial emissions by more than 25% by2010 [5]. This paper presents a system that is capable of monitoring motor currents and voltages, temperature, and speed and sinks all data to one central point for processing. The basic topology of the device is shown, in which a atmega16 AVR microcontroller is used. The device provides motor parameter monitor and protection. This device is a low-cost and robust WSN for an industrial application.

II.MOTIVATION

Motor is a most commonly used industrial load and guzzles a key part of overall electrical consumption. Induction motors, especially the asynchronous motors, play a vital part in the field of electromechanical energy conversion. The main advantages of induction motors are cost-effectiveness, reliability and higher efficiency**.** Different fault occurs in induction motor because of environmental stress and many other reasons. Induction motors are commonly controlled by contactors, which are electro-magnetic switches that are highly sensitive to voltage depressions and momentary service interruptions.

Voltage depressions are huge problems for many industries, and it is probably the major pressing power quality problems today. The Voltage depressions caused by faults on the system affect the performance of induction motors, in terms of the production of both transient currents and transient torques [1]. It is essential to minimize the fault.

III.LITERATURE REVIEW.

[1]Qing ping Chi, Haring Yan, Chuan Zhang, Zhibo Pang, and Li Da Xu, Senior Member, IEEE.**"**A Reconfigurable Smart Sensor Interface for Industrial WSN in IOT Environment**"** VOL. 10, NO. 2, MAY 2014

This paper presented the sensor interface device is essential for sensor data collection of industrial wireless sensor networks (WSN) in IOT environments. However, the current connect number, sampling rate, and signal types of sensors are generally restricted by the device. Meanwhile, in the Internet of Things (IOT) environment, each sensor connected to the device is required to write complicated and cumber some data collection program code. In this paper, to solve these problems, a new method is proposed to design a reconfigurable smart sensor interface for industrial WSN in IOT environment**.**

This paper describes a reconfigurable smart sensor interface for industrial WSN in IOT environment. The system can collect sensor data intelligently. It was designed based on IEEE1451protocol by combining with CPLD and the application of wireless communication. It is very suitable for real-time and effective requirements of the high-speed data acquisition system in IOT environment. The application of CPLD greatly simplifies the design of peripheral circuit, and makes the whole system more flexible and extensible. Application of IEEE1451 protocol enables the system to collect sensor data intelligently. Different types of sensors can be used as long as they are connected to the system. Main design method of the reconfigurable smart sensor interface device is described in this paper. Finally, by taking real time monitoring of water environment in IOT environment as an example, we verified that the system achieved good effects in practical application.

Nevertheless, many interesting directions are remaining for further researches. For example, the IEEE1451 protocol can be perfected and the function of spreadsheet should be expanded. It will have a broad space for development in the area of WSN in IOT environment.

[2]Nagender Kumar Suryadevara, *Student Member, IEEE,* Subhas Chandra Mukhopadhyay, *Fellow, IEEE,* Sean DieterTebjeKelly and Stander Pal Singh Gill

A smart power monitoring and control system has been designed and developed toward the implementation of an intelligent building. The developed system effectively monitors andcontrols the electrical appliance usages at an elderly home.

Thus, the real-time monitoring of the electrical appliances can be viewed through a website. The system can be extended for monitoring the whole intelligent building. We aim to determine the areas of daily peak hours of electricity usage levels and come with a solution by which we can lower the consumption and enhance better utilization of already limited resources during peak hours.

The sensor networks are programmed with various user interfaces suitable for users of varying ability and for expert users such that the system can be maintained easily and interactedwith very simply. This study also aims to assess consumer's response toward perceptions of smart grid technologies, theiradvantages and disadvantages, possible concerns, and overallperceived utility.

The developed system is robust and flexible in operation. For the last three months, the system was able to perform the remote monitoring and control of appliances effectively. Local and remote user interfaces are easy to handle by a novice consumer and are efficient in handling the operations.

In future, the system will be integrated with co-systems like smart home inhabitant behavior recognitions systems to determine the wellness of the inhabitant in terms of energy consumption.

[3]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 Wireless SensorNetwork for Online Dynamic Torque and Efficiency Monitoring in Induction Motors".VOL 17, NO. 3, JUNE 2012

This paper presents an embedded system for determining torque and efficiency in industrial electric motors by employing WSNs technology. For a set of electric motors, current and voltage measures are gathered for later processing into an embedded system. Torque and efficiency results are then sent to abase unit for real-time monitoring. This way, preventive actions can be taken whenever low-efficiency motors are detected andin cases of torque outbreaks. The system proposed in this paper aims at monitoringthe torque and efficiency in induction motors in real time byemploying wireless sensor networks (WSNs). An embedded systemis employed for acquiring electrical signals from the motor ina noninvasive manner, and then performing local processing fortorque and efficiency estimation. The values calculated by the embeddedsystem are transmitted to a monitoring unit through anIEEE 802.15.4-based WSN. At the base unit, various motors canbe monitored in real time. An experimental study was conductedfor observing the relationship between theWSN performance andthe spectral occupancy at the operating environment. This studydemonstrated thatthe use of intelligent node local processing capability is essential for this type of application. The embedded system was deployed on a workbench, and studies were conducted to analyze torque and system efficiency

[4]B.AranaKumari, K.NagaSujatha, K.Vaisakh,Dept. of Electrical Engineering,"Assessment of Stresses on Induction Motor under Different Fault Conditions", Journal of Theoretical and Applied Information Technology, Vol.50, 2009.

