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IOT BASED SPEED CONTROL OF DC MOTOR USING PWM TECHNIQUE

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Abstract - In this paper, the IOT based control of dc motor has been reported. Internet is the most widely used, high speed and easily accessible communication medium in modern day world. In this system, the switching and the speed of dc motor can be controlled by using self-developed android application. In industry dc motor is widely uses for speed control and load characteristics, speed control of dc motor is very crucial in application where required speed is precision and correcting signal representing and to operate motor at constant speed, so we use PWM method.

Index Terms - IOT, android application, Internet.

1. INTRODUCTION

Internet was used in earlier time only for basic communication and information sharing. today the power of internet is applied for doing many task like controlling a remotely place server machine from anywhere in the world. DC motor are very useful for various application because of their wide range of speed control and relatively small size. In previous time for controlling or operating two or more motors the workers need to go to respective location where the motor is placed but with the help of this technology the operator can easily control all motors of the plant from single control room. In this paper controller presented uses the pulse width modulation (PWM) technique for speed control of dc motor. Using ATMEGA 328 microcontroller generate the PWM wave for speed control of dc motor. We need a variable voltage dc power source to control the speed of the dc motor. In this paper we use PWM method so it switches the motor ON and OFF with a pulse wave. The main objective of this paper is to become easy with the implementation of hardware of ATMEGA328 microcontroller based speed control of dc motor. L293D IC is used to provide to motor and infrared sensor is used to count the speed which are interface with ATMEGA328 IC. It gives a sense of occurring overload to operator at overload condition and speed display on LCD screen. The system consist of very simple and easy to use equipment which can handle tasks as a controlling the dc motor using the concept of Internet of things (IOT). The system will improve the efficiency of industries to great extent. Also it reduce the man power used substantially resulting in great save in industrial revenue as human resource is very precious.

2. METHODOLOGY

The main methodology of this entire project is depend on IOT based embedded system so interfacing of all hardware with wifi and internet is very important part in its functioning. The whole programming is done in Arduino IDE and then it is loaded in the node MCU and with the help of wifi and various sensors we have achieved the required goal like speed control of dc motor from mobile application. with the help of PWM technique which can generated by ATMEGA328 microcontroller by varying the width of duty cycle we can vary the speed of dc motor.

3. COMPONENTS USED:

A. Pulse width modulation:

PWM have many characteristics of control system. A simple method to control the speed of dc motor is to control driving voltage, when the voltage is high the speed would be high. In many application normal voltage control would cause lot of power loss on control system, so PWM method is mostly used in dc motor speed control application. PWM method is the high frequency avoided and we know that large motor is mainly inductive so avoid high frequency, hence will not perform well using high frequencies. This method work on low frequency so lower frequency is better than higher frequency. We can easily understand by example, ON and OFF time is refer to as "duty cycle ".The figure1 shows the waveform of 20%, 50% and 80% duty cycle signal. As we can see in figure1 for 20% waveform 20% duty cycle signal in ON and 80% OFF

while a for 80% waveform 80% duty cycle signal is ON and 20% OFF. This signals are send to motor. The end result of the PWM is that power is send to the motor and it can adjust from 0% to 100% duty cycle with stable control and high frequency.

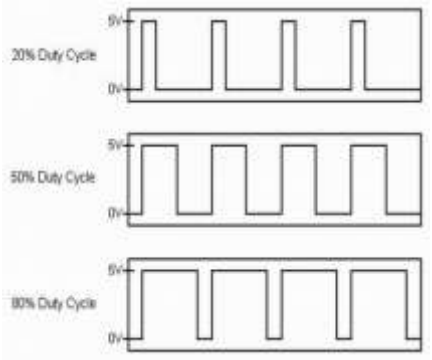


fig.1.Waveform at different duty cycles.

B. Power supply:

Power supply is main source to operate any electronics based circuit and need of supply should at direct current low voltage, for low voltage we used the step down transformer from 230VAC to 12V DC. The 12VDC is getting after the full wave bridge rectifier is used to convert AC to DC by combination of 4 diode which are connected in bridge type.

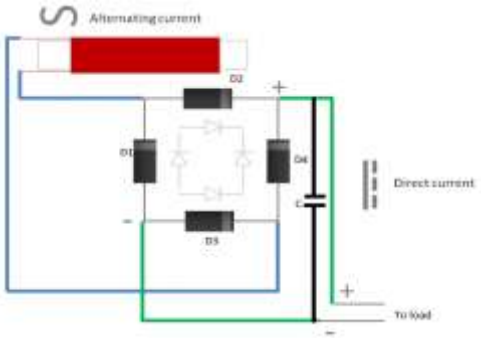


fig.2. Rectifier schematic.

C. Motor Driver IC:

Motor driver IC is primarily used in autonomous robotics mostly microcontrollers operates at low voltage and required small amount of current to operate it. In this project we can use L293D. while motor operate relatively at higher current and voltage thus we cannot supply the high rating of voltage and current directly from microcontroller which can used in this project. so motor driver IC is primarily used. The figure3 shows the schematic arrangement of motor driver IC L293D.

fig.3.L293D motor driver.

D. LCD Display:

We will discuss how a 16*2 LCD is interface with ATMEGA328 microcontroller. LCD 16*2 is used as output by the controller to display data to user. The 16*2 LCD display have 16 number of data can be written on two lines. The data may

be letter (A-Z) or number (0-9) or any symbol. The LCD display can show in fig. no.4 and its connection need some important components which are given below,

COMPONENNT REQUIRED :-

1) ATMEGA328 micro controller.
2) 16*2 LCD display.
3) Capacitors 3-470 mf, 10 mf, 22 pf.
4) Resistors 3-1k, 470 ohm, 10k ohm.

