International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 5 457 - 459

TMS Microcontroller Based PWM Signal Generation for Speed Control of DC Motor

Pravin B. Patil
Dept of E&TC
Government college of Engg.
Jalgaon ,Maharashtra
206pravin@gmail.com

***Abstract*—**In today's any modern factory all types of AC motors, DC motors, power amplifiers are used. Therefore there is serious need of intelligent devices capable of driving and controlling a wide range of electrical and electromechanical devices. For controlling the speed of DC motor series architecture of variable resistors is not good because it drops excess of energy and flux and armature control methods cannot provide speed control in the desirable range. Therefore DC motor is controlled by Voltage control method in which PWM signal is used to control electromechanical devices and this PWM signal is generated from analog, digital IC and microcontroller. PWM signal obtained from analog or digital IC contains harmonics, therefore mostly PWM signals are generated from (TMS 320 F 28027) Microcontroller. It reduces the hardware complexity and it consumes less power. PWM signal generated using modifying CCP register of microcontroller. DC motor is interfaced with TMS microcontroller through H-bridge driver. H-bridge control the motion of DC motor. PWM signal is generated at four duty cycles for increasing or decreasing the speed of motor.

Keywords-*DC motor controlling, TMS microcontroller , Motor Driver*

*****

I. INTRODUCTION

Any modern factory or facility is full of all types of intelligent machines. These machines contain one or more microcontrollers/microprocessors capable of controlling them. The different types of AC motors, DC motors and power amplifiers use the PWM signal to be controlled. This PWM signal is usually generated by special microcontrollers.

In industries, there are some of control techniques that can be applied to solve the problems such as DC motor speed, water tank and others. In designing a control system, factors such as the nonlinearity systems, time response, cost and reliability have to be taken into account. Many controller have been proposed to control digital servo motors including Optimal Control, Sliding Mode Control, Adaptive Control, Neural Network, Fuzzy Logic etc., however, these controllers are complex hence difficult to implement.On the other hand, microcontroller is widely used in feedback control of industrial processes and is simple in both structure and principles[1].

There is many microcontroller are available with special feature such as PWM function. The user is able to use the characteristics of PWM signal by accessing the PWM register and by modifying the value of PWM register such as:

- Frequency of PWM signal
- Duty cycle
- Pre-scale factor
- Bit length of timers.

The main aim of this project is to implement microcontroller (TMS 320 F 28027) based PWM signal generation for speed control of DC motor. PWM signal will be generated at four duty cycles with values 25%, 50% ,75% and 100% using (TMS 320 F 28027) microcontroller. A motor driver used typically is a H-Bridge system.The rest of the paper is organized as follows- Section II gives an overview of the previously published methods of speed control of DC motors. Section III describes Framework of proposed system. Section IV& V describes Hardware and Software parts of the proposed system and section VI concludes the paper.

II. LITERATURE REVIEW

While studying IEEE paper, we know that DC Motor control has been used for variable speed and position applications were the first choices for speed control applications requiring accurate speed control, controllable torque, reliability and simplicity[8].

The basic principle is that the speed of a separately excited DC motor is directlyproportional to supply voltage, inversely proportional to armature voltage drop and inversely proportional to flux due to field winding.

In flux control method, the magnetic flux due to the field windings is varied in order to vary the speed of the motor. As the magnetic flux depends on the current flowing through the field winding, it can be varied by varying the current through the field winding. This can be achieved by using a variable resistor in a series with the field winding resistor [6].

In Armature control method, the speed of the DC motor can be controlled by controlling the armature resistance to control the voltage drop across the armature. This method also uses a variable resistor in series with the armature[6].

In voltage control method, the field winding receives a fixed voltage, and the armature gets a variable voltage. One such technique of voltage control method involves the use of a switch gear mechanism to provide a variable voltage to the armature, and the other one uses an AC motor driven Generator to provide variable voltage to the armature. Apart from these two techniques, the most widely used technique is the use of pulse width modulation (PWM) to achieve speed control of a DC motor[3], [6].

After studying this paper, firstly they are giving the supply to PIC microcontroller. Then controller generates the pulse of 5 volts DC, the generated pulse is nothing but PWM signal. This is giving to driver circuit to generate 12v DC pulse. This isnecessary to switch on MOSFET for triggering purpose [2], [9].

III. FRAMEWORK AND SYSTEM ARCHITECTURE

PWM is an effective method for adjusting the amount of power delivered to the load. PWM technique allows smooth speed variation without reducing the starting torque and eliminates harmonics.

The block diagram of propose system is shown in Figure1. This system compromises both hardware and software elements. Main system elements are (TMS 320 F 28027) microcontroller, DC motor, H-bridge driver and power supply.

