PERFORMANCE ANALYSIS OF THE DC MOTORS USING 8051 MICROCONTROLLER

Vikas Kulshreshtha[1], Neeraj Garg[2]
[1]Assistant Professor, IT, [2]Assistant Professor, EE
Govt. Engg. College Jhalawar

Abstract
DC motors are the analog device. The speed of the DC motorscan be analysed digitally connected through microcontroller by generating the pulse width modulation signals (PWM) and can take the feedback of the speed by using hall sensing device placed in the DC motor. This application helps in embedded application like making of robotic arm, smart cars, motorized treadmill and many other smart embedded devices. It can be done by using microcontroller.This paper explains the design by connecting microcontroller 8051 with the computer. The communication takes place serially between computer and microcontroller. The driver circuit is connected between microcontroller and the DC motors in order to maintain the driving voltage of the DC motors.
Index Terms: 8051 Microcontroller, Dc motor, Pulse width modulation, hall sensing effect

I. INTRODUCTION

The 8051 microcontroller is used to analysis the performance of the DC motor[1] through computer system. The paper explains the working mechanism of the DC motors i.e. the speed of the DC motor using microcontroller peripherals. The signals are sending by the computer in a digital form and it helps in driving the motor at the different duty cycles and then performance of the dc motor is analyzed on the computer. Although the dc motor is a analog device then also its performance i.e. nothing but the speed of the dc motor is controlled and analyzed by the microcontroller through the computer system. This system helps in control drives of the electrical system like to control the speed of the fan, robotic arm can be made by using this system.

II. METHODOLGY

In this paper the PWM methodology and hall sensing effect are analyzed with 8051 microcontroller[2]. PWM is a technique to provide logic "1" and logic "0" for a controlled period of time. Pulse Width Modulation is used in many applications such as controlling the speed of DC motors. The basic principle is to use a register to store the value which is loaded to the Up/Down counter whenever counter reached its terminal count. The terminal counter is used to generate the Pulse Width Modulation.

This mechanism is done by generating the PWM (Pulse Width Modulation) with the different duty cycles. The author has analyzed the speed of the dc motor by generating PWM signal at 25%, 50%, 75% and at 100% duty cycle. This is done by making comparative graphs which represent the performance (speed) analysis of the dc motor. 8051 development board consist PWM controller ADC (analog to digital convertor)[3], DAC (digital to analog convertor) and serial port RS232 which is responsible for transferring the signal from computer to microcontroller. DC motor has the hall sensor which is responsible for the feedback speed of the dc motor. The operational voltage for the dc motor is 5v, whereas the voltage

generated by the microcontroller is 3v. The driver circuit which is responsible for modulate the 3v voltage to the driving voltage i.e. 5v of the dc motor. It is used to compile the code at the host machine and generate the binaries for the 8051 microcontroller with Ride cross compiler. The communication between host machine and the microcontroller is done with the help of serial cable i.e. RS 232[4].

III. Case Study

Figure 1 shows the connection between the host machine and the microcontroller. The microcontroller is connected to the driver circuit which is responsible for modulating the generating voltage to the driving voltage of the dc motor.

The Figure 1 explains the working model of the whole system. It has been analyzed by the pulse width modulation signal at 25% duty cycle. This is done by writing the code for the 25% duty cycle for the PWM controller place at the microcontroller. Then the code is compiled at Ride cross compiler which compiled the code at the host machine and generate the binaries for the target device i.e. 8051 microcontroller. These binaries are transferred serially from host machine to the target device through serial port RS 232. These PWM signal goes from controller to DAC (digital to analog convertor) which converts the digital signal to analog signal as the dc motors are analog device. Then the analog signal generates the voltage of 3v which is not sufficient for driving the dc motor. This voltage is transferred to driver circuit which modulates this voltage to the driving voltage of the dc motor which is 5v. After this when the analog signal of 5v reached to the dc motors then it starts moving with a certain speed. To know at what speed motors are driving the speed feedback has been taken by the author. This is done by hall sensing effect. The hall sensor is place inside the dc motor which generates the signal which is responsible for taking the feedback of the speed of the dc motors. The signal is send to the driver circuit which demodulates the voltage to 3v. Then the signal is gone inside the ADC unit (Analog to digital convertor) of the 8051 microcontroller. This unit sends the digital signal to the host machine serially with the help of serial cable RS232 which is connected between microcontroller and the host machine. When the digital signal reached at the host machine, the feedback speed of the dc motors is analyzed. In other words it is explained that when the pulse width modulation is generated at 25% duty cycle then at what frequency the dc motor drives and the same process is followed with 50%, 75%, and 100% duty cycles. After generating the PWM signals with the above mentioned duty cycles the author took the speed feedback Units.

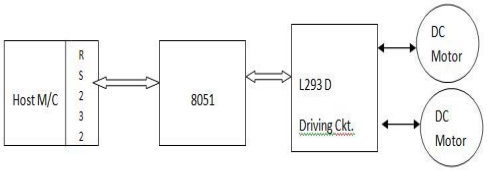

Fig.1 Block Diagram

IV. RESULTS

Figure 2 and 3 shows the waveform of the PWM signals with 25%, 50%, 75% and 100% duty cycles with 4ms delay. The 8051 microcontroller is connected serially with the host machine. The pin #0 of Port 1 is connected to driver circuit (L293D) which modulate the 3V to 5V which is the driving voltage of the dc motors. Figure 2 shows the variation PWM signal i.e change in the speed of the dc motor. Figure 3 shows the relationship between the frequency and voltage with the change in the duty cycles of the PWM signal.

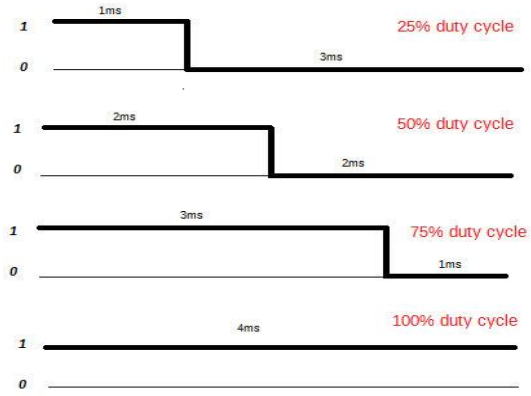

Fig.2 Duty Cycle of PWM with Delay

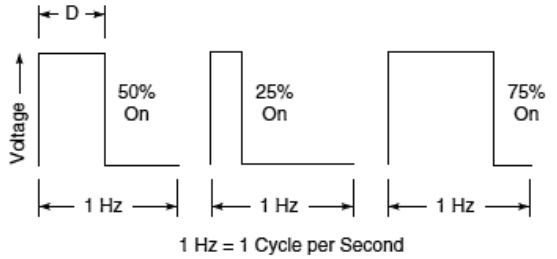

Fig.3 Relation between Frequency and Voltage

V. CONCLUSION

This application is used to controls the speed of the dc motors. It is used in controlling the speed of the fan, robotic arm which holds the object. Secondly as it is a digital application the precision rate is very high and the probability of error is reduced.

REFERENCES

[1] AN905 Microchip Brushed DC motors Fundamentals
[2] User Manual 8051
[3]"DS1103 PPC Controller Board", Germany: dSPACE, July 2008. Janice Gillispie Mazidi. "Books on Microcontroller: The 8051 microcontroller and embedded systems"
[4] Maiocchi.G., "Books on DC motors:
Driving DC Motors "BL.Theraja. "DC Motors and drives "