Monitoring of DC Motor using Zigbee Module

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ABSTRACT

Wi-Fi primarily based industrial automation is a top situation in our daily life. The approach to Zigbee based Wi-Fi network for business packages has been standardized in recent times. on this challenge, a wireless manipulate and tracking machine for a D.C motor is found out the usage of the Zigbee conversation protocol for secure and monetary records communiqué in commercial fields in which the stressed out communiqué is either extra high priced or not possible due to physical situations. The undertaking includes the design of remotely beginning, stopping, controlling and tracking the D.C motor via pc interface the usage of a Zigbee wireless motor manage module. The module also includes the continuous online monitoring of the motor parameters such as current, voltage, temperature, speed via radio frequency (RF) data acquisition system and storing them in a database designed using Visual basic. The designed system hence provides continuous online monitoring, controlling and protection of the motor in real time. This work is oriented towards improving the remote controlling abilities of the system while keeping the hardware requirements minimum. An eight- bit AVR (boost virtual RISC) microcontroller has been used on this paintings to interface the numerous sensors the usage of the IEEE 802.15.4 preferred, Zigbee protocol. Zigbee is a Wi-Fi communication protocol which has the characteristics of low electricity consumption, low value and self-organizing features. The designed embedded machine can be utilized in applications such as meals enterprise, chemical enterprise, and so forth. The gadget is fully managed via the private laptop from far off vicinity thru visible basics GUI (Graphical consumer Interface).The GUI is evolved primarily based on the requirement of the user. The non-public laptop will constantly reveal all of the statistics from far off processing unit and could keep the acquired information in its database.

Keywords: *ATMEGA-328 controller, DC Motor, Monitor & Control System, Speed Sensor, WSN, Zigbee.*

1. Introduction:

The efficient layout and implementation of WSN (wireless Sensor Networks) has become a rising region of studies in current years. WSN includes spatially dispensed independent sensors to screen bodily or environmental conditions like temperature, sound, stress and many others. The advantage of Wi-Fi sensor community is that they may be used effectively inside the surroundings in which stressed out system cannot be used or if used, are to be handled with caution, as an instance, in clinical treatment. This challenge is to automize the industrial system the usage of a wireless embedded gadget the use of superior technology. The purpose of this task is to enhance the statistics acquiring device and also to provide ok statistics logging for unique location.

The performance of a DC motor is without delay laid low with whole fundamental qualities. On the other hand, controlling the machines at some stage in the procedure of manufacturing remains a dangerous operation in some branches of industry. In such cases, remote manage and monitoring techniques emerge as a full-size solution to eliminate these hazards. Consequently, Wi-Fi facts conversation is utilized in various industries. Wireless conversation referred to as wireless is able to excessive information fee transmission, Bluetooth, and 3G in commercial organizations. Those devices use gadget resources loads and are proportional to transmission velocity. The Institute of electrical and Electronics Engineers (IEEE) developed 802.15.4 standards and helped the manufacturing of Zigbee protocol and gadgets that support this protocol. As a result, Zigbee supported gadgets have low-cost, wise network topologies and are strength saving features. So, they've their location in each day life and

commercial agencies in diverse approaches. Loads of devices and machines may be managed, and facts may be acquired and sent on the sometime through ZigBee Wi-Fi generation. So, device strolling can be performed with none trouble.

In the literature, numerous techniques had been presented for going for walks, tracking, and detecting mechanical and electrical defects in DC Motor. Traditional protection practices for detecting motor defects and defensive automobiles use numerous sorts of protection relays which include over cutting-edge relays, temperature relays, low and high modern-day safety relays, electromagnetic switches, contactors, and time relays. If the conventional safety techniques are 9 as compared with the pc-based totally ones, conventional techniques considerably reduce the performance and sensitivity of the device due to the fact many mechanical components which include within the complete machine growth the time for detecting defects. Any other drawback of the traditional safety strategies is their price; particularly, it is clear that traditional strategies increase the price of structures while digital systems reduce it. All measurements related to the DC motor were executed and protection against the failure of DC motor has been executed. But, it changed into realized that the fee is multiplied because of use of sensors to accumulate the present day and the voltage facts from the network and switch them to the laptop by an analogue/digital converter card. Manipulate of the DC motor has been completed through the laptop over the Zigbee protocol. Especially, a powerful far flung manage has been done successfully to reveal the fundamental size for those places in where the motor is hard to reach.

