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Power Monitoring with Wireless Sensor Networks

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ABSTRACT:
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.

I. 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 automatingthe 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 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. The numerous techniques had been presented for going for walks, tracking, and detecting mechanical and electrical defects in DC Motor.

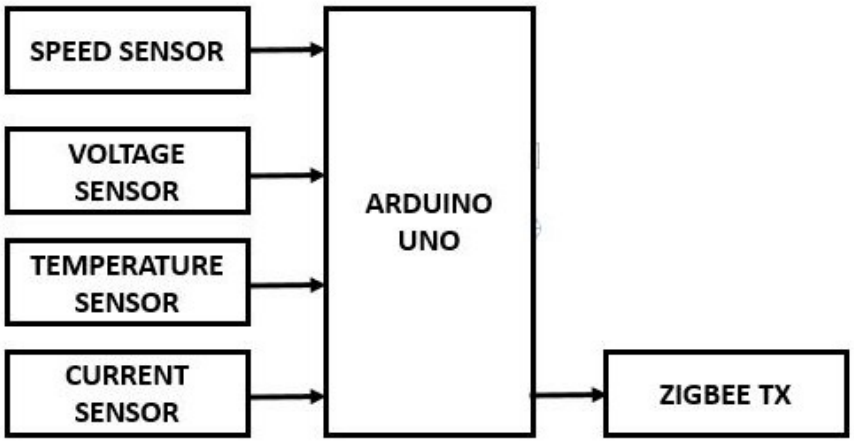
Traditional protection practices for detecting motor defects and defensive automobiles use numerous sorts of protection relays which include over cutting- edge relays, temperature relays, low and high modern-day safety relays, electromagnetic switches, contactors, and time relays. If the conventional 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.

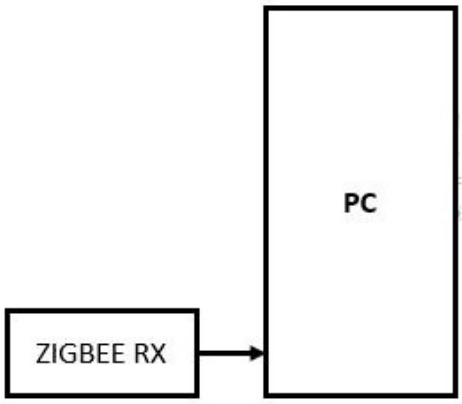
Any other drawback of the traditional safety strategies is their price; particularly, it is clear that traditional strategies increase the price of structures while digital systems reduce it. All measurements related to the DC motor were executed and protection against the failure of DC motor has been 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.

II. XPERIMENTAL OR MATERIAL AND METHOD

BLOCK DAIGRAM



Block diagram of transmitter side



Block diagram of Receiver side

Figure: 1. Block Diagram

III. ARDUINO UNO

It is an open-source platform, means the boards and software are readily available and anyone can modify and optimize the boards for better functionality. The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn it. It can be programmed using C and C++ language.

Arduino Uno is a microcontroller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328.

First Arduino project was started in Interaction Design Institute Ivrea in 2003 by David Cuartielles and Massimo Banzi with the intention of providing a cheap and flexible way to students and professional for controlling a number of devices in the real world. The current version of Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output.It allows the designers to control and sense the external electronic devices in the real world.

This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. IDE is equally compatible with Windows, MAC or Linux Systems, however, Windows is preferable to use. Programming languages like C and C++ are used in IDE.

Apart from USB, battery or AC to DC adopter can also be used to power the board.

Arduino Uno boards are quite similar to other boards in Arduino family in terms of use and functionality, however, Uno boards don't come with FTDI USB to Serial driver chip.

There are many versions of Uno boards available, however, Arduino Nano V3 and Arduino Uno are the most official versions that come with Atmega328 8-bit AVR Atmel microcontroller where RAM memory is 32KB..When nature and functionality of the task go complex, Mirco SD card can be added in the boards to make them store more information.

CURRENT SENSOR

This sensor is used to monitor the current rating of the DC motor.A current sensor is a device that detects and converts current to an easily measured output voltage, which is proportional to the current through the measured path.

Fig 2 Current sensor

When a current flows through a wire or in a circuit, voltage drop occurs. Also, a magnetic field is generated surrounding the current carrying conductor. Both of these phenomena are made use of in the design of current sensors. Thus, there are two types of current sensing: direct and indirect. Direct sensing is based on Ohm's law, while indirect sensing is based on Faraday's and Ampere's law.

