



A REVIEW ON SMART PHONE BASED ENERGY MONITORING SYSTEM FOR BLDC

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ABSTRACT: - Speed control of Brushless DC motor has a wide range of applications in today's world. In this paper a strategy dependent on remote speed control of Brushless DC engine by means of Bluetooth is proposed. The sign is sent from the android portable which is associated with the Atmega 328 through Bluetooth module. Heartbeat Width Modulation (PWM) method is utilized to control the speed of the Brushless Direct Current motor (BLDC). The display shows the control commands and responses obtained to get both Clockwise and Anti-clockwise torque.

Index terms - ATmega328 microcontroller, Bluetooth, Brushless DC (BLDC) motor

I. INTRODUCTION

The Internet of things is the internetworking of physical devices, vehicles also referred to as "connected devices" and "smart devices", buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. [1] In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IOT as "the infrastructure of the information society." [2]. The IoT allows objects to be sensed or then again controlled distantly across existing organization framework, setting out open doors for more straightforward joining of the actual world into PC based frameworks, and bringing about further developed effectiveness, precision and monetary advantage notwithstanding diminished human mediation [3], [4] When IOT is increased with sensors and actuators, the innovation turns into a case of the more broad class of digital actual frameworks, which additionally incorporates advances like brilliant matrices, keen homes, insightful transportation and shrewd urban communities. Every thing is remarkably recognizable through its installed figuring framework yet can interoperate inside the current Internet foundation. Specialists gauge that the IoT will comprise of just about 50 billion articles by 2020 [5]. Normally, IoT is relied upon to offer progressed availability of gadgets, frameworks, and administrations that goes past machine to machine (M2M) communications and covers a variety

of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to areas such as smart cities [6]. The current market examples include home automation also known as smart home devices such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning, (HVAC) systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens or refrigerators/freezers that use Wi-Fi for remote monitoring. As well as the expansion of Internet-connected automation into a plethora of new application areas, IoT is also expected to generate large amounts of data from diverse locations, with the consequent necessity for quick aggregation of the data, and an increase in the need to index, store, and process such data more effectively [7].

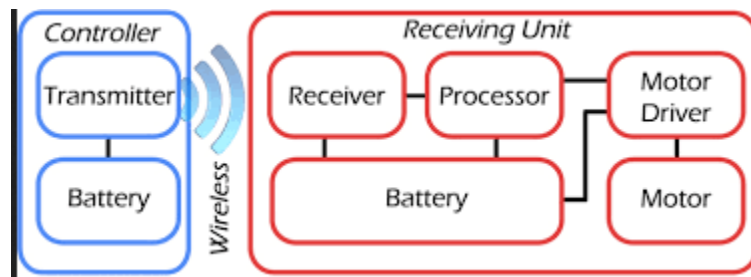


Fig 1- Wireless control of motor

A energy monitoring system is set of economical handheld online real-time data-acquisition devices for motor abnormal detection based on vibrational and electrical detection methods was developed. This is a low cost, small size and simple use motor condition monitoring system. Remote Sensing Electric Motor Operation Optimizes Maintenance and Energy Efficiency. Instantaneous power consumption and motor efficiency monitoring enables real time optimization of energy usage required for the motor load condition. DC motors are extensively used in domestic and modern applications because of better attributes over their AC partners. Brushless DC engines are quick supplanting the ordinary DC engines due to their brilliant attributes, higher effectiveness and less mileage and so forth A Brushless DC engine is a perpetual magnet simultaneous electric engine, driven by direct flow. Not at all like show DC engines having brushes that connect with commutator on rotor to finish the electrical way between the electrical source and armature windings. In BLDC engine there are no brushes present rather electrical compensation is done through perpetual magnet rotor and a stator with a grouping of curls. Speed control of D.C Motors assumes a significant part in mechanical computerization for assembling purposes. The industrial applications such as pharmaceutical, textile, plastics, robotics and even automobile industries require speed control of such motors. The BLDC motors have wide range of applications including actuators for industrial robots, washing machines, fans and CD/DVD drives etc.

