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CLOSED LOOP SPEED CONTROL OF DC MOTOR USING PWM

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ABSTRACT

In This work reveals the digital closed loop control system for speed control of DC motor using PWM technique. In present days the power semiconductor devices have completely revolutionized the control of drives especially in the area of control usage of thyristors IGBT's power MOSFET etc., was increased.

The digital circuit can be interfaced to microcontroller. So that the speed can be controlled by Microcontroller there by making speed control of DC motor even more easily. PWM technique to the digital circuit drives the components correspondingly speed will change.

The project basically consists of micro controller ATmega16 and motor driver, comparator, key pad, 16X2 dot matrix LCD display and rotation feedback sensor (optical encoder). The program is written in micro controller to take the input values from the user, then rotates the motor by placing 50% duty cycle pulse on the motor. The motor is rotated at X RPM speed, can be detected by using feedback sensor and micro controller. If the speed is above the specified speed then the micro controller continuously reduces the duty cycle till the speed comes to a predetermined level. If the detected speed is less than the pre determined speed then the micro controller continuously increases the duty cycle till the determined level. The micro controller keeps on tracking the determined speed by varying duty cycle in a closed loop control system (10pt Times New Roman, Justified).

KEYWORDS: PWM technique,. A micro controller ATmega16, of thyristors IGBT's, power MOSFET, drives

INTRODUCTION

Today's industries are increasingly demanding process automation in all sectors. Automation results into better quality, increased production and reduced costs. The variable speed drives, which can control the speed of A.C/D.C motors, are indispensable controlling elements in automation systems. Depending on the applications, some of them are fixed speed and some of the variable speed drives.

The variable speed drives, till a couple of decades back, had various limitations, such as poor efficiencies, larger space, lower speeds, etc., However, the advent power electronic devices such as power MOSFETs, IGBTs etc., and also with the introduction of micro -controllers with many features on the same silicon wafer, transformed the scene completely and today we have variable speed drive systems which are not only in the smaller in size but also very efficient, highly reliable and meeting all the stringent demands of various industries of modern aera.

Direct currents (DC) motors have been used in variable speed drives for a long time. The versatile characteristics of dc motors can provide high starting torques which is required for traction drives. Control over a wide speed range, both below and above the rated speed can be very easily achieved. The methods of speed control are simpler and less expensive than those of alternating current motors.

There are different techniques available for the speed control of DC motors. The phase control method is widely adopted, but has certain limitations mainly it generates harmonics on the power line and it also has got p .f when operated lower speeds. The second method is pwm technique, which has got better advantages over the phase control.

In order to have better speed regulation, it is required to have a feedback from the motor. The feedback can be taken either by using a tachogenerator or an optical encoder or the back EMF itself can be used .In present project, we provide feedback from the knob i.e., the change in voltage is given to the micro-controller

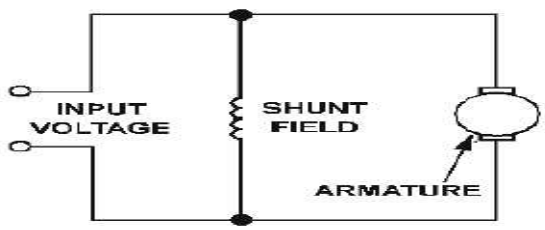
In the proposed project, a 12V, 1 Amp DC motors circuitry is designed, and developed using pulse with modulation (PWM).The pulse width modulation can be achieved in several ways. In the present project, the PWM generation is done using micro- controller.

The project proposed is a real time working project, and this can be further improvised by using the other safety features, such as field current, air gap magnetic flux, armature current, etc.,

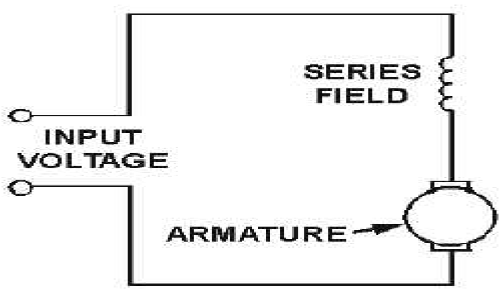
LITERATURE SURVEY

A. Classification of DC Motor.

DC motors are classified into three types depending upon the way their field windings are excited. Field windings connections for the three types Of DC motors have been shown in figures.