Direct Sensing involves measuring the voltage drop associated with the current passing through passive electrical components.

Indirect Sensing involves measurement of the magnetic field surrounding a conductor through which current passes.

Generated magnetic field is then used to induce proportional voltage or current which is then transformed to a form suitable for measurement and/or control system. Sensing and Control (S&C) offers a wide variety of current sensors to monitor alternating (ac) or direct (dc) current. From digital output detectors sensing a few hundred milliamps to linear sensors monitoring over one thousand amps, our comprehensive line provides superior, often accurate performance at a reduced cost. As well as the advantages you'd expect from an experienced provider offering decades of engineering expertise: thru-hole design, fast response times, output voltage isolation from input

VOLTAGE SENSOR

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

A voltage sensor can in fact determine, monitor and can measure the supply of voltage. It can measure AC level or/and DC voltage level. The input to the voltage sensor is the voltage itself and the output can be analog voltage signals, switches, audible signals, analog current level, frequency or even frequency modulated outputs. That is, some voltage sensors can provide sine or pulse trains as output and others can produce Amplitude Modulation, Pulse Width Modulation or Frequency Modulation outputs.

In voltage sensors, the measurement is based on the voltage divider. Mainly two types are of voltage sensors are available- Capacitive type voltage sensor and Resistive type voltage sensor.

Fig 3. Voltage sensor

This module is based on the principle of resistive voltage divider design, it can make the red terminal connector input voltage to 5 times smaller. Arduino analog input voltages up to 5 v. The voltage detection module input voltage not greater than 5Vx5=25V (if using 3.3V systems, input voltage not greater than

Vx5=16.5V

The Smart Q Voltage Sensors are used to measure the potential difference between the ends of an electrical component. This range of Voltage Sensors can be used to measure both DC and low-voltage AC circuits. The Smart Q Voltage Sensors are equipped with a micro controller that greatly improves v the sensor accuracy, precision and consistency of the readings.

They are supplied calibrated and the stored calibration (in Volts) is automatically loaded when the Voltage Sensor is connected.

TEMPERATURE SENSOR

This sensor is used to monitor the temperature of the DC motor. Here we are using LM35 as temperature sensor. Temperature sensor is a thermocouple or a resistance temperature detector (RTD) that gathers the temperature from a specific source and alters the collected information into understandable type for an apparatus or an observer. Temperature sensors are used in several applications namely HV system and AC system environmental controls, medical devices, food processing units, chemical handling, controlling systems, automotive under the hood monitoring and etc.

The most frequent type of temperature sensor is a thermometer, used to determine the temperature of solids, liquids, and gases. It is also mostly used for non-scientific purposes as it is not so accurate. The different kinds of sensors are categorized by the sensing capacity of the sensor as well as the range of applications. The different types of temperature sensors include the following.

- Thermocouples
- Thermistors
- Resistor temperature detectors
- Semiconductors
- Infrared sensors
- Thermometers

LM35 is a precession Integrated circuit Temperature sensor, whose output voltage varies, based on the temperature around it. It is a small and cheap IC which can be used to measure temperature anywhere between -55°C to 150°C. It can easily be interfaced with any Microcontroller that has ADC function or any development platform like Arduino.

Power the IC by applying a regulated voltage like +5V (VS) to the input pin and connected the ground pin to the ground of the circuit.

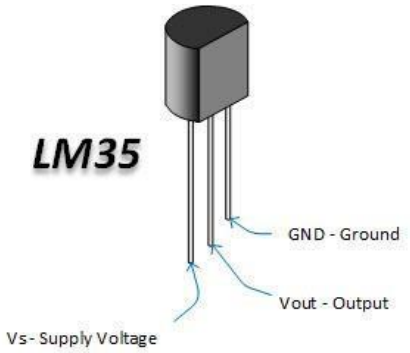


Fig 4. Temperature sensor

If the temperature is 0°C, then the output voltage will also be 0V. There will be rise of 0.01V (10mV) for every degree Celsius rise in temperature. The voltage can converted into temperature using the below formulae.

SPEED SENSOR

Speed is measured using different kinds of sensors operating on different principles. Subsequent sections will discuss various kinds of sensors used for measurement of speed and related vector quantity, velocity.