Chapter 1.1 ZIGBEE MODULE

ZigBee is a synonym of IEEE 802.15.4 protocol, which is a hot research topic in short-distance wireless communication technology. Its main advantages are dissipating low-power, lower complexity, self-organization, being low-cost, and so on. It is widely used in industry, home and building automation, automatic control, monitoring and control of agricultural area, hospital and other fields. The complete ZigBee technology is constituted by Application layer, Network layer, Data link layer and Physical layer. Its transmission distance is more than 10 m distance and compatible with the 2.4GHz and 900MHz frequency bands. Network architecture has Master/Slave characteristic and it works operated as two-way communication for public use. Although the transfer rate of ZigBee technology is not high enough, the ZigBee technology has great potentials in sensing and control applications.
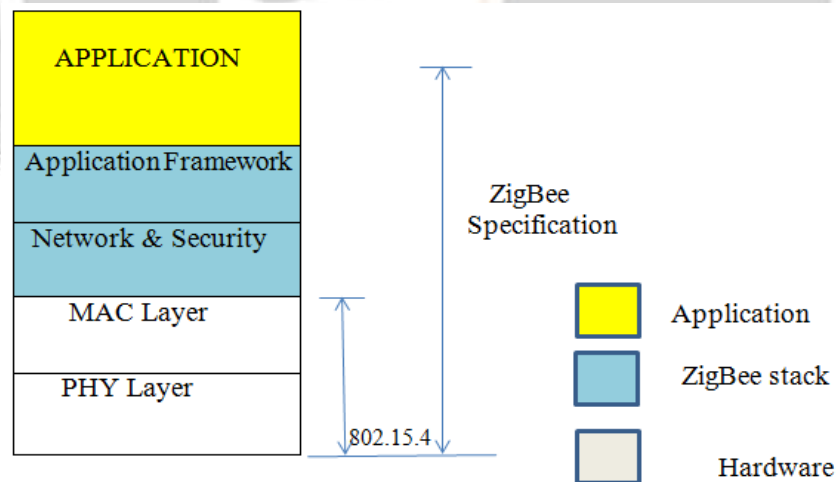

Fig- 1 Architecture of ZigBee

1.1.1 IEEE 802.15.4:

Defines lower layers of protocol stack: MAC and PHY
Lower networks layers of a type of WPAN
□ Low cost.

□ Low speed communication between devices.

□ Contrasted to other approaches such as Wi-Fi, which offer more bandwidth and require more power.

Main identifying features of IEEE 802.15.2 among WPANs is it achieve low manufacture and operational cost.

1.1.2 Physical Layer:
• The 802.15.4 standard specifies two different services that the Physical Layer (PHY) provides.

• The PHY data service controls the radio, and thus, the transmission and reception of the PPDUs.

• The management service performs Energy Detection in the channel, Clear Channel Assessment before sending the messages and provides LQI for the received packets.

1.1.3 Mac Layer:
  • Interface between the SSCS and the PHY layer.
  • Similar to the PHY layer, the MAC layer supports two services.
  • The MAC data service is responsible for the transmission and reception of the MPDUs through the PHY data service.