SHUNT MOTOR



SERIES MOTOR

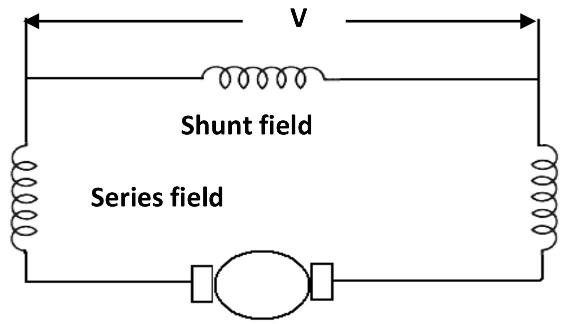


Fig.1.1 Classification of DC Motor

B. Speed Control of DC Motor.

The DC motors are in general much more adaptable speed drives than AC motors which are associated with a constant speed rotating field. Indeed one of the primary reasons for the strong competitive position of DC motors in modern industrial drives is the wide range of specified afforded we know the equation

$$N= K (E_b/\phi)$$

$$=K (V-Ia\ Ra / \phi)$$

Where V=supply voltage (volts)

Ia = armature current (amps)

Ra=armature resistance (ohms)

Φ=flux per pole (Weber)

E_b = back emf(volts)

This equation gives two methods of effective speed changes.i.e.

(a)The variation of field excitation, if this causes in the flux per pole Φ and is known as the field control.

(b) The variation of terminal voltage (V).this method is known as armature control.

2.2.1 Flux Control Method.

It is known that Nα1/ Φ by decreasing the flux, the can be increased and vice versa. Hence, name flux or field control method.

The flux of DC motor can be changed by changing I_{sh} with help of a shunt field rheostat. Since I_{sh} in relatively small, shunt field rheostat has to carry only a small, so that rheostat is small in size. This method therefore very efficient in non-interpolar machines the speed can be increased by this method in the ratio

2:1 any further weakening of flux Φ adversely affect the communication

And hence puts a limit to the maximum speed obtainable with this method in machines fitted with interlopes in ratio of maximum to minimum speeds of 6:1 is fairly common.
The connection diagram for this type of speed control is shown in figure below

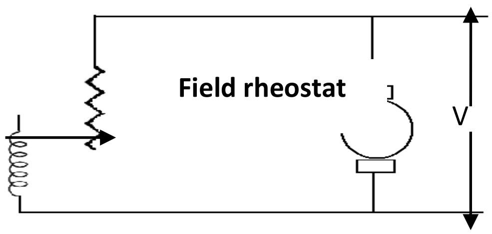


Fig.1.2 Flux Control Method

2.2.2 Armature Control Method.
This method is used when speeds below the no load speed are required. As the supply voltage is normally constant, the voltage across the armature is varied by inserting a variable rheostat or controller resistance in series with the armature circuit as shown in fig. as controller resistance is increased, potential difference across the armature is decreased, thereby decreasing the armature speed. For a load of constant torque, speed is approximately proportional to the potential difference.

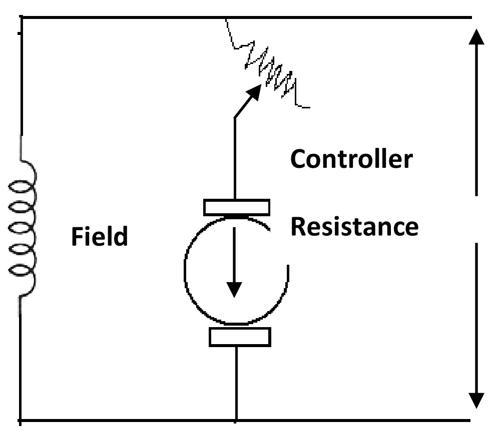


Fig.1.3 Armature Control Method.

PWM TECHNIQUE.

A. Introduction.
Pulse-width modulation (PWM) or duty-cycle variation methods are commonly used in speed control of DC motors. The duty cycle is defined as the percentage of digital 'high' to digital 'low' plus digital 'high' pulse-width during a PWM period.