Useful Applications in Real-time

1. In home automation application, convinced of remotely controlling the speed of fan is achieved.
2. Many industrial applications require adjustable speed and constant speed for improvement of quality product.
3. Intensity of light can also be controlled with the help of android application.
4. Bell drive application like small conveyors, large blowers, pumps as well as many direct drive or geared application.
5. Wood working machinery air compressors, high processors, water pumps, vaccum pump and high torque application.
6. Remote operation is achieved by any smart-phone /tablet etc. With android os.
7. Technically expert controller is not required.
8. Android app is an open source system to develop any programming code.
9. Programming code is not always required to change for different input parameters.
10. Bluetooth consumes less power so more preferable.
11. More useful for the patient and disabled person.

Communication:

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an *.inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. To use the SPI communication, please see the ATmega328 datasheet.

SENSING PRINCIPLES

Various kinds of principles are employed in speed sensors. Some of them are listed below

1. Variable reluctance based
2. Hall effect based
3. Eddy Current based
4. Radar Doppler based
5. LIDAR based
6. Accelerometer based
7. Pitot tube based.
8. Pitotmeter based.

Fig 5 Speed sensor

Speed of revolution of induction machine can be measured using shaft encoder wheel and sensor. An encoder is a rotational transducer that converts angular movement into digital impulses. Speed sensor: Different types speed measurement sensors are there. To count the events, is nothing but speed sensing. The photo electric transducer may be used for this purpose. The arrangement is as below. The rotating disc is mounted on a shaft. The rotation is sensed. The transducer section of the project is followed by analog signal conditioning of each parameter.

3.7 DC SERVO MOTOR

A motor is an electrical machine which converts electrical energy into mechanical energy. The principle of working of a DC motor is that "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". The direction of this force is given by Fleming's left hand rule and it's magnitude is given by F = BIL.

Where, B = magnetic flux density, I = current and L = length of the conductor within the magnetic field.

Fig 6 Dc servo motor

Three types of DC Motor available.

Brushed Motor

This type of motor produces a magnetic field in a wound rotor (the part that rotates) by passing an electrical current through a commutator and carbon brush assembly, hence the term “Brushed”. The stators (the stationary part) magnetic field is produced by using either a wound stator field winding or by permanent magnets. Generally brushed DC motors are cheap, small and easily controlled.

Brushless Motor

This type of motor produce a magnetic field in the rotor by using permanent magnets attached to it and commutation is achieved electronically. They are generally smaller but more expensive than conventional brushed type DC motors because they use “Hall effect” switches in the stator to produce the required stator field rotational sequence but they have better torque/speed characteristics, are more efficient and have a longer operating life than equivalent brushed types.

Servo Motor

This type of motor is basically a brushed DC motor with some form of positional feedback control connected to the rotor shaft. They are connected to and controlled by a PWM type controller and are mainly used in positional control systems and radio controlled models.

APPLICATIONS OF A DC MOTOR

In depends on the type of DC motor, which applications are ideal. Generally speaking, the following applications are common.

- Cranes
- Conveyors
- Pumps
- Fans
- Machine tools
- Air compressors
- Toys
- Motor starters in cars

-Motor Driver

Motor drives are circuits used to run a motor. In other words, they are commonly used for motor interfacing. These drive circuits can be easily interfaced with the motor and their selection depends upon the type of motor being used and their ratings (current, voltage).Motor Driver circuits are current amplifiers. They act as a bridge between the controller and the motor in a motor drive. Motor drivers are made from discrete components which are integrated inside an IC. The input to the motor driver IC or motor driver circuit is a low current signal. The function of the circuit is to convert the low current signal to a high current signal. This high current signal is then given to the motor. The motor can be a brushless DC motor, brushed DC motor, stepper motor, other DC motors etc.

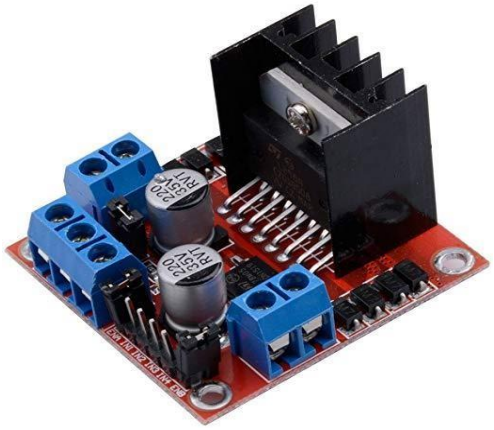


Fig 7. Motor driver

Features

- High level functionality.
- Better performance.
- Provides high voltage.
- Provides high current drive.
- Includes protection schemes to prevent the failure of motors due to any faults.