E. Microcontroller (ATMEGA328):

In this project we can use microcontroller ATMEGA328. Its operating voltage is +1.8V to +5.5V, the number of pins in this microcontroller is 28 pins. ATMEGA328 is high performance, low power controller from microchip. It is an 8 bit microcontroller based on AVR RISC (advanced virtual risc / automatic voltage regulator) also it is most popular of all AVR controllers and it is used in ADRUINO board. The ATMEGA328 chip has an analog to digital convertor inside it. This must be or else the ATMEGA328 wouldn't be capable of interpreting analog signal. Because there is an ADC, the chip can interpret analog input which is the chip has 6 pins for analog input for generating PWM wave, with the help of this wave we can control the speed of DC motor by varying the width of duty cycle. It has 14 digital I/O pins, of which 6 pins can be used as PWM output and 6 analog input pins.

fig.4.Diagrammatic representation.

F. VOLTAGE REGULATOR:

In this system we can use two voltage regulator, name as 7805 (24 V, 2 amp) and LM 117 (5 V, 500 mA) 3.3 voltage regulator. A voltage regulator is an integrated circuit that provide a constant fixed output voltage regardless of a change in the load or input voltage. It can do this many ways depending on the topology of the circuit, but for the purpose the project basic, we will mainly focus on the linear regulator. 7805 voltage regulator is used for ATMEGA328 microcontroller to regulate the voltage of 5 volt and LM1117 is used for wi-fi module ESP8266 to regulate the voltage to 3.3 volt.

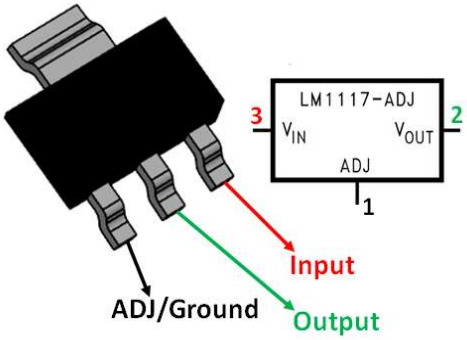


fig.5.LM117 Voltage regulator

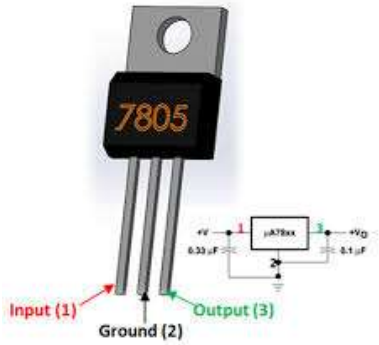


fig.6.7805 Voltage regulator.

G. ANDROID APPLIVATION:

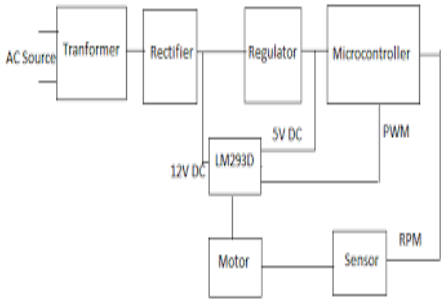
The android application is developed using an open source platform like android studio. The application thus developed will have options for both the operator and the control person. The application would provide a two-way control. The first mode of control can be a control where the controller can select the machine whose parameter is to be controlled. Once this is done, the current activity will be linked to the next activity which will contain different values for the speed control. Once the selection is made, authorization token will authorize the user using a predefined password in the application. Once the password matches with the predefined password, the internet on the phone sends the control data to the cloud web server. However, in contrast to the conventional cloud-centric architecture, virtual resources for the Internet of Things, a software architecture to resolve the tension between effective development and efficient operation of IOT applications has also emerged. Now in the first mode of control, an operator can be physically present at the machine location and can download the required machine running parameters from the web server from time to time and thereby, he can operate the machine accordingly. In the second proposed method, the running parameters of the machine will be obtained by the microcontroller and through the code uploaded in the microcontroller, it will send required instructions to the motor driver through switching array and the machine will run at the given parameters.

H. WI-FI Module:

There are a number of ways in which the Arduino microcontroller can be connected with the internet. One way is using the Arduino UNO Wi-Fi board. It has been represented in Fig. It is a microcontroller board with Wi-Fi module embedded in it. Another way is to use a separate ESP8266 Wi-Fi module. It has integrated TCP/IP protocol stack. It comes pre-programmed with AT command set firmware. It has 1MB Flash memory. It is IEEE 802.11 b/g/n Wi-Fi. It has 16 GPOI pins. It supports SPI as well as I2Ccommunication protocols. Predefined library is also available for coding. The fig.4 shows a ESP8266 Wi-Fi module.

fig.7.ESP8266 Wi-Fi module

B. Block diagram



C. CONCLUSION

Speed control of DC motor can be achieved using digital or analog pulse width modulation technique. When digital PWM is used, control is obtained at two levels, high and low. Whereas using analog PWM, control can be obtained over a wide range of values. In the proposed work, duty cycle is varied from 0% to 80% and motor is controlled at different speeds. Intervals are taken at every 10%. At 50% of duty cycle, speed of DC motor is observed to be half of that at full voltage.

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