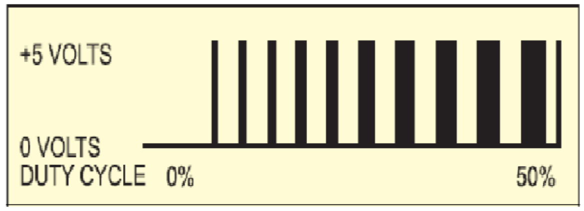


Fig.1.4. 5V Pulses With 0% Through 50% Duty Cycle

Fig.1 shows the 5V pulses with 0% through 50% duty cycle. The average DC
Voltage value for 0% duty cycle is zero; with 25% duty cycle the average value is 1.25V (25% of 5V). With 50% duty cycle the average value is 2.5V, and if the duty cycle is 75%, the average voltage is 3.75V and so on. The maximum duty cycle can be 100%, which is equivalent to a DC waveform. Thus by varying the pulse-width, we can vary the average voltage across a DC motor and hence its speed. The average voltage is given by the following equation:
$\acute{y} = D.\ Y_{max} + (1- D)\ Y_{min}$
But usually minimum equals zero so the average voltage will be:
$\acute{y} = D.\ Y_{max}$
The circuit of a simple speed controller for a mini DC motor, such as that used in tape recorders and toys, is shown in Fig

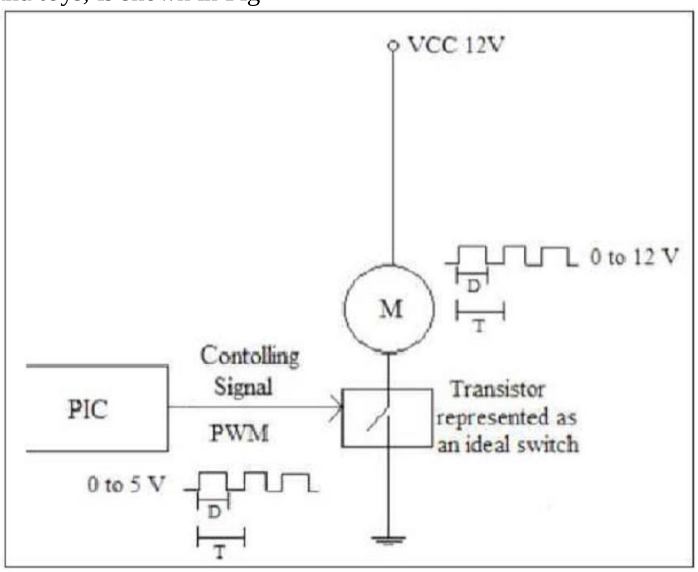


Fig.1.5. DC motor speed control using PWM method

a) Write an assembly program to generate a PWM with a frequency of 1 kHz and a duty cycle of 50%, and watch your signal on the oscilloscope.

b) Now connect your signal to the motor driver.

The major reason for using pulse width modulation in DC motor control is to avoid the excessive heat dissipation in linear power amplifiers. The heat dissipation problem often results in large heat sinks and sometimes forced cooling. PWM amplifiers greatly reduce this problem because of their much higher power conversion efficiency. Moreover the input signal to the PWM driver may be directly derived from any digital system without the need for any D/A converters.

The PWM power amplifier is not without disadvantages. The desired signal is not translated to a voltage amplitude but rather the time duration (or duty cycle) of a pulse.

This is obviously not a linear operation. But with a few assumptions, which are usually valid in motor control, the PWM may be approximated as being linear (i.e., a pure gain).The linear model of the PWM amplifier is based on the average voltage being equal to the integral of the voltage waveform. Thus,

$$VS * Ton = Veq * T$$

Where

VS = the supply voltage (+12 volts)

Ton = Pulse duration

Veq = the average or equivalent voltage seen by the motor

T = Switching period (1/f)

The recommended switching frequency is 300Hz.The switching frequency (1/T), is determined by the motor and amplifier characteristics. The control variable is the duty cycle which is Ton / T. The duty cycle must be recalculated at each sampling time. The voltage that the motor sees is thus Veq, which is equal to the duty cycle times the supply voltage.