Due to recent development in technology, wireless or remote control of motors is in demand due to ease of operation and control from distance. The aim of proposed work is to develop a prototype for future applications. Here we are combining two different technologies i.e. a

Brushless DC motor and a Bluetooth module. Bluetooth technology helps us to make the control wireless.

II. DESIGN AND IMPLEMENTATION

The schematic diagram for speed and direction control of a BLDC motor is shown in given in Fig.2. In this signal is sent by the android application and further transmitted to the Bluetooth module and received by atmega 328. This scheme is able to drive the motor clockwise or anticlockwise. The direction control of the motor is done by reversing the current flow direction either in Armature or Field winding of the Brushless DC motor.

- The 5V-2A supply is given to the microcontroller atmega 328 and Bluetooth module. As we know Bluetooth module is used for wireless application. The atmega 328 microcontroller consists of advanced RISC architecture, good performance, low power consumption, real timer counter having separate oscillator, 6 PWM pins. This microcontroller is suitable for our project.
- The Bluetooth will blink after giving supply and the software we are using for the project is automation which is easily available in android based device. As when we open the software there is the option of pairing. Once the Bluetooth module is paired to our mobile it will show you the type of command as we give through the program.
- To control the BLDC motor we connect the BLDC controller which limits the speed of BLDC.
- Here we have added a command 1 to 7 numbers as we know speed will vary as we increase the number and vice versa.
- When we give command 1 the motor will be placed at its initial condition that is 'OFF STATE'. Once we put command 2 the motor will start moving in clockwise direction. As we type 3 the speed of motor will increase more than 2. The speed of motor increases till 7 because we are giving limited current. If we put command 8, 9 or anything the speed of the motor will remain the same.
- If we randomly choose any number between 1 to 7, the motor will act as per command.

