Implementation of Wireless Sensor Network for Motor Speed Control Using Wi-Fi Network

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***Abstract*—**A *way to watching the torsion and potency in induction motor in real time by using wireless detector networks (WSNs). In industries most of the mechanical works square measure done by motors. during this motors ninetieth square measure induction motors. A controller unit (stellaries) is used for deed electrical signals from the motor in a very non invasive manner, so activity native process for torsion and potency estimation. These values calculated by the controller unit square measure transmitted to a watching unit through a WLAN primarily based WSN. At the bottom unit, varied motors will be monitored in real time.*

***Keywords*—** *Induction motor, arm cortex-M4, IEEE 802.11g, condition monitoring, torque and efficiency estimation.*

I. INTRODUCTION

In associate degree industrial setting, mechanical systems driven by electrical motors square measure utilized in most production processes, accounting for quite common fraction of trade electricity consumption. concerning the sort of motors typically used, regarding ninetieth square measure three-phase ac induction primarily based, in the main owing to its price effectiveness and mechanical hardiness. torsion is one in every of the most parameters for production machines. In many trade sectors, torsion measurements will establish failure, that makes their watching essential so as to avoid disasters in vital production processes (e.g., oil and gas, mining, and sugar and alcohol industries). for many years, researchers have studied strategies and systems for decisive the torsion in rotating shafts. There square measure primarily 2 lines of study: direct torsion measuring on the shaft, and calculable torsion measuring from motor electrical signal. In most cases, the strategies for direct torsion measuring on the shafts square measure the a lot of correct.

However, they're extremely invasive, considering the coup ling of the measuring instrument between the motor and therefore the load. Moreover, a number of these techniques still have serious operational challenges. The calculable torsion from the motor's electrical signals (i.e., current and voltage) makes the system less invasive, however it's less correct when put next to direct measuring systems. There square measure issues, like noise in signal acquisition, those associated with numerical integration, and low levels of voltage signals at low frequencies. However, in several cases, high exactness isn't vital, and low invasiveness is needed. There square measure totally different strategies to live potency in induction motors, that square measure supported measuring system, duplicate machines, and equivalent circuit approaches. However, their application for in-service motors is impractical, as a result of it needs interrupting the machine's operation to put in the instruments. There square measure some straightforward strategies for in-service potency estimation, just like the plate methodology, the slip methodology, and therefore the current methodology. These strategies gift because the main limiting factors the low accuracy, estimative supported nominal motor knowledge and therefore the want of typical efficiency-versus-load curves. within the ORMEL96 methodology, the potency is obtained from a similar circuit that's generated from the motor plate and therefore the rotor speed measuring.

Hsu and Scoggins given the air-gap torque[1] (AGT) for energy potency estimation. In, the AGT is additionally wont to live potency in a very abundant less invasive manner. The AGT[1] methodology will be used while not interrupting the motor operation and it's not supported the motor plate. This methodology usually is a lot of correct than the opposite strategies delineate earlier. during this study, the AGT [2]method was used for the estimation of the motor shaft torsion and potency[3], as a result of it's the non invasive methodology for decisive torsion and potency that has less uncertainty[4]. historically, energy watching associate degreed fault detection in industrial systems square measure performed in an offline manner or through wired networks[5]. The installation of cables and sensors typically features a higher price than the value of the sensors themselves. Besides the high price, the wired approach offers very little flexibility, creating the network readying and maintenance a more durable method.

In this context, wireless networks gift variety of benefits compared to wired networks as, as an example, the convenience and speed of readying and maintenance, and low price

.In addition thereto, wireless detector networks(WSNs) offer self organization and native process capability. Therefore, these networks seem as a versatile and cheap resolution for building industrial watching and management systems. ne'er the less, the employment of WSNs[6], once developing automation systems for industrial environments, presents variety of challenges that ought to be featured. Wireless networks have unreliable communication links, what will be aggravated with noise and interference within the communication spectrum range[7]. Studies on the applying of WSNs in industrial environments, aiming at replacement wired systems, are extensively explored in recent years. This paper presents associate degree embedded system for decisive torsion and potency in industrial electrical motors by using WSNs technology. For a collection of electrical motors, current associate degreed voltage measures square measure gathered for later process into an embedded system. torsion and potency results square measure then sent to a base unit for period watching. This way, preventive action will be taken whenever low-efficiency motors square measure detected and in cases of torsion outbreaks.

II. BLOCK DIAGRAM

Sensor sense the signal that signal strength is increase in signal conditioner that signal is method to the controller and relay is controlled. This data sent to the bottom station through a wireless detector network. The controller square measure victimisation arm cortex M4 family, they're watching the values by fast process quick response during this controller..