3.2 Principle.

Pulse width modulation control works by switching the power supplied to the motor on and off very rapidly. The DC voltage is converted to a square wave signal, alternating between fully on (nearly 12v) and zero, giving the motor a series of power "kicks".

Pulse width modulation technique (PWM) is a technique for speed control which can overcome the problem of poor starting performance of a motor.

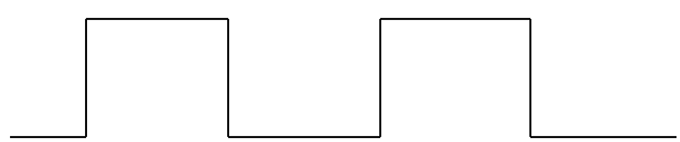
PWM for motor speed control works in a very similar way. Instead of supplying a varying voltage to a motor, it is supplied with a fixed voltage value (such as 12v) which starts it spinning immediately. The voltage is then removed and the motor 'coasts'. By continuing this voltage on/off cycle with a varying duty cycle, the motor speed can be controlled.

The wave forms in the below figure to explain the way in which this method of control operates. In each case the signal has maximum and minimum voltages of 12v and 0v.

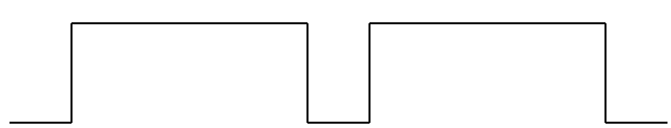
- In wave form, the signal has a mark space ratio of 1:1.with the signal at 12v for 50% of the time, the average voltage is 6v, so the motor runs at half its maximum speed.
- In wave form, the signal has mark space ratio of 3:1.which means that the output is at 12v for 75% of the time. This clearly gives an average output voltage of 9v, so the motor runs at 3/ 4 of its maximum speed.
- In wave form, the signal has mark space ratio is 1:3, giving an output signal that is 12v for just 25% o the time. The average output voltage of this signal is just 3v, so the motor runs at 1/4 of its maximum speed.

By varying the mark space ratio of the signal over the full range, it is possible to obtain any desired average output voltage from 0v to12v .The motor will work perfectly well, provided that the frequency of the pulsed signal is set correctly, a suitable frequency being 30Hz.setting the frequency too low gives jerky operation. And setting it too high might increase the motor's impedance.

1:1 Mark space ratio (50% duty cycle)



3:1 Mark space ratio (75% duty cycle)



1:3Mark space ratio (25%dutycycle)

Fcig.1.6. Pulse Width Modulation Waveforms

C. Methods.
The PWM signals can be generated in a number of ways. There are several methods:

- analogue method
- digital method
- discrete IC
- On board micro controller

Analogue method:
A block diagram of an analogue PWM generator is

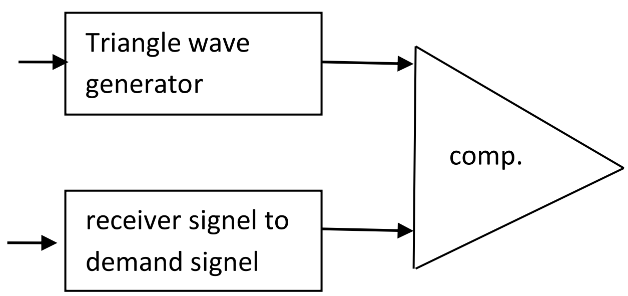


Fig.1.7. Block Diagram of an Analogue PWM Generator

The simplest way to generate a PWM signal is the intersective method, which requires only a saw tooth or a triangle wave form (easily generated using a simple oscillator) and a comparator. When the value of the reference signal is more than the modulation wave form, the PWM signal is in the high state, otherwise it is in the low state.

Digital Method:
The digital method involves incrementing a counter, a comparing the counter value with a pre-loaded register value, or value set by an ADC. They normally us a counter that increments periodically and is reset at the end very period of the PWM. When the counter value is more than the reference value, the PWM output changes state from high to low.