1.2 Network Topologies:
Exceptional network topologies built up through ZigBee gadgets like celebrity topology, cluster tree topology and mesh network as shown in determine.1. For all network topologies, there can be best one coordinator in every community. Figure- 2 is a celebrity topology wherein a coordinator is responsible for all around the network. All different gadgets are returned-end devices and at once talk with the coordinator. This topology is appropriate for networks with a centralized tool and for time critical applications. Discern Fig. 3 is a cluster tree network wherein coordinators are nevertheless responsible for the community initiating and preservation.

In mesh network coordinators that is visible in determine.Fig-4 is nonetheless liable for the community initiating and upkeep. Routers can be used to extend the community. A mesh community lets in complete peer-to-peer verbal exchange. A mesh relies on this way self-recuperation era so that if a node fails any other direction is used for the statistics delivery.
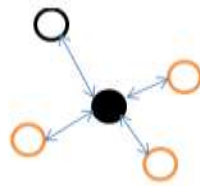

**Fig- 2) Star Network**   **Fig-3) Tree Network**

● Coordinator
◆ Router
○ End Device RFD
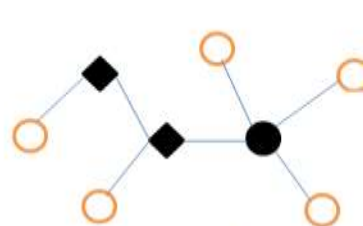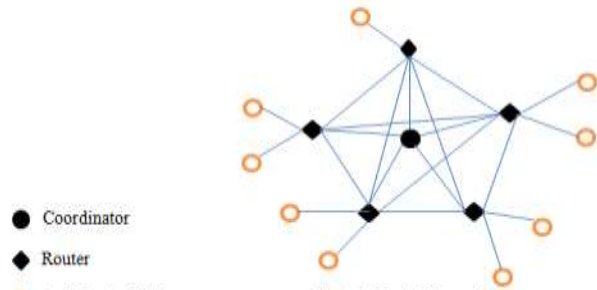
Fig-4) Mesh Network