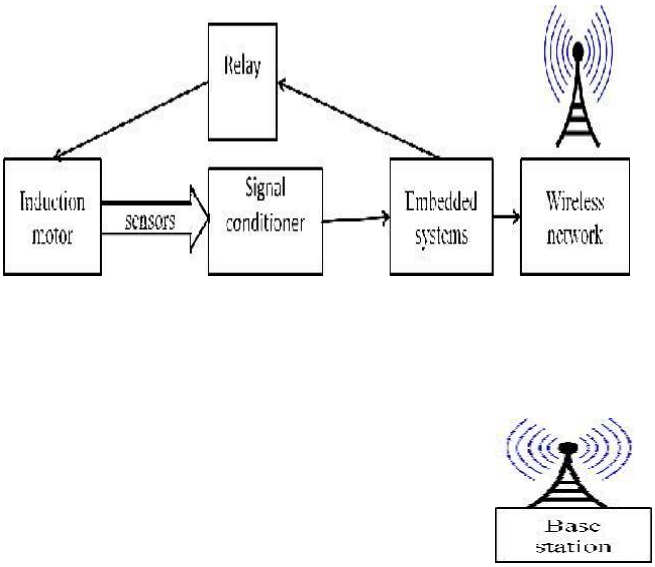

Fig. 1 block diagram

III. SYSTEM DESCRIPTION

The WSN planned during this paper. finish nodes square measure composed by the embedded systems placed near the electrical motors. The values of motor voltage and current square measure obtained from the sensors, and therefore the embedded system performs the process for decisive the values of torsion, speed, and efficiency. data obtained once the process square measure transmitted to the bottom station through the WSN. counting on the gap between finish nodes and therefore the organizer, it should not be attainable to realize direct communication, owing to the radio's restricted vary and therefore the interference gift on the setting, among alternative factors. Therefore, the communication among nodes and organizer will be through with help of router. For current measuring, Hall result sensors square measure used owing to their hardiness and non invasiveness. Transformers with grain-oriented core {are|ar|area unit|square live} wont to measure the voltage between phases, which give the voltages within the secondary and first directly. The acquisition and processing unit (ADPU) is accountable for knowledge acquisition and conversion, besides the information process.

The written board power offer provides this and voltage for the sensors, the IEEE 802.11 transceiver, and therefore the ADPU. the most part of the ADPU could be a PIC16F877A, that could be a digital signal controller designed for applications that need high process capability. it's 2 integrated ADC, that perform coincidental acquisition of the voltage and current sensors. The input/output channels will be used for program, and attainable connections to auxiliary sensors and actuators. The values of torsion and motor potency square measure transmitted victimisation the IEEE 802.11 Transceiver. we've used associate degree MRF24J40 transceiver, designed by semiconductor. The affiliation between the transceiver and therefore the PIC is accomplished employing a Serial Peripheral Interface Bus. the interior operation of the embedded system is illustrated by the activity diagram. once the system starts, the embedded system parameters square measure organized. These parameters embody the wireless network settings (e.g., address, channel), and therefore the ADC settings.

to get smart accuracy from a straightforward numerical integration methodology, like quadrilateral (used to implement the algorithm), a sample rate bigger than two kilohertz [31] ought to be used. In our system, we tend to set the ADC to control with three kilohertz and ten bits of resolution. once the primary step, the system connects to the WSN. The embedded system solely begins to amass

and method knowledge once with success connecting to a organizer operational within the same channel. Then, the system gets into the acquisition loop, processing, and transmission knowledge, that is perennial till the system shuts down. The voltage and current values, once noninheritable , should be adjusted to replicate the $64000 values measured from the sensors.

After that, the algorithmic rule is dead to figure the AGT, in step with (1). After that, the losses square measure removed, and therefore the shaft torsion is calculable in step with (2). victimisation the shaft torsion values, the system estimates the motor speed and potency. The embedded systems were organized to calculate a collection of 360 values (2 bytes each) of torsion and potency, so transmit these values collective into twenty packets with seventy two bytes of payload every. The time necessary to amass the signals and calculate the 360 values of torsion and potency is regarding eleven s (6 s to amass 360 cycles of current and voltage, and five s to perform the calculations). Thus, the system transmits knowledge in burst mode, defrayal solely regarding V-E Day of the time transmission knowledge, at a rate of twenty packets/s (about fourteen kb/s, together with management overhead).