ZIGBEE

Zigbee communication is specially built for control and sensor networks on IEEE 802.15.4 standard for wireless personal area networks (WPANs), and it is the product from Zigbee alliance. This communication standard defines physical and Media Access Control (MAC) layers to handle many devices at low-data rates.The date rate of 250 kbps is best suited for periodic as well as intermediate twoway transmission of data between sensors and controllers.

Zigbee is low-cost and low-powered mesh network widely deployed for controlling and monitoring applications where it covers 10-100 meters within the range. This communication system is less expensive and simpler than the other proprietary short-range wireless sensor networks as Bluetooth and Wi-Fi.

ZigBee Module

ZigBee is a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios. Though its low power consumption limits transmission distances to 10–100 meters line-of-sight, depending on power output and environmental characteristics, ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking (ZigBee networks are secured by 128 bit symmetric encryption keys). ZigBee has a defined rate of 250kbit/s, best suited for intermittent data transmissions from a sensor or input device. Applications include wireless light switches, electrical meters with in-home- displays, traffic management systems, and other consumer and industrial equipment that require short-range low-rate wireless data transfer. ZIGBEE is a new wireless technology guided by the IEEE 802.15.4 Personal Area Networks standard. It is primarily designed for the wide ranging automation applications and to replace the existing non-standard technologies. It currently operates in the 868MHz band at a data rate of 20Kbps in Europe, 914MHz band at 40Kbps in the USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250Kbps.

The ZIGBEE specification is a combination of Home RF Late and the 802.15.4 specification. The specification operates in the 2.4GHz (ISM) radio band - the same band as 802.11b standard, Bluetooth, microwaves and some other devices. It is capable of connecting 255 devices per network. The specification supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZIGBEE's technology is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power.

802.15.4 (ZIGBEE) is a new standard uniquely designed for low rate wireless personal area networks. It targets low data rate, low power consumption and low cost wireless networking, and its goal is to provide a physical-layer and MAC-layer standard for such networks. Wireless networks provide advantages in deployment, cost, size and distributed intelligence when compared with wired networks. This technology allows users to set up a network quickly, and allows them to set up networks where it is impossible or inconvenient to wire cables. Wireless networks are more cost- efficient than wired networks in general. Bluetooth (802.15.1) was the first well known wireless standard facing low data rate applications.

The effort of Bluetooth to cover more applications and provide quality of service has led to its deviation from the design goal of simplicity, which makes it expensive and inappropriate for some simple applications

requiring low cost and low power consumption. These are the kind of applications this new standard is focused on. It's relevant to compare here Bluetooth and ZIGBEE, as they are sometimes seen as competitors, to show their differences and to clarify for which applications suits each of them. The data transfer capabilities are much higher in Bluetooth, which is capable of transmitting audio, graphics and pictures over small networks, and also appropriate for file transfers. ZIGBEE, on the other hand, is better suited for transmitting smaller packets over large networks; mostly static networks with many, infrequently used devices, like home automation, toys, remote controls, etc.

Applications of Zigbee Technology

Industrial Automation

In manufacturing and production industries, a communication link continually monitors various parameters and critical equipments. Hence Zigbee considerably reduce this communication cost as well as optimizes the control process for greater reliability.

Home Automation:

Zigbee is perfectly suited for controlling home appliances remotely as a lighting system control, appliance control, heating and cooling system control, safety equipment operations and control, surveillance, and so on.

Smart Metering:

Zigbee remote operations in smart metering include energy consumption response, pricing support, security over power theft, etc.

Smart Grid monitoring:

Zigbee operations in this smart grid involve remote temperature monitoring, fault locating, reactive power management, and so on.

IV. SYSTEM DESIGN

IoT stands for Internet of Things, which means accessing and controlling daily usable equipments and devices using Internet.Connecting everyday things embedded with electronics, software, and sensors to internet enabling to collect and exchange data without human interaction called as the Internet of Things (IoT). The term "Things" in the Internet of Things refers to anything and everything in day to day life which is accessed or connected through the internet.

IoT is an advanced automation and analytics system which deals with artificial intelligence, sensor, networking, electronic, cloud messaging etc. to deliver complete systems for the product or services. The system created by IoT has greater transparency, control, and performance.

As we have a platform such as a cloud that contains all the data through which we connect all the things around us. For example, a house, where we can connect our home appliances such as air conditioner, light, etc. through each other and all these things are managed at the same platform. Since we have a platform, we can connect our car, track its fuel meter, speed level, and also track the location of the car.