2. SYSTEM BLOCK DIAGRAM:

The block diagram for Transmitter and Receiver is as shown in Figure. In this system the D.C motor parameter such as speed, voltage, temperature winding and current rating are monitored and controlled. At the transmitter side voltage, temperature and current are continuously monitored by the appropriate sensors. The speed sensor is used to monitor the speed (rpm) of the motor. The driver is used to drive the D.C motor. The sensed signals are inputted to the microcontroller, which triggers the Zigbee module to transmit the signals. Microcontroller will decode and analyze it. Thus, the sensed signals will be displayed with the help of a LCD and depending on the various sensor inputs output devices will be driven using the other. The Zigbee will transmit the signal to Personal computer. For the interface between the Zigbee and the PC USB Cable is used to Connect Zigbee to PC. The data will be displayed on PC through Zigbee protocol.
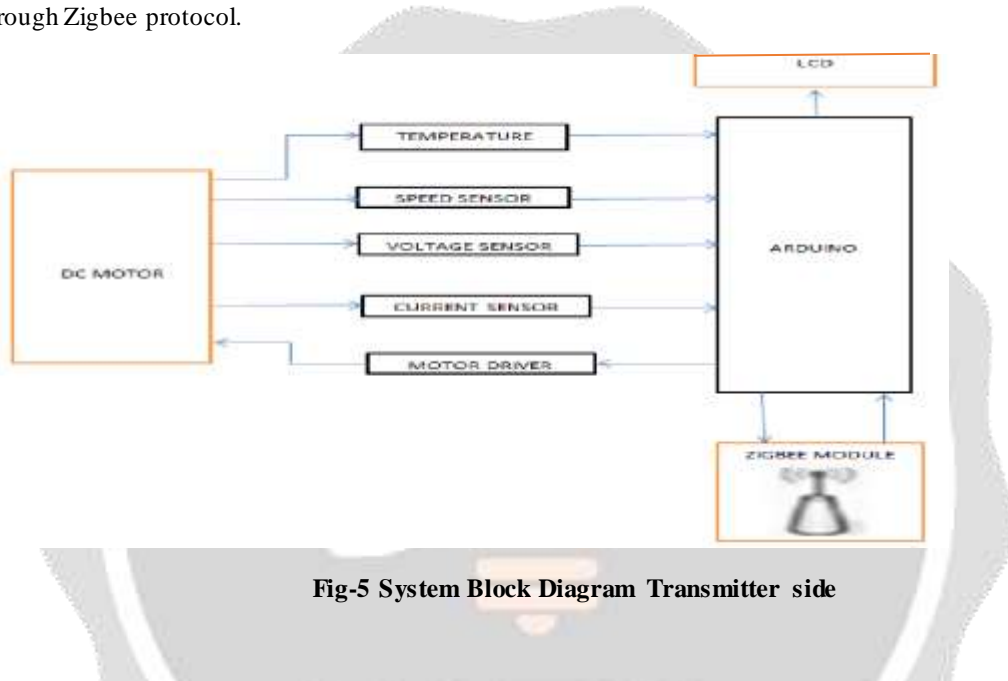
**Fig-5 System Block Diagram Transmitter side**
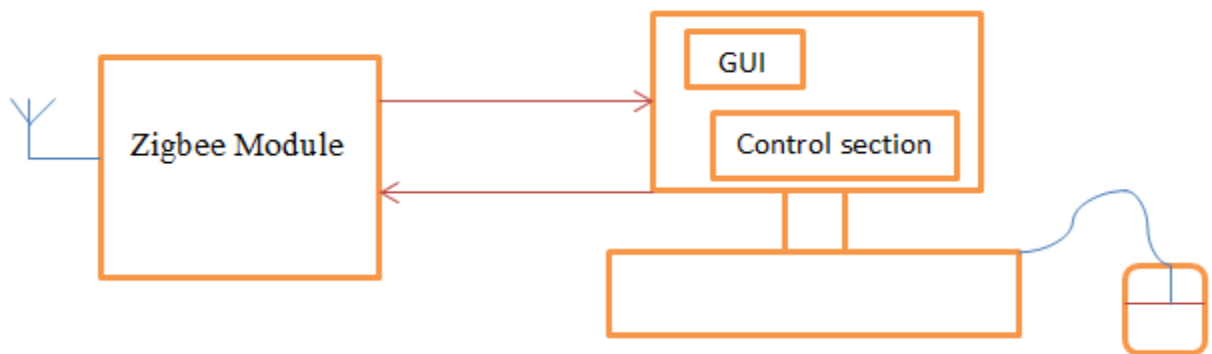
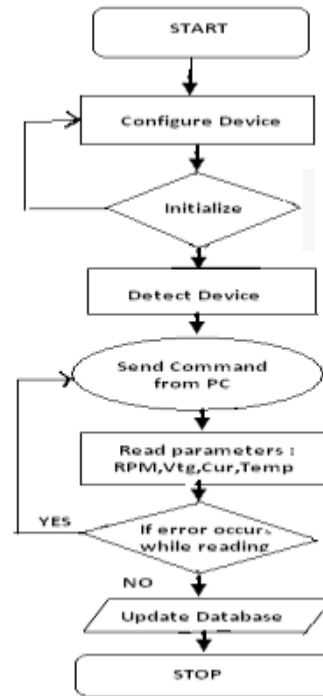**Fig- 6 System block diagram Receiver Module**