PWM generator chips:

PWM There are several IC's available which converts a DC level into a PWM output. many of these are designed for use in switch mo power supplies .unfortunately, the devices designed for switch mode power supplies not to allow the mark-space ratio to alter over the entire 0 – 100% range. Many limit the maximum to 90% which is effectively limiting the power you can send to the motors. Devices designed as pulse generators should allow the whole range to be used.

Onboard micro controller
A micro controller on the robot, this may be able to generate the wave form, although if you have a more than a couple of motors, this may be too much of load on the micro controller's resources. So if you have chosen to use an on board micro controller, then as part of you selection process, include whether it has PWM outputs .if it has this can greatly simplify the process of generating signals.

SYSTEM MODEL DESCRIPTION

A. Power Supply.
The Power Supply is a Primary requirement for the project work. The required DC power supply for the base unit as well as for the recharging unit is derived from the mains line. For this purpose center tapped secondary of 12V-012V transformer is used. From this transformer we getting 5V power supply. In this +5V output is a regulated output and it is designed using 7805 positive voltage regulator. This is a 3 Pin voltage regulator, can deliver current up to 800 milliamps. Rectification is a process of rendering an alternating current or voltage into a unidirectional one. The component used for rectification is called 'Rectifier'. A rectifier permits current to flow only during positive half cycles of the applied AC voltage. Thus, pulsating DC is obtained to obtain smooth DC power additional filter circuits required

CIRCUIT DIAGRAM

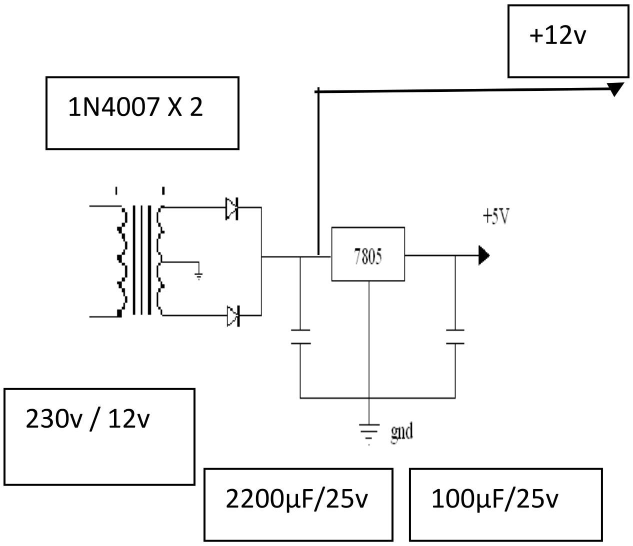


Fig.1.8. Block Diagram Of Power Supply

A diode can be used as rectifier. There are various types of diodes. However, semiconductor diodes are very popularly used as rectifiers. A semiconductor diode is a solid-state device consisting of two elements is being an electron emitter or cathode, the other an electron collector or anode. Since electrons in a semiconductor diode can flow in one direction only-form emitter to collector-the diode provides the unilateral conduction necessary for rectification. The rectified Output is filtered for smoothening the DC, for this purpose capacitor is used in the filter circuit. The filter capacitors are usually connected in parallel with the rectifier output and the load. The AC can pass through a capacitor but DC cannot, the ripples are thus limited and the output becomes smoothed. When the voltage across the capacitor plates tends to rise, it stores up energy back into voltage and current. Thus, the fluctuation in the output voltage is reduced considerable.

C. Voltage Regulator.

The LM 78XXX series of the three terminal regulations is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation. The voltages available allow these regulators to be used in logic systems, instrumentation and other solid state electronic equipment. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents. The LM78XX series is available in aluminum to 3 packages which will allow over 1.5A load current if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. The LM 78XX is available in the metal 3 leads to 5 and the plastic to 92. For this type, with adequate heat sinking. The regulator can deliver 100mA output current. The advantage of this type of regulator is, it is easy to use and minimize the number of external components.

The following are the features voltage regulators:

a) Output current in excess of 1.5A for 78 and 78L series

b) Internal thermal overload protection

c) No external components required

d) Output transistor sage area protection

e) Internal short circuit current limit.

D Positive Voltage Regulator.

