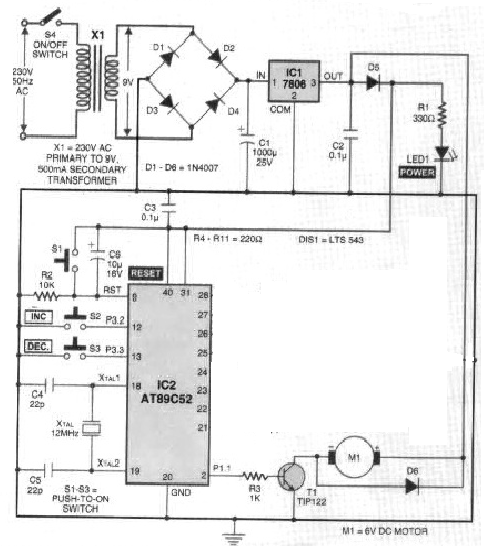
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| ELECTRICAL DRIVES PROJECT REPORT ON |
| MICROCONTROLLER -BASED DC MOTOR SPEED CONTROLLER |



**INTRODUCTION**

**D**C motor speed controllers are very useful for controlling the motion of robotic and industrial automation systems. The controller presented here uses the pulse-width modulation (PPWM) technique. The PWM wave for speed control is generated using Atmel AT89C52 microcontroller.To control the speed of the DC motor, you need a variable-voltage DCpower source. When the DC motor isswitched on, it takes certain time toreach the full speed. As soon as the power supply is switched on, the DCmotor starts gaining speed and if you switch off the power supply before itreaches the maximum rated speed, itstarts to slow down.

**Circuit :**

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**Parts List**

*Semiconductor:*

IC1 -7806, 6V regulator

IC2 -AT89C51 microcontroller

T1 -TIP122 pnp transistor

D1-D6 -1N4007 rectifier diode

LED1 -5mm light-emitting diode

*Resistors (all ¼-watt, 5% carbon):*

R1 -330-ohm

R2 -10-kkilo-oohm

R3 -1-kilo-oohm

R4-RR11 -

220-ohm

*Capacitors:*

C1 -1000 µF, 5V electrolytic

C2, 3 -0.1µF ceramic disk

C4, 5 -22pF ceramic disk

C6 -10 µF, 6V electrolytic

*Miscellaneous:*

X1 -230V C primary to V,

500mA secondary transformer

S1-SS3 -Push-to-on switch

S4 -On/off switch

X TAL -12MHz crystal

-6V C motor

CON1 -

Connector for power supply

**Circuit Description:**

Fig. 1 shows the circuit of the DC mo-tor speed controller. 230V AC mains is stepped down by transformer X1 to deliver secondary output of 9V, 500 mA. The secondary output is rectified by a full-wave bridge rectifier comprising diodes D1 through D4,filtered by capacitor C1 and regulated by IC 7806 Capacitor C2 bypasses any ripple present in the regulated output. LED1 acts as the power- ‘on’ indicator. Resistor R1 limits the current passing through LED1.Diode D5 causes a voltage drop of 0.6V and, as a result, the final output of the circuit is approx.44V.

**Construction:**

IC AT89C51 is a low-power, high-performance, 8-bit microcontroller with 8 kB of Flash programmable and eras-able read-only memory

(EPEROM),256 bytes of RAM,32 input/output (I/O)lines, three 16-bit timers/counters, a six-vector two-level interrupt architecture, a full-duplex serial port, on-chip oscillator and clock circuitry.

In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software- selectable power-saving modes. The idle mode stops the CPU while allowing the RAM, timers/counters, serial port

and interrupt system to continue functioning.

The power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next hardware reset is activated.

At the heart of the speed controller system is microcontroller AT89C52

which creates (using timer 0)pulses of varying width for pulse-width modulation and controls the motor speed.