Different fault occurs in induction motor because of environmental stress and many other reasons. Induction motors are commonly controlled by contactors, which are electro-magnetic switches that are highly sensitive to voltage depressions and momentary service interruptions. Voltage depressions are huge problems for many industries, and it is probably the major pressing power quality problems today. The Voltage depressions caused by faults on the system affect the performance of induction motors, in terms of the production of both transient currents and transient torques

[5] Y.amuna.K. Moorthy,PournamiS.Chandran,RishidasS.Asst Professor, Dept. of Electronics & Communication College of Engineering, Trivandrum "Motor Current Signature Analysis by Multi-resolution Methods using Sup-port Vector Machine", 978-1-4244-9477-4/11/$26.00 ©2011 IEEE 096

It is essential to minimize the effect of the voltage dip on both the induction motor and more significantly on the process where the motor is used. Large torque peaks may cause damage to the shaft or equipment connected to the shaft.

[6] S.K. Ahamed1, Arghya Sarkar2, M.Mitra3 and S. Sengupta4 "Broken Rotor bar Fault Detection of Induction Motor through Wavelet Transform and Envelope Analysis" International conference, s.k.Ahamed, ArghyaSarkar, M.Mitra and S. Sengupta explains that errors may creep in when broken rotor bar fault of induction motor is detected using conventional FFT based approach as small sideband harmonics are completely masked by the power frequency.

IV. PROBLEM DEFINATION

It is essential to minimize the effect of electrical and mechanical fault both the induction motor and more significantly on the process where the motor is used. Large torque peaks may cause damage to the shaft or equipment connected to the shaft. Some common reason for voltage depressions are lightning strikes in power lines, equipment failures, accidental contact power lines, and electrical machine starts. Despite being a short duration between 10 milliseconds to 1 second event during which are diction in the RMS voltage magnitude takes place, a small reduction in the system voltage can cause serious consequences. This unexpected interruption at the industrial plant disturbs the cost, product quality and safety. Thus any fault affecting induction motor has a drastic effect.

Hence fault detection and diagnosis have much importance. It is highly essential to protect the induction motor against failures. It is better to detect faults before motor crashes completely faults before motor crashes completely.

V.PROPOSED METHODOLOGY

WSNs are formed by devices equipped with sensors and are capable of communicating via radio frequency. These sensors can produce responses to changes in physical conditions such as temperature, humidity, or magnetic field. Specific types of WSNs, such as for industrial monitoring, have unique characteristics and specific application requirements Therefore, the deployment of WSNs must necessarily involve considerations of the targeted application .In general; there are key features that should be provided by the WSN, such as security, robustness, reliability, throughput, and adequate determinism. Among these characteristics, the lack of reliability is the main reason why many users do not deploy wireless equipment. Much of this concern is related to the interference in the spectrum used by the wireless networks for communication.

Nodes in a wireless network may suffer interference from the coexistence with other network nodes, from other networks, and other technologies operating in the same frequency range. In industrial environments, there can be other sources of noise, such as thermal noise, and noise from motors and devices that cause electrical discharge. The error characteristics presented in the wireless channel depend on the propagation environment, the modulation, transmission power, frequency range, among other parameters. In general, industrial wireless systems tend to have varying and often high error rates. It provides wireless communication with low power consumption and low cost, for monitoring and control applications that do not require high data transmission rate.

The first step, the system connects to the WSN. Theembedded system only begins to acquire and process data aftersuccessfully connecting to a coordinator operating in the samechannel. Then, the system gets into the acquisition loop, processing,and transmitting data, which is repeated until the system shuts down. The voltage and current values, after acquired, must be adjusted to reflect the real values measured from the sensors

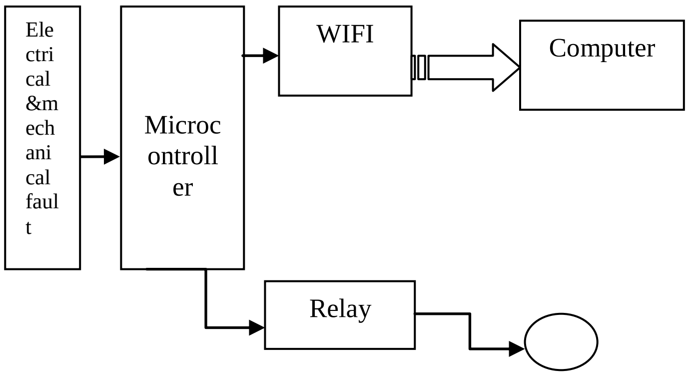

Figure1. Block Dig Of proposed methodology WSN

VI.SYSTEM DESCRIPTION

The system has been designed for measurement of induction motor. Important functions to thesystem are the ease of modeling, setup, and use. Fig. 1 shows the functional description of the developed system to monitor electrical and mechanical faults. The measurement of electrical parameters of induction motor is done by interfacing with fabricated sensing modules.