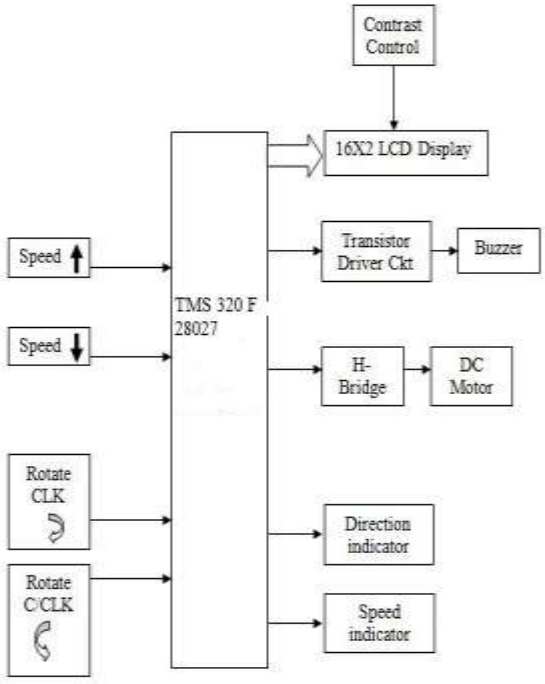

Figure 1: Block Diagram of Speed Control Of DC Motor

Fig.1 shows that two push-to-on switches are provided for increasing / decreasing the speed of the motor. Two more push-to-on switches are provided to rotate the motor in Clock wise / Counter clock wise direction. 16X2 LCD is connected to display the speed level of the motor and the direction. LED indication is also provided for visual indication.

An H bridgeis an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards.

A buzzer is provided for audio indication of DC motor speed variation and change in direction. Whenever the speed is increased / decreased, the system acknowledges by a short beep. This buzzer is driven by transistor driver circuit.

IV. HARDWARE SPECIFICATION

A. *Microcontroller TMS 320 F 28027*

The TMS320F28027 is highly integrated, high-performance solutions for demanding control applications. The TMS320F28335 is a standalone development platform that enables user to evaluate and develop applications. It has a wide range of application environments. The TMS320F28027 is designed to work with Code Composer Studio. Code Composer communicates with the board through an On Board JTAG emulator [7], [11].

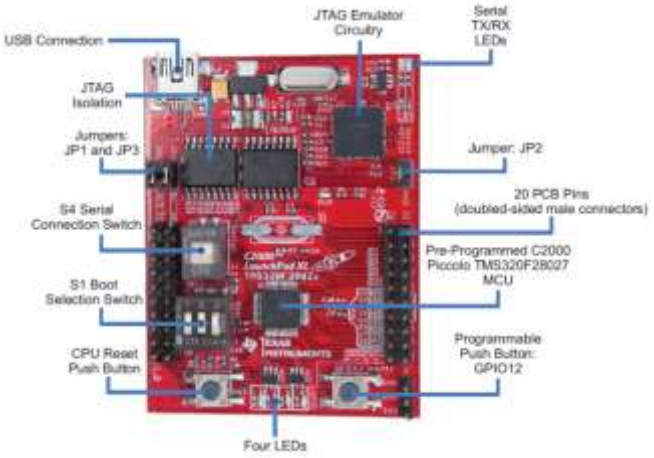

Figure 2: TMS 320 F 28027 Board

Features of TMS 320 F 28027

- High-Efficiency 32-Bit CPU (TMS320C28x™)
- 16 x 16 Dual MAC
- Harvard Bus Architecture
- Code-Efficient (in C/C++ and Assembly)
- Single 3.3-V Supply
- Small Packaging, as Low as 38-Pin Available
- Up to 22 Individually Programmable, Multiplexed GPIO Pins With Input Filtering
- Peripheral Interrupt Expansion (PIE) Block ThatSupports All Peripheral Interrupts
- Three 32-Bit CPU Timers
- Independent 16-Bit Timer in Each ePWM module
- Code-Security Module.

B. *H-Bridge Driver*

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications [10].

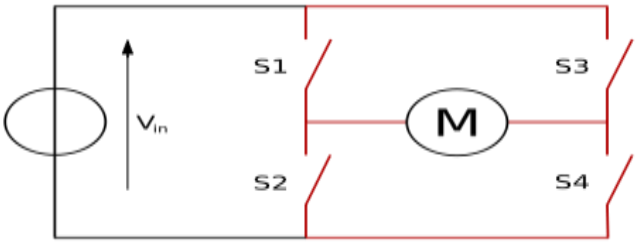

Figure 3: H-Bridge Driver

Fig 3.shows that, An H bridge is built with four switches (solid-state or mechanical). When the switches S1 and S4 (according to the first figure) are closed (and S2 and S3 are open) a positive voltage will be applied across the motor. By opening S1 and S4 switches and closing S2 and S3 switches, this voltage is reversed, allowing reverse operation of the motor [2].