IV. HYPERTERMINAL SOFTWARE

Most Spectracom product have associate degree RS-232 Com port to tack selectable parameters and retrieve operational standing and performance logs. Connect the Spectracom RS-232 Com (Setup) port to a pc employing a one to at least one stapled DB9 serial cable. This cable features a DB9 male on one finish and a DB9 feminine on the opposite finish. don't try and use a null electronic equipment cable with gender changers to induce the "correct" pin configuration. A null electronic equipment cable reverses transmit and receive lines and so won't add this application. to permit communication the pc should be running a emulation program like HyperTerminal

V. HARDWARE DESCRIPTION

Induction Motor is 3-phase induction motors square measure straightforward, rugged, low cost, and simple to take care of. They run at primarily constant speed from zero-to-full load. Therefore, they're the motors most often encountered in trade. detector once current is seasoned the conductor and therefore the same conductor is placed in flux perpendicular to this flow then a voltage known as the hall voltage is generated perpendicular to each this and flux. this can be referred to as Hall result. once no flux is applied to this carrying skinny semiconductor material(hall element) the hall voltage(Vh) is zero. once associate degree external flux is applied to this carrying hall part perpendicular to this flow a Lorentz force acts on this owing to that a voltage known as hall voltage(Vh) is generated perpendicular to each this and therefore the flux. This voltage is incredibly little (in uV) and desires amplification.

Relay choice Relays (and switches) are available in totally different configurations. the foremost common square measure shown to the proper. Single Pole Single Throw (SPST) is that the simplest with solely 2 contacts. Single Pole Double Throw (SPDT) has 3 contacts. The contacts square measure typically tagged Common (COM), unremarkably Open (NO), and unremarkably Closed (NC). The unremarkably Closed contact are connected to the Common contact once no power is applied to the coil. The unremarkably Open contact are open (i.e. not connected) once no power is applied to the coil. Ex: If you would like to show on the AC unit with a 12VDC power offer get a 12VDC coil. Note: Coils are rated for either AC or DC operation. WLAN could be a facility permitting computers, good phones, or alternative devices to attach to the web or communicate with each other wirelessly among a specific space.

Wi-Fi is progressively changing into the popular mode of net affiliation everywhere the globe. To access this kind of affiliation, one should have a wireless adapter on their pc. Typically, DAQ plug-in boards square measure general knowledge acquisition instruments that square measure similar temperament for measurement voltage signals. However, several real-world sensors and transducers output signals that has to be conditioned before a DAQ board or device will effectively and accurately acquire the signal. Wi-Fi provides wireless property by emitting frequencies between two.4GHz to 5GHz supported the number of information on the network. Areas that square measure enabled with Wi-Fi property square measure referred to as Hot Spots. One will use advanced computer code like Wireless on to find and request affiliation to Hotspots. needed settings square measure properly put in. Signal Conditioner PC-based knowledge acquisition (DAQ) systems and plug-in boards square measure utilized in a awfully wide selection of applications within the laboratory, within the field, and on the industrial plant floor. This front-end pre-processing, that is mostly mentioned as signal acquisition, includes functions like signal amplification, filtering, electrical isolation, and multiplexing.

Additionally, several transducers need excitation

currents or voltages, bridge completion, linearization, or high amplification for correct and correct operation. Therefore, most PC-based DAQ systems embody some kind of signal acquisition additionally to the plug-in DAQ board and private pc. Base Station planned IS, embedded computer code development for the electronic equipment contains four tasks and four interruptions.4 tasks include sensing knowledge assortment from FLS, knowledge elementary process, important malfunction scan and program response. Sensing knowledge assortment indicates assembling dynamic sensing knowledge and mechanically storing these knowledge within the IS. knowledge elementary process suggests that to method the raw sensing knowledge to amass the desired typical knowledge, like the maximal/minimal/average price, the active/reactive power and therefore the system potency, etc...Significant malfunction scan is to find the severe malfunctions, like short, missing section and over current, and report them. Keyboard interruptions guarantees that the external input will be gone through electronic equipment in time.

VI. SIMULATION RESULTS

Proteus is computer code for micro chip simulation, schematic capture, and computer circuit board (PCB) style. it's developed by work centre physical science. The Proteus style Suite is completely distinctive in providing the flexibility to co-simulate each high and low-level micro-controller code within the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modelling activity, you'll be able to rework your product style cycle, reaping Brobdingnagian rewards in terms of reduced time to plug and lower prices of development.

If one person styles each the hardware and therefore the computer code then that person edges because the hardware style is also modified even as simply because the computer code style. In larger organizations wherever the 2 roles square measure separated, the computer code designers will begin work as before long because the schematic is completed; there's no want for them to attend till a physical image exists. Fig two traditional motor running condition. providing input values to controller as motor convenient then motor will run in traditional condition.