The positive voltage regulator has different features like

1. Output current up to 1.5A
2. No external components
3. Internal thermal overload protection
4. High power dissipation capability
5. Internal short-circuit current limiting
6. Output transistor safe area compensation

Direct replacements for Fairchild microA7800 series

Table A.a. Various regulators with their voltages.

10V	uA7810C
12V	uA7812C
15V	uA7815C
18V	uA7818C
24V	uA7824C

E. Motor and *Motor Drive.*

The purpose of a motor speed controller is to take a signal representing the demanded speed, and to drive a motor at that speed. The controller may or may not actually measure the speed of the motor. If it does, it is called a Feedback Speed Controller or Closed Loop Speed Controller, if not it is called an Open Loop Speed Controller. Feedback speed control is better, but more complicated, and may not be required for a simple robot design.

Motors come in a variety of forms, and the speed controller's motor drive output will be different dependent on these forms. The speed controller presented here is designed to drive a simple cheap starter motor from a car, which can be purchased from any scrap yard. These motors are generally

series wound, which means to reverse them; they must be altered slightly, (see the section on motors).
Below is a simple block diagram of the speed controller. We'll go through the important parts block by block in detail.

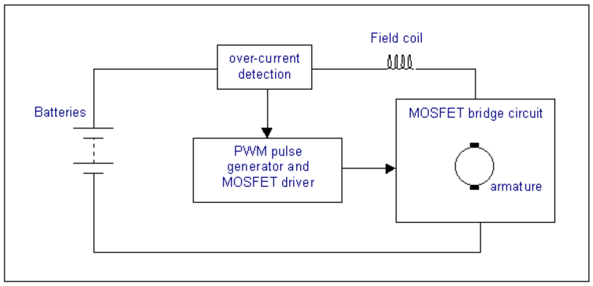


Fig.1.9. Block Diagram of Speed Controller

1) The speed of a DC motor is directly proportional to the supply voltage, so if we reduce the supply voltage from 12 Volts to 6 Volts, the motor will run at half the speed. How can this be achieved when the battery is fixed at 12 Volts? The speed controller works by varying the average voltage sent to the motor. It could do this by simply adjusting the voltage sent to the motor, but this is quite inefficient to do. A better way is to switch the motor's supply on and off very quickly. If the switching is fast enough, the motor doesn't notice it, it only notices the average effect.
2) When you watch a film in the cinema, or the television, what you are actually seeing is a series of fixed pictures, which change rapidly enough that your eyes just see the average effect - movement. Your brain fills in the gaps to give an average effect. Now imagine a light bulb with a switch. When you close the switch, the bulb goes on and is at full brightness, say 100 Watts. When you open the switch it goes off (0 Watts). Now if you close the switch for a fraction of a second, and then open it for the same amount of time, the filament won't have time to cool down and heat up, and you will just get an average glow of 50 Watts. This is how lamp dimmers work, and the same principle is used by speed controllers to drive a motor. When the switch is closed, the motor sees 12 Volts, and when it is open it sees 0 Volts. If the switch is open for the same amount of time as it is closed, the motor will see an average of 6 Volts, and will run more slowly accordingly.
3) As the amount of time that the voltage is on increases compared with the amount of time that it is off, the average speed of the motor increases. This on-off switching is performed by power MOSFET. A MOSFET (Metal-Oxide-Semiconductor Field Effect Transistor) is a device that can turn very large currents on and off under the control of a low signal level voltage. For more detailed information, see the dedicated chapter on MOSFET) The time that it takes a motor to speed up and slow down under switching conditions is dependent on the inertia of the rotor (basically how heavy it is), and how much friction and load torque there is. The graph below shows the speed of a motor that is being turned on and off fairly slowly:

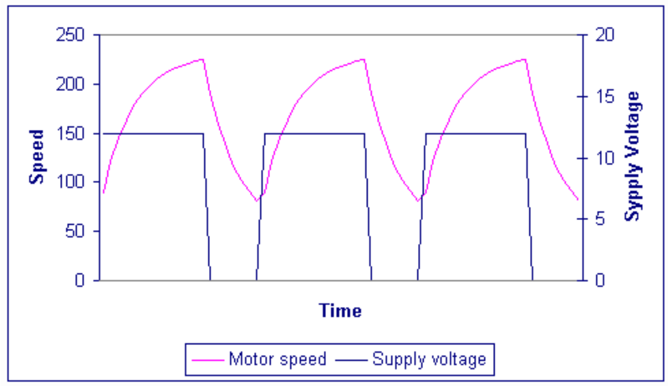


Fig.1.10.Graph between Speed and Supply Voltage

You can see that the average speed is around 150, although it varies quite a bit. If the supply voltage is switched fast enough, it won't have time to change speed much, and the speed will be quite steady. This is the principle of switch mode speed control. Thus the speed is set by PWM.

4.6 ATmega16 Micro-controller.
The ATmega16 provides the following features: 16K bytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bitADC with optional differential input stage with programmable gain (TQFP package only),a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing

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the user to maintain a timer base while the rest of the device is sleeping.

The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run. The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits

4.6.1 Pin Diagram.

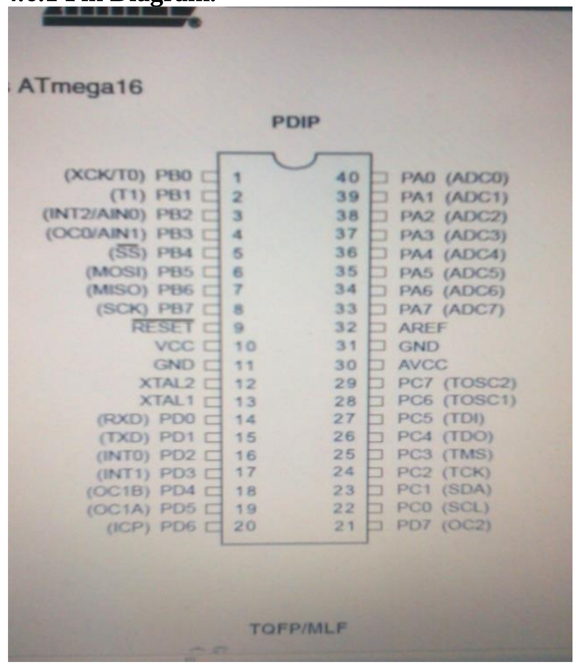

Fig.2.1 Pin diagram of ATmega16.

Pin Description.

- VCC ----- Digital supply voltage.

- GND ----- Ground.

- Port A (PA7..PA0) ----- Port A serves as the analog inputs to the A/D Converter. Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

- Port B (PB7..PB0) ------ Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock

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is not running. Port B also serves the functions of various special features of the ATmega16.

- Port C (PC7..PC0) ------ Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs. Port C also serves the functions of the JTAG interface and other special features of the ATmega16.

- Port D (PD7..PD0) ------- Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running. Port D also serves the functions of various special features of theATmega16.

- RESET ------- Reset Input. A low level on this pin for longer than the minimum pulse length will generate reset, even if the clock is not running. The minimum pulse length is given in Table15 on page 35. Shorter pulses are not guaranteed to generate a reset.

- XTAL1 -------- Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

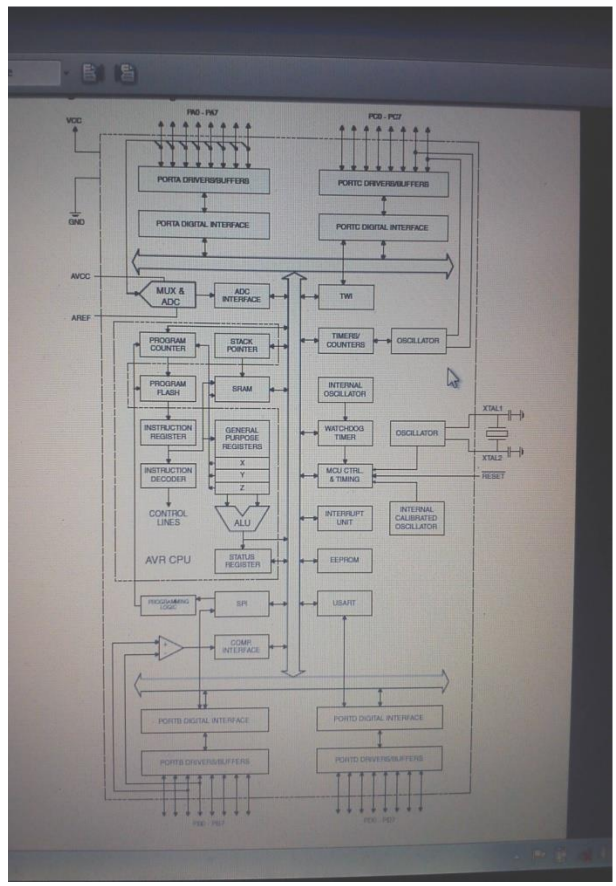
- XTAL2 ------- Output from the inverting Oscillator amplifier.