C. *12V DC Geared Motor (10-400rpm)*

12V DC Geared Motor can be used in variety of robotics applications and is available with wide range of RPM and Torque. Hence, in this system DC motor with following specification is used :

- Length: 80 mm
- Torque: 1.5 kg.cm
- Shaft Diameter: 6mm
- Weight: 130g

V. SOFTWARE SPECIFICATION

Code Composer Studio speeds and enhances the development process for programmers who create and test real-time, embedded signal processing applications. Code Composer Studio extends the capabilities of the Code Composer Integrated Development Environment (IDE) to include full awareness of the DSP target by the host and real-time analysis tools. Code Composer Studio extends the basic code generation tools with a set of debugging and real-time analysis capabilities. Code Composer Studio supports all phases of the development cycle shown here:

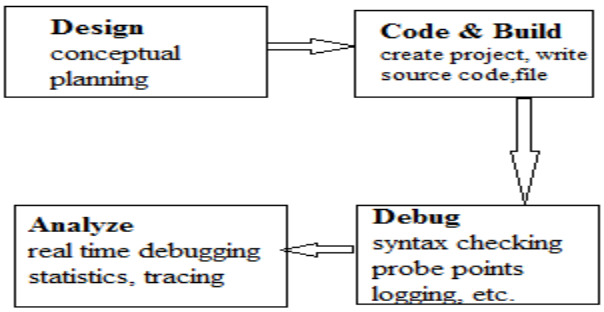

Figure 4: Development cycle

VI. CONCLUSION

For controlling of DC motor, mainly three methods are used such as flux control, armature control and voltage control. Flux and armature control methods cannot provide speed control in the desirable range. DC motor is also controlled by series architecture of variable resistor, but it has a large power dissipation. Therefore DC motor is controlled by Voltage control method in which PWM signal is used to control electromechanical devices and this PWM signal is generated from analog , digital IC and microcontroller. PWM signal obtained from analog or digital IC contains harmonics, therefore mostly PWM signals are generatedfrom Microcontroller. It reduces the hardware complexity and it consumes less power.

REFERENCES

[1] Bogdancroitoru, Adrian tulbure, Mihaliabrudean, "Microcontroller Based Multiple Platform PWM Signal Generation procedures for industrial use", IEEE International conference on Automaton, Quality and Testing, Robotics, 2014.

[2] Shrutishrivastava, Jagashwarrawat, AmitAgraval, "Controlling DC motor using microcontroller PIC16F72 with PWM",International journal of Engineering Research, Volume no.1,Issue no.2,pp:45-47,01 Dec.2012.

[3] A.S.M.Bakibillah, NaziburRahman, Md.AnisUzZaman,"Microcontroller based closed loop speed control of DC motor using PWM technique", International journal of computer Applications(0975-8887),volume 108-No. 14 ,Dec.2014.

[4] Sandeep Kumar Singh, Harish Kumar, Kamal Singh, AmitPatel "A Survey And Study Of Different Types Of PWM Techniques Used In Induction Motor Drive" International Journal of Engineering Science & Advanced Technology ISSN: 2250-3676 [IJESAT] Volume-4, Issue-1, 018-122. Jan-Feb 2014.

[5] AyuAnnurFetrahBtYusoff, "Microcontroller Based Delta Modulated PWM For 3-Phase Inverter", Faculty of Electrical & Electronic Engineering University Malaysia Pahang , JUNE, 2012.

[6] PrabhaMalviya, MenkaDubey, "Speed Control Of Dc Motor A Review" International Journal Of Engineering Sciences & Research Technology , Issn:2277-9655 S(I2or), Publication Impact Factor: 3.785 , August, 2015.

[7] Mekala.N, Muniraj.C "Implementation of PI Controller for 4Φ SRM Drive Using TMS320F28335 " PInternational Journal of Power Electronics and Drive System (IJPEDS) Vol. 5, No. 3, pp. 283~292 ,ISSN: 2088-8694, February 2015.

[8] ThineshKunasegeren,"Direct current motor control LED by microcontroller created "Faculty of Manufacturing Engineering UNIVERSITY MALAYSIA PAHANG.

[9] ShindeKrishantTarateAkshay,TaurSandip,Prof.Jayashree Deka,"speed control of DC motor using pic 16F877A microcontroller "multidisciplinary journal of research in engineering and technology.ISSN:2348-6953.

[10] Texas instruments, L-293d quadruple half-h drivers datasheet, slrs008c,November 2004.

[11] Texas Instruments ,TMS 320 F 28027 datasheet, Literature Number: SPRS439M, August 2012