The details of the design and development of the sensing modules are provided in the following sections. The output signals from the sensors are integrated and connected to RFD (Radio Frequency Devices) for transmitting electrical parameters data wirelessly. The RFD are interfaced with various sensing devices and interconnected in the form of mesh topology to have reliable data reception at a centralized RFD coordinator. Reliable sensor fusion data has been performed.

The RFD coordinator has been connected through the USB cable of the host computer, which stores the data into a database of computer system. The collected sensor fusion data have been sent to an internet monitoring induction motor. Measurement of electrical and mechanical faults of induction motor such as vibration, noise, voltage and current, frequency, winding temperature and it result will obtained by simulation and shown on internet through WIFI results are shown in the form graphs.

Monitoring induction motor, data are collected by a smart coordinator, which saves all data in the system for processing as well as for future use. The parameters will be entered in the data coordinator in software from induction motor including voltage, current, vibration, winding temperature, speed etc. These parameters will be stored in a database and analyzed. Collected data will be displayed on the computer through graphic user interface window so that appropriate action can be taken from the GUI the processed parameters values are displayed on the graphical user interface running on a computer.

The processed data are accurate and user friendlyhe developed system has software recovery strategies such as exception-handling, auto restart, and alert text mechanism for sensors failure. The exception handling procedure can handle errors such as no sensor data reception and high range values of analog-to-digital-converted values and computational errors resulted during the normalization of voltage and current sense datavalues. Depending on the inhabitant usages, appliances connected by smart sensing units are controlled either by automation based on the tariff conditions or by the inhabitant locally usingGUI and remotely using the website. The tariff conditions referto the situation wherein unimportant induction motor will be automatically switched off by the system during high priceof the electricity.

A.*CONTROL OF INDUCTION MOTOR*

The current paper is novel in terms of other reported literature due to its control features. Controlling of motor: The users (inhabitants) have the options of switching the motor on/off in three different ways

1) Automatic control: Based on the electricity tariff conditions, the appliance can be regulated with the help of smart software. This enables the user to have more cost saving by auto switch off the system during the electricity peak hours. The electricity tariff is procured from the website of the electricity supply company and is updated at regular intervals.

2) Manual control: An on/off switch is provided to directly intervene with the device. This feature enables the user to have more flexibility by having manual control on the motor usage without following automatic control. Also, with the help of the software developed for monitoring and controlling user interface, user can control the device for its appropriate use. This feature has the higher priority to bypass the automatic control.

3) Remote control: The smart monitoring and controlling software system has the feature of interacting with the system remotely through internet (website). This enables user to have flexible control mechanism remotely through a secured internet web connection. This sometimes is a huge help to the user who has the habit of keeping the appliances ON while away from house. The user can monitor the condition of all the System and dothe needful.

B.*RELETION WITH IOT*

With the advancements in Internet technologies and WSN, a new trend is forming in the era of ubiquity [5], [6]. “IOT” is all about physical items talking to each other, where machine to-machine (M2M) communications and person-to-computer communications will be extended to “things” [7], [8]. Key technologies that drive the future of IOT are related to smart sensor technologies including WSN, nanotechnology, and miniaturization

[9]. Since, IOT is associated with a large number of wireless sensor devices; it generates a huge number of data [10].

Sensor data acquisition interface equipment is one of the key parts in IOT applications. Data collection is the essential application of WSN and more importantly it is the foundation of other advanced applications in IOT environment [11].

IOT is a major drive to support service composition with various applications [12]. The architecture of IOT is illustrated as in Fig. 1. It consists of three layers: 1) perception layer;2) network layer; and 3) application layer [13]. The design of data acquisition interface is mainly applied to the perception layer of IOT [14]. The perception layer of IOT is mainly composed of sensors, RFID readers, cameras, M2M terminals, and various datacollection terminals [15]. The data acquisition interface is responsible for the integration and collaboration of various environments and collection of sensor data.

Examples of such a workflow include a water environment monitoring system that adopts sensors to detect pollution and water quality. Water environment monitoring is one of the IOT application fields, where complex water quality information, is used to determine the water environmental quality at the same time. However, currently, there are few data collection devices that are dedicated to water quality monitoring on the market.

Such devices can ensure high speed of data acquisition for multiple sensors and adapt to complex and various sensor types well. Thus, we design and implement a WSN data acquisition interface that can be used for water environmental monitoring. Other application are as in IOT also need to collect sensor data. If there is a data acquisition interface compatible with the sensor of each

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