To change the speed of the motor, switches S2 and S3 are interfaced to

interrupt the input to pins P3.22 and P3.33 of IC2,respectively.Whenever any of

switches S2 and S3 is pressed, an interrupt is generated, which changes the duty

cycle of the pulse train. Switch S2 interfaced to Interrupt-0 increases the

duty cycle of the pulse waveform, whereas switch S3 interfaced to Inter-

rupt-11 decreases the duty cycle of the pulse waveform. Power-on reset for

the microcontroller is achieved through capacitor C6 and resistor R2.Switch S1

provides manual reset to the microcontroller. A 12MHz crystal (XX TAL ) is used for basic clock frequency. Port 2 is an 8-bit,bidirectional, input/output (II/O) port with internalpull-ups.Port-2 output buffers can sink/source four TTL inputs.

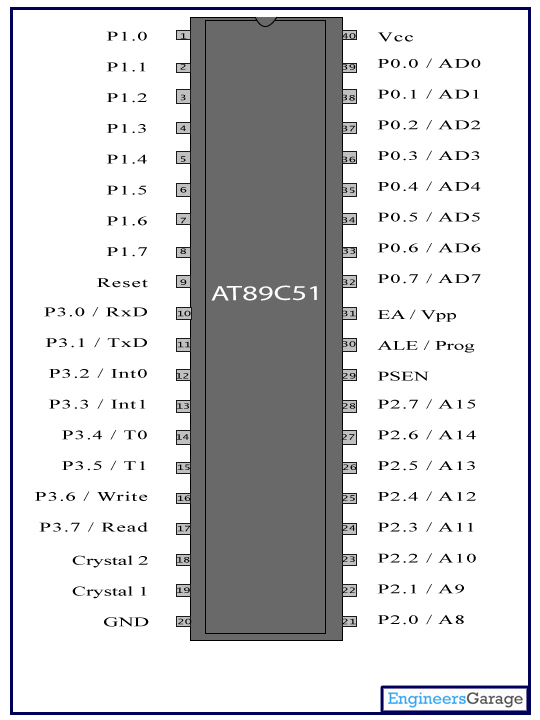
The software is written such that the duty cycle for PWM is increased in discrete intervals of ‘10 ’.Hence the speed of the DC motor is divided into eleven steps from Port pin P1.11 is internally pulled up. It is used as the output to control the motor with driver transistor T1. Whenever timer-0 overflows, the status of pin P1.1 is complemented and hence a square wave with appropriate duty cycle is generated. This pin is inter-faced to power transistor TIP122 (TT1),, which is fed to drive the motor. When the transistor is driven into saturation, current flows through the motor. When the transistor is cut off,

the motor current keeps flowing be cause of the motor ’s inductance. Diode

D6 connected across the motor coil prevents reverse current flow. A heat-sink

is fed with over transistor T1.

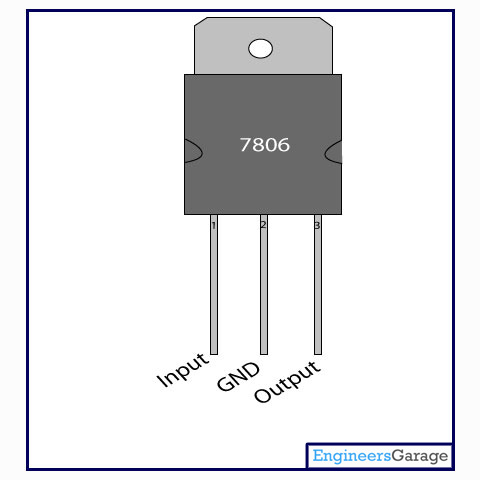
PIN DESCRIPTION OF AT89C51



**7806 IC**

7806 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7806 provide +6V regulated power supply Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

PIN DIAGRAM



**Software**

The software is written in ‘C ’ language and compiled using Keil C compiler, which generates Intel hex code for the microcontroller. The µVision3 integrates all tools including the ‘C’ compiler, micro assembler, linker/allocator

and hex file generator. The generated hex code is burnt into the micrcontroller using a suitable programmer. Whenever any switch is pressed,the duty cycle of PWM varies.The software then calculates the appropriate values for TH0 and TL0 for ‘on’and ‘off ’ time of the output,which are copied in TH0 and TL0 on timer interrupts. In this circuit, we have used timer-0 of the microcontroller for generatingPWM pulses, which is clocked using a 12MHz crystal oscillator. The basefrequency is kept constant at 1 kHz and the duty cycle of this have varied to

change the analogue level at output pin P1.11 of the microcontroller.