3. SOFTWARE DESIGN FOR PROPOSED SYSTEM

The software design for system is proposed which incorporates measuring the DC motor parameter by sensors and convert them into digital form through microcontroller and displaying the parameters on LCD. It also includes the serial transmission of data to the receiver end wirelessly, using Zigbee protocol and storing the data on visual basics

database and controlling the system wirelessly .The flowchart for transmitter and receiver is as shown in flow chart 1& 2.
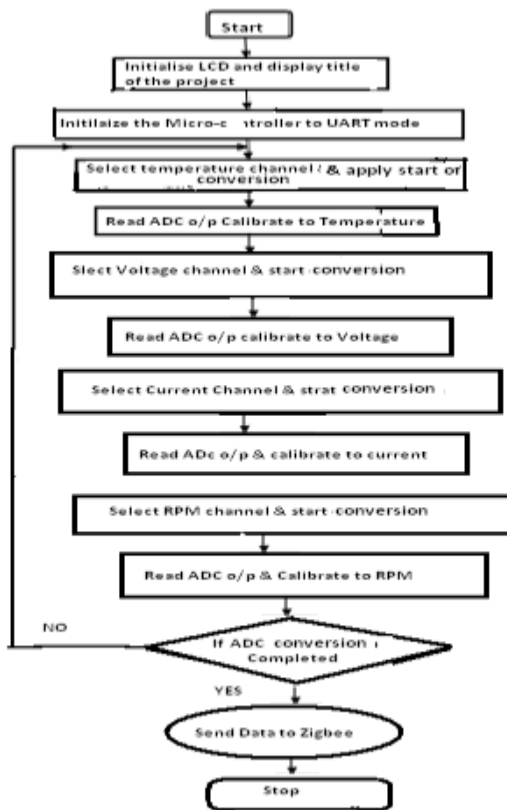
Flow Chart-1 For Transmitter Side   **Flow Chart-2 For receiver section**

4. IMPLEMENTATION:

Temperature Sensor: This sensor is used to monitor the temperature of the DC motor. Here we are using LM35 as temperature sensor.

Fig-7: Hardware Implementation

Temperature Sensor: This sensor is used to monitor the temperature of the DC motor. Here we are using LM35 as temperature sensor.
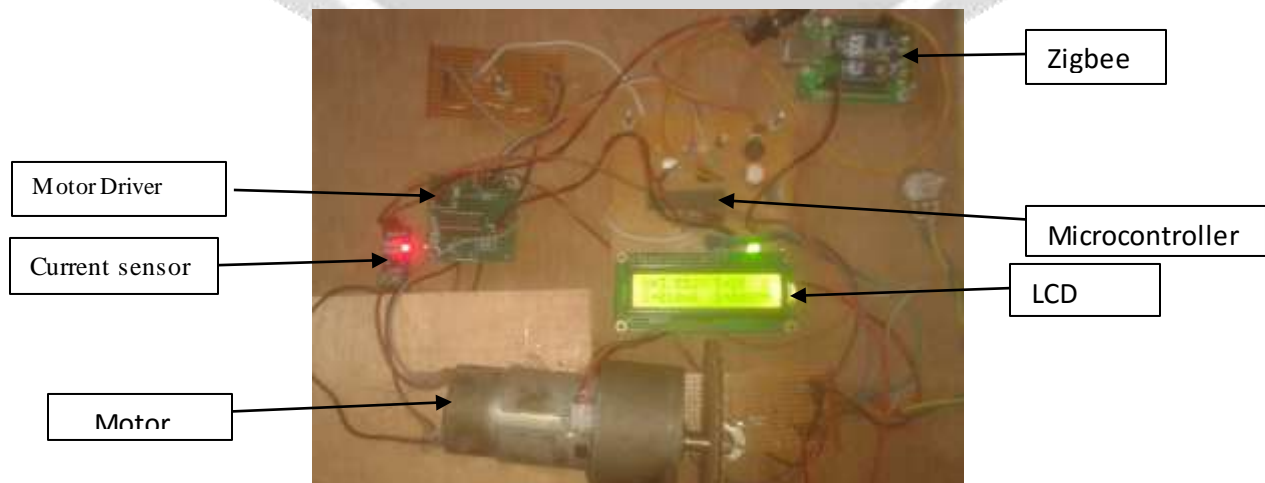
Current Sensor: This sensor is used to monitor the current rating of the DC motor. Here we are using Current hall sensor ACS 712 20A.