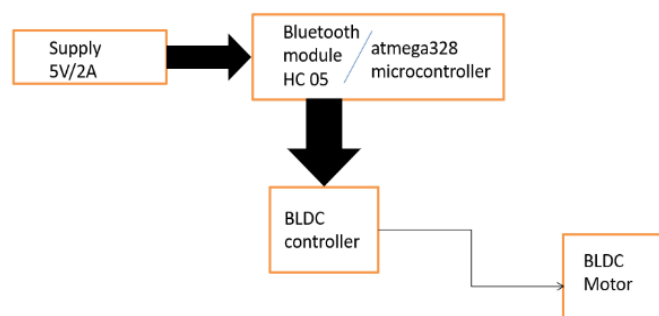


Fig.2. Schematic Diagram of Proposed Speed Control System

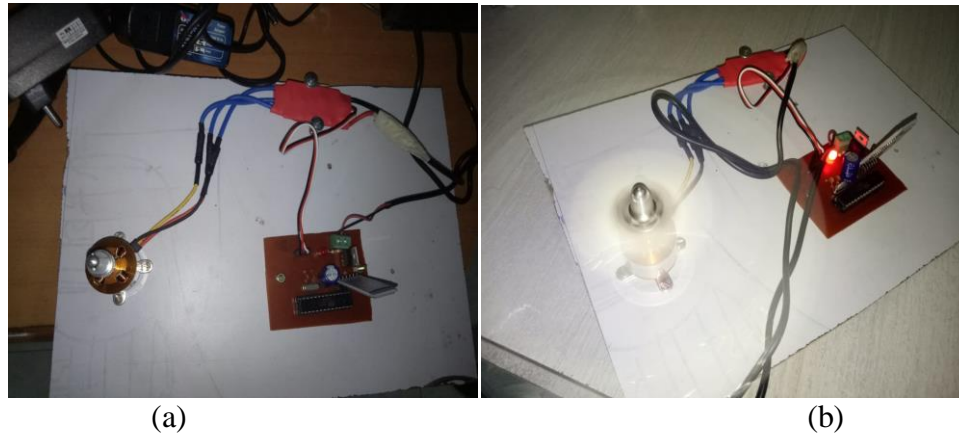


Fig 3 – Hardware of Speed Control System

Fig .2a it shows the schematic system of the speed control system BLDC motor connected to atmega 328 microcontroller through bldc controller and bluetooth module hc05 receives the signal according to that motor runs and speed is controlled. Fig 2b shows the bluetooth module control on the mobile display [12] for speed and direction control of BLDC motor. The inputs 1,2,3 rotates the motor in clockwise direction and the inputs 4,5,6 rotates the motor in anticlockwise direction.

a) ATMEGA328 microcontroller

Its function is ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory. ATmega328 has 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). ATmega328 is an 8-bit, 28-Pin AVR Microcontroller, manufactured by Microchip, follows RIS Architecture and has a flash-type program memory of 32KB. The essential features of the controller are:

- 28-pin AVR Microcontroller
- Flash Program Memory: 32 kbytes
- EEPROM Data Memory: 1 kbytes
- SRAM Data Memory: 2 kbytes
- I/O Pins: 23
- Timers: Two 8-bit / One 16-bit
- A/D Converter: 10-bit Six Channel
- PWM: Six Channels
- RTC: Yes with Separate Oscillator
- MSSP: SPI and I²C Master and Slave
- USART: Yes
- External Oscillator: up to 20MHz

b) Bluetooth Module (HC05)

For Bluetooth connectivity, HC05 module is used in this work. It is needed for a wireless, transparent communication setup. Master/Slave configuration of the module can be used as a better solution for wireless communication. The module is a Bluetooth V2.0 with EDR. Also it has a 2.4 GHz transceiver and baseband [19]. The specifications of Bluetooth Module are-

- Bluetooth Version: V2.0 EDR
- Frequency: 2.4GHz
- Modulation: GFSK
- Dissipated power: $\leq 4\text{dBm}$
- Sensitivity: $\leq -84\text{dBm}$
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps Synchronous: 1Mbps/1Mbps
- Security: Encryption and Authentication
- Input Voltage and Current: 3.3VDC, 50mA
- Working temperature: $-15 \sim 75\text{Centigrade}$
- Dimension: 27mm x 13mm x 2mm

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data. • Model: HC-05 • Input Voltage: DC 5V • Communication Method: Serial Communication • Master and slave mode can be switched.

c) Brushless DC Motors

Brushless DC motor unlike conventional D.C. motor doesn't have any brushes. In a vast speed range these motors are capable of producing high torques efficiently. In these motors there are permanent magnets rotating around a stationary armature. The problem of connecting current to the armature is solved by using permanent magnets. These motors are used widely due to their smooth operation [20].



Fig. 4- C. Brushless DC Motor



Some of the advantages of BLDC Motors are-

- High Rotating Speed – A BLDC motor can be operated at speeds above 11,000 rpm under both loaded and unloaded conditions.
- Accelerate and decelerate quickly due to low inertia.
- High Power – BLDC motors have the high running torque per inch cube as compared to any DC motor.
- High Reliability – Absence of brushes results in more reliable and higher life expectancies of over 11,000 hours.

d) E&E: Arduino Automation Application

Our Arduino Automation is an application that allows you to control devices using your Arduino Board (and similar boards) via Bluetooth or WiFi, and so to create awesome and fully customized projects, with the interfaces available within the app

III. CONCLUSION

In this work, the Brushless DC engine speed and bearing have been controlled through Arduino Uno by means of Bluetooth. The terminal voltage has been changed with change in obligation cycle. The obligation cycle is differed through PWM control. The circuit utilized in the plan is not difficult to carry out and might be helpful for different distant speed control applications for Brushless DC engine.

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