Features of IOT

The most important features of IoT on which it works are connectivity, analyzing, integrating, active engagement, and many more. Some of them are listed below:

Connectivity:
Connectivity refers to establish a proper connection between all the things of IoT to IoT platform it may be server or cloud. After connecting the IoT devices, it needs a high speed messaging between the devices and cloud to enable reliable, secure and bi- directional communication.

Analyzing:
After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence. If we have a good insight into data gathered from all these things, then we call our system has a smart system.

Integrating:
IoT integrating the various models to improve the user experience as well.

Artificial Intelligence:
IoT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine itself order the coffee beans of your choice from the retailer.

Sensing:
The sensor devices used in IoT technologies detect and measure any change in the environment and report on their status. IoT technology brings passive networks to active networks. Without sensors, there could not hold an effective or true IoT environment.

Active Engagement:
IoT makes the connected technology, product, or services to active engagement between each other.

Endpoint Management:
It is important to be the endpoint management of all the IoT system otherwise, it makes the complete failure of the system.

Embedded Devices (System) in (IoT)
It is essential to know about the embedded devices while learning the IoT or building the projects on IoT. The embedded devices are the objects that build the unique computing system. These systems may or may not connect to the Internet.

An embedded device system generally runs as a single application. However, these devices can connect through the internet connection, and able communicate through other network devices.

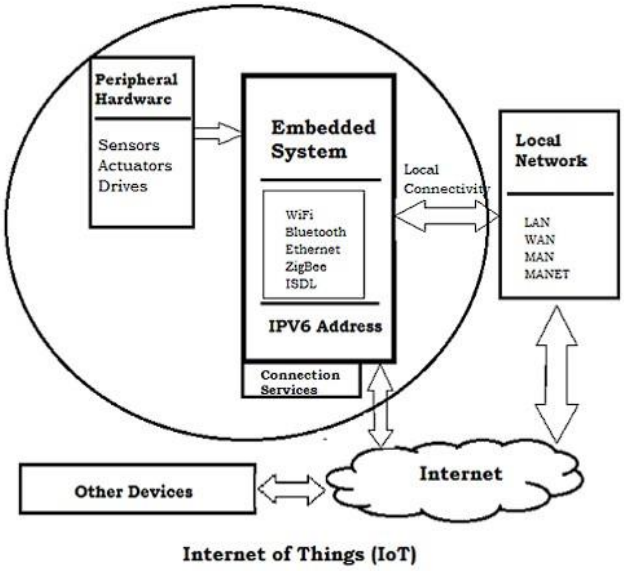


Fig 8. Block diagram of Embedded device system

WIRELESS SENSOR NETWORK

The wireless system for monitoring purpose will not only reduce the overall cost, but also provide flexibility in system in term of distance or location. So these systems are widely used in industries, military, hospitals, home and other commercial areas. According to these aspects the ZigBee becomes the new standard intended for low cost devices in automation, computer peripherals and home controls. ZigBee standard performs well at industrial environments. The developed platform is cost-effective and reduces the energy consumption.

ZIGBEE NETWORK STRUCTURES

There are three network topologies. They are Star Network, Cluster- Tree Network and Mesh Network. For all network topologies, there can be only one coordinator in each network. In star topology there is a coordinator which is responsible for all over the network. All other devices are back-end devices and directly communicate with the coordinator. This topology is suitable for networks with a centralized device and for time critical applications. Next is a cluster tree network where coordinators are still responsible for the network initiating and maintenance. However, routers can be used to extend the network. Routers control data flow by using hierarchical routing strategies in the network. They also may imply beacon enabled network that is defined in IEEE 802.15.4 for periodical data transmission. In mesh network, coordinator is seen as responsible for the network initiating and maintenance. Routers can be used to extend the network. A mesh network allows full peer to peer communication. A mesh relies on this self-healing technology so that if a node fails another route is used for the data delivery.

EXISTING SYSTEM:

The RS-485 link is preferred over other serial interfaces due to its immunity over noise and its ability to withstand proper and undistorted communication over larger distances User Interface: The UI is an Android based application. The code is developed in Java and XML to create buttons, String entries and displays. This application is installed on an Android mobile phone or tablet. The application uses Bluetooth hardware

Present in the Android device and communicates with The Bluetooth module (WT11-A) present at the drive-end. It provides a user interface for a number of functions:

Switching the motor ON/OFF Setting priming speed.
Setting different values of speed and duration of running. This will be set in a number of sequential steps with different settings. An override option will also be available.
Displaying feedback to monitor parameters and detect faults.