Estimating the desired output from the measured price by applying Embedded system. watching the information, Malfunction Occurred, PWM technique the motor condition knowledge will watching , If malfunction square measure execute management the circuit through relay, PWM technique could be a modulation technique that conforms the breadth of the heart beat, formally the heart beat period, supported modulator signal data. though this modulation technique will be wont to cypher data for transmission, its main use is to permit the management of the facility equipped to electrical devices, particularly to mechanical phenomenon masses like motors. additionally, PWM is one in every of the 2 principal algorithms utilized in electrical phenomenon electrical device chargers, the opposite being MPPT.

The typical price of voltage (and current) fed to the load is controlled by turning the switch between offer and cargo on and off at a quick pace. The longer the switch is on compared to the off periods, the upper the facility equipped to the load.

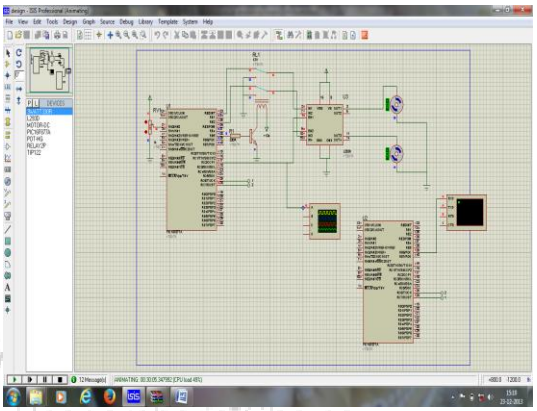

Fig.2 motor running condition

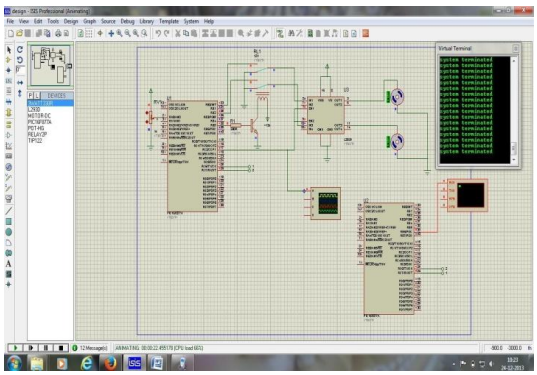

Fig.3 malfunction monitor

The PWM switch frequency should be abundant quicker than what would have an effect on the load, that is to mention the device that uses the facility. usually switching's ought to be done many times a moment in an electrical stove, one hundred twenty cycle in a very lamp

rheostat, from few kilocycle per second (kHz) to tens of kilohertz for a motor drive and well into the tens or many kilohertz in audio amplifiers and pc power provides.

When knowledge square measure monitored, to the virtual terminal, in this some error square measure high voltage or current and the other faults occurred suggests that they show in virtual terminal by system terminated. Then the relay is tripping the circuit.

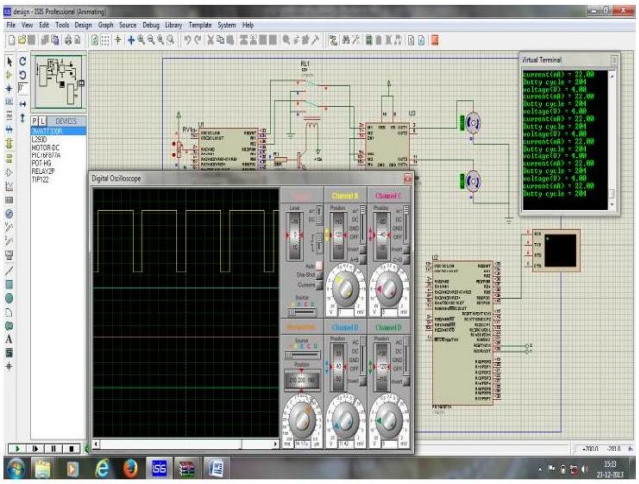

Fig . 4 PWM Technique

V.CONCLUSION

An Embedded system integrated into a WSN for on-line speed management, torsion and potency watching in induction motors. The calculations for estimating the targeted values square measure done domestically so transmitted to a watching base unit through associate degree IEEE 802.11 WSN. Even with the difficulties in knowledge transmission victimisation the WSN in some eventualities, the system was able to offer helpful watching data, since all process is finished domestically (i.e., solely the knowledge already computed is transmitted over the network). while not native process, it'd be not possible to use the WSN technology for this specific application, considering associate degree unreliable transmission medium. Allied to the native process capability, alternative techniques will be developed to mitigate interference in those environments, resulting in higher communication performance. In future multiple of motors will be utilized in real time. To known the fault condition by non invasive manner on-line watching method.

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