- AVCC ------- AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

- AREF ------- AREF is the analog reference pin for the A/D Converter.

4.6.2 Block Diagram of ATmega16 Micro-Controller.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.



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External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications. The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

4.6.3 Features of ATmega16

- High-performance, Low-power AVR® 8-bit Microcontroller.
- 131 Powerful Instructions – Most Single-clock Cycle Execution.
- Non-volatile Program and Data Memories.
- Optional Boot Code Section with Independent Lock Bits.
- In-System Programming by On-chip Boot Program.
- Programming Lock for Software Security.
- Power-on Reset and Programmable Brown-out Detection.
- External and Internal Interrupt Sources.

1. WORKING.

The main aim of the dc motor speed control using pwm is after power on the power supply generates +5v dc ,+12v dc ,the logic section works on +5v dc and the motor and motor driven sections are working on +12v dc .the explanations of the power supply is given in the power supply module.

After power on the micro controller generates oscillations at the rate of 11.059-12Mhz.frequency sine wave i.e. internally converted into square wave with the help of internal oscillator. The oscillator section is given bellowing the oscillator module

The reset logic generates the reset signal are applied at the rxd pin of the micro controller. After reset, the micro controller starts executing program on the memory location program area 0000h. initially the micro controller initializes the LCD display connected to the port0, port2.7, port2.6, port2.5.After receiving the signal of change in voltage through the knob, that signal is given to the ADC converter and the output of ADC converter is given to the internal pwm inside the micro-controller which in turns with help of transistors, the speed of the motor is controlled. Initially we are rotating at the rate of 50% duty cycle i.e. 50% on time and 50% off time.

PWM for motor speed control works in a very similar way. Instead of supplying a varying voltage to a motor, it is supplied with a fixed voltage value (such as 12v) which starts it spinning immediately. The voltage is then removed and the motor 'coasts'. By continuing this voltage on/off cycle with a varying duty cycle, the motor speed can be controlled.

ADVANTAGES & DISADVANTAGES.

Advantages.

- PWM duty cycle control techniques enable greater efficiency of the DC motor .
- PWM switching control methods improve speed control and reduce the power losses in the system.
- The pulses reach the full supply voltage and will produce more torque in a motor by being able to

overcome the internal motor resistances more easily.

- By using PWM technique power loss in the switching devices is very low.

Disadvantages.

- The main Disadvantages of PWM circuits are the added complexity and the possibility of generating radio frequency interference.
- It can give speed below the full speed not above. It cannot be used for fast controlling of speed.

APPLICATIONS

The application of this project is as follows:

- Traction application
- Conveyor Belt carrying loads.
- Various motors requiring smooth speed control.
- DC motors of all range can be controlled, which are used for the production of materials Electric locomotives DC motor using precise job preparations.

FUTURE SCOPE

The future scope of this project is as follows:

- By using this technique with the help of power electronics devices, we can control the large motors in the industry automatically instead of manually.
- Another scope of this technique will be in the traction system and aerospace engineering where constant speed of motor is required.
- With the help of power electronics devices lot of automation and high speed can be achieved.

4) Read already published work in the same field.
5) Goggling on the topic of your research work.
6) Attend conferences, workshops and symposiums on the same fields or on related counterparts.
7) Understand the scientific terms and jargon related to your research work.

CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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