V. PROPOSED SYSTEM

In this system the D.C motor parameter such as speed, voltage, temperature winding and current rating are monitored and controlled[5]. At the transmitter side voltage, temperature, 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. 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.
PC will consists of Data logger which will have monitored data of all sensors with date and time. The system is fully controlled by the Personal Computer through Visual Basics GUI (Graphical User Interface).Signal to the control section is given from PC. The GUI is developed based on application by the user. All the processor and controllers are interconnected to personal computer through Zigbee.

ADVANTAGES OF PROPOSED SYSTEM:
The advantage of wireless sensor network is that they can be used with ease in the environment where wired system cannot be used or if used, are to be treated with caution, for example, in medical treatment.

VI PERFORMANCE ANALYSIS

INTERNET OF THINGS (IOT)
Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes.Some also use the term industrial Internet interchangeably with IoT. This refers primarily to commercial applications of IoT technology in the world of manufacturing.

BENEFITS OF IoT
• Improved Customer Engagement
IoT improves customer experience by automating the action. For e.g. any issue in the car will be automatically detected by the sensors. The driver, as well as the manufacturer, will be notified about it. Till the time driver reaches the service station, the manufacturer will make sure that the faulty part is available at the service station.
• Technical Optimization
IoT has helped a lot in improving technologies and making them better. The manufacturer can collect data from different car sensors and analyze them to improve their design and make them much more efficient.

• Reduced Waste

Our current insights are superficial, but IoT provides real-time information leading to effective decision making & management of resources. For example, if a manufacturer finds fault in multiple engines, he can track the manufacturing plant of those engines and can rectify the issue with manufacturing belt.

APPLICATIONS OF IoT

The versatility of IoT has become very popular in recent years. There are many advantages to having a device based on IoT. Mckinsey Global Institute reports that IoT business will reach 6.2 trillion in revenue by 2025. There are lots of applications are available in the market in different areas.

Personal Home Automation System:

Wemo Switch Smart Plug: It is the most useful devices which connected home devices in the Switch, a smart plug. It plugs into a regular outlet, accepts the power cable from any device, and can be used to turn it on and off on hit a button on your smartphone.

Enterprise:

In the enterprise area many applications are there Like environmental monitoring system, smart environment etc.

Nest Smart Thermostat: It is connected to the internet. The Nest learns automatically your family's routines and will automatically adjust the temperature based on your activities, to make your house more efficient. There is also a mobile app which allows the user to edit temperature and schedules.

Utilities:

Smart metering, smart grid, and water monitoring system are the most useful applications in the various utility area.

Energy Management:

Advanced Metering Infrastructure is the major example in this area.

Large scale deployment:

There are various large projects ongoing in the world. Songdo (South Korea), the first of its kind fully wired Smart City, is near completion. Everything in this city is planned to be wired, connected and turned into a data stream that would be monitored by an array of computers without any human interaction.

Transportation:

Electronic toll collection system is the most useful example in this area.

Medical and Health Care:

Remote health monitoring and emergency notification system are examples of IOT in the medical field.

Health patch Health Monitor: It can be used for the patient who can't go to doctors, letting them get ECG, heart rate, respiratory rate, skin temperature, body posture, fall detection, and activity readings remotely.

SOFTWARE INTRODUCTION

-Introduction To Embedded C

Looking around, we find ourselves to be surrounded by various types of embedded systems. Be it a digital camera or a mobile phone or a washing machine, all of them has some kind of processor functioning inside it. Associated with each processor is the embedded software. If hardware forms the body of an embedded system, embedded processor acts as the brain, and embedded software forms its soul. It is the embedded software which primarily governs the functioning of embedded systems.

During infancy years of microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. There used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check correct execution of the program. Some 'very fortunate' developers had In-circuit Simulators (ICEs), but they were too costly and were not quite reliable as well.

As time progressed, use of microprocessor-specific assembly- only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Initially C was developed by Kernighan and Ritchie to fit into the space of 8K. and to write (portable) operating systems. Originally it was implemented on UNIX operating systems.

As it was intended for operating systems development, it can manipulate memory addresses. Also, it allowed programmers to write very compact codes. This has given it the reputation as the language of choice for hackers too.