Voltage Sensor: This sensor is used to continuously monitor the voltage of the DC motor and Helps in sensing under and over voltage.

Encoder Sensor: Speed of revolution of DC motor can be measured using shaft encoder disc and Sensor. Here we are using FC-33/LM 393 for sensing the speed of DC motor.

Zigbee Trans Receiver: ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios. Its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics.

Microcontroller: A microcontroller (sometimes abbreviated µC, uC or MCU) is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals.
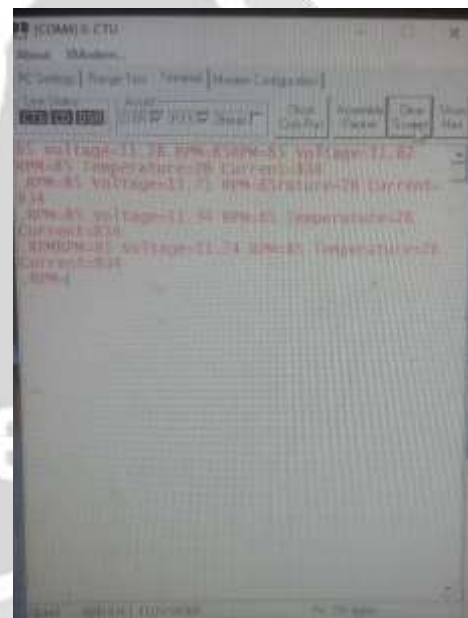
5. RESULT

Figure No. 8 shows the COM port selected when Zigbee is connected to COM port of PC or Laptop.

Figure No. 9 shows the serial communication with Zigbee and data on X-CTU.
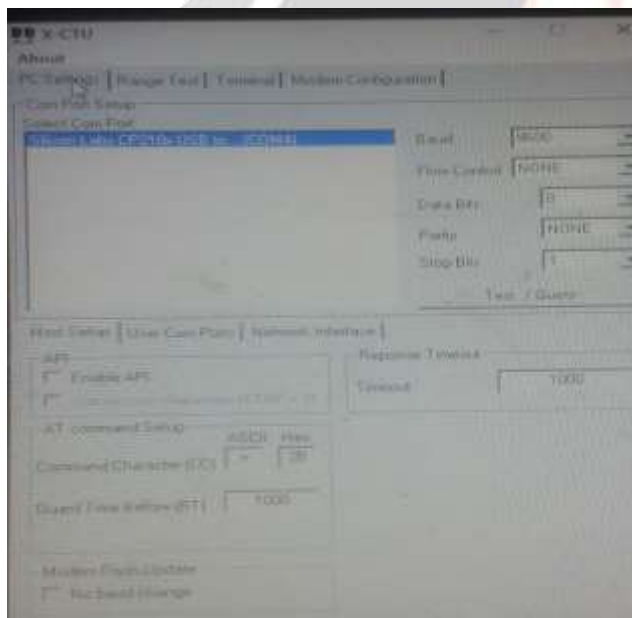
Fig. 8 Zigbee COM port Selection   **Fig. 9 Serial communication between Zigbee**

6. CONCLUSIONS

With the assistance of this study, a parameter monitoring system for DC Motor machines based on Zigbee protocol is achieved and tested with success. The system developed is capable to perform such operations as measuring, observation and dominant the most parameters of the motor like part currents, part voltages, wiring temperature and speed. All of those values can be transferred to the host pc, displayed on the interface, drawn graphically; observation and dominant the basic parameters of the DC Motors were examined and achieved in various ways. ZigBee technology is a new wireless protocol is employed for the communication. This protocol is wide used varied

areas for its higher reliableness, low power overwhelming profile, excellent Capability, high flexibility and low value. So it's vital to imbed the ZigBee protocol into the WSN system that wide applied currently in each space. The system achieved will be used for industrial applications. The entire system is also very helpful to schools and analysis institutes that have line, technical, and industrial education.

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