-Embedded Systems Programming

Embedded systems programming is different from developing applications on a desktop computers. Key characteristics of an embedded system, when compared to PCs, are as follows:

- Embedded devices have resource constraints(limited ROM, limited RAM, limited stack space, less processing power)
- Components used in embedded system and PCs are different; embedded systems typically uses smaller, less power consuming components.
- Embedded systems are more tied to the hardware.

Two salient features of Embedded Programming are code speed and code size. Code speed is governed by the processing power, timing constraints, whereas code size is governed by available program memory and use of programming language. Goal of embedded system programming is to get maximum features in minimum space and minimum time.

Embedded systems are programmed using different type of languages:

- Machine Code
- Low level language, i.e., assembly
- High level language like C, C++, Java, Ada, etc.
- Application level language like Visual Basic, scripts, Access, etc.

Assembly language maps mnemonic words with the binary machine codes that the processor uses to code the instructions. Assembly language seems to be an obvious choice for programming embedded devices. However, use of assembly language is restricted to developing efficient codes in terms of size and speed. Also, assembly codes lead to higher software development costs and code portability is not there.
Developing small codes are not much of a problem, but large programs/projects become increasingly difficult to manage in assembly language. Finding good assembly programmers has also become difficult nowadays. Hence high level languages are preferred for embedded systems programming.

Use of C in Embedded Systems:
• It is small and reasonably simpler to learn, understand, program and debug.
• C Compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.
• Unlike assembly, C has advantage of processor- independence and is not specific to any particular microprocessor/ microcontroller or any system. This makes it convenient for a user to develop programs that can run on most of the systems.
• As C combines functionality of assembly language and features of high level languages, C is treated as a 'middle-level computer language' or 'high level assembly language'
• It is fairly efficient
• It supports access to I/O and provides ease of management of large embedded projects.

Many of these advantages are offered by other languages also, but what sets C apart from others like Pascal, FORTRAN, etc. is the fact that it is a middle level language; it provides direct hardware control without sacrificing benefits of high level languages .Compared to other high level languages, C offers more flexibility because C is relatively small, structured language; it supports low-level bit-wise data manipulation. Compared to assembly language, C Code written is more reliable and scalable, more portable between different platforms (with some changes). It is easier to write good code in C & convert it to an efficient assembly code rather than writing an efficient code in assembly itself. Benefits of assembly language programming over C are negligible when we compare the ease with which C programs are developed by programmers.
Applications of Embedded Systems
Embedded systems have a vast variety of application domains that varies from low cost to high, consumer electronics to industrial equipments, entertainment devices to academic equipments and medical instruments to weapons and aerospace control systems. The applications of embedded systems include home appliances, office automation, security, telecommunication, instrumentation, entertainment, aerospace, banking and finance, automobiles personal and in different embedded systems projects.

SOFTWARE DESCRIPTION Arduino IDE:

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.
Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they

can be communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

1. Open Arduino IDE as shown below

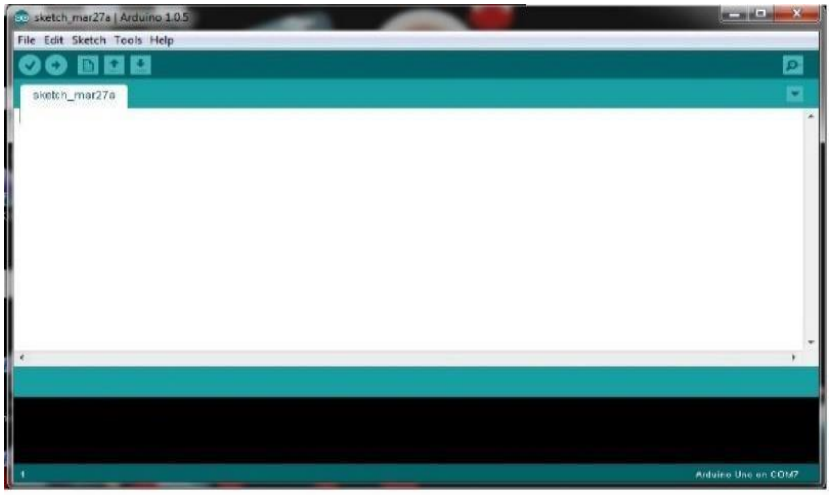


Fig 9 Opening Arduino IDE

2. Select the COM Port from tool

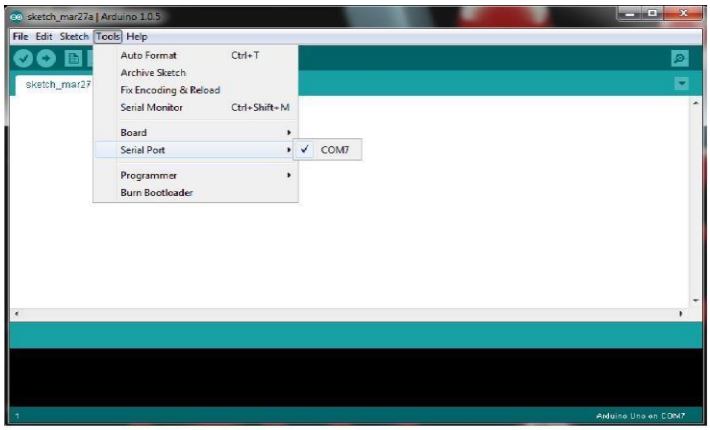


Fig 10 Selecting the COM Port

3. Select the required Arduino board from Tools as shown below
5. Compile and upload the Sketch to Arduino board

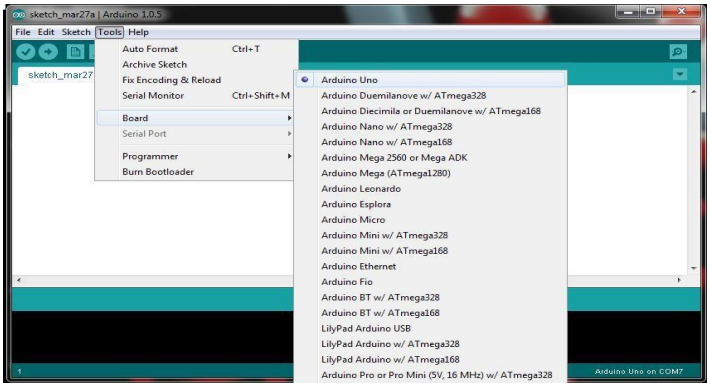


Fig 11 Selecting the required Arduino board

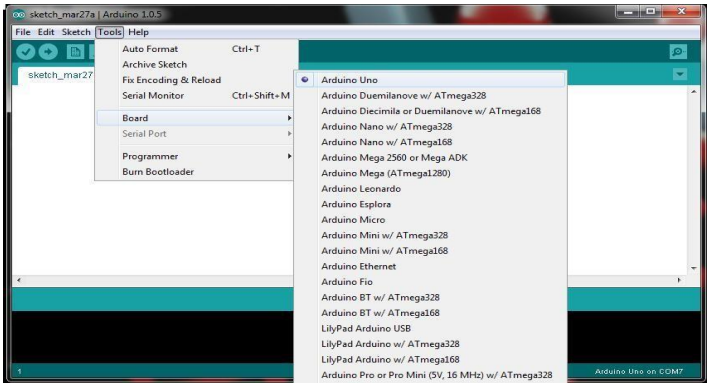


Fig 12 Selecting the required Arduino board

4. Write the sketch in Arduino IDE

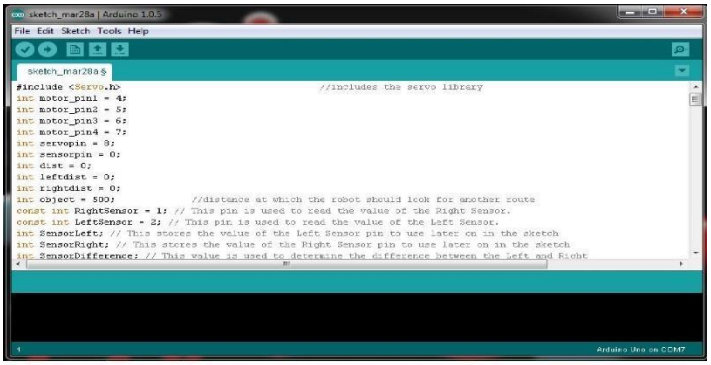


Fig 13. Sketching a program in Arduino IDE

Fig 14. upload the program sketch to Arduino board

CONCLUSION

This system will help in monitoring and control the D.C motor parameters which is widely used in industries. Use of Zigbee communication protocol helps in reducing the wires and hardware significantly. Remote monitoring and controlling is possible. 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 reliability, 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. Entire system is also very helpful to schools and analysis institutes that have line, technical, and industrial education.

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