An Advance Approach to Control DC Motor Speed Using PID Control in MATLAB Simulink

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Abstract— **Control system design and analysis technologies are widely suppressed and very useful to be applied in real-time development. DC Motors can be used in various applications and can be used in various sizes and rates as per our applications. In this project we have control the actual speed of dc motor as per our requirement. This can be achieved through PIC microcontroller. The microcontroller computes the actual speed of the motor by sensing the terminal voltage and displayed on LCD In this project firstly we are giving the supply to PIC microcontroller. Then controller generates the pulse generally 5V DC. The generated pulse is nothing but PWM signal. Which is giving to driver circuit.It is necessary for switching on the MOSFET. Thus speed of DC motor is control through inbuilt PWM module of the PIC controller. The same motor can be implemented in MATLAB Simulink. Here we use PID Controller for error minimization purpose. This unit drives a Power MOSFET amplifier, which in turn supplies a PWM voltage to the dc motor.**

Keywords—**PIC controller, MPLAB, LCD, MOSFET, PWM module, MOSFET amplifier.**

I. INTRODUCTION

Whenever we think about any programmable devices then the embedded technology comes into forefront. The embedded is now-a- days very much popular and most of the product are developed with Microcontroller based embedded technology. The advantages of using the microcontroller is the reduction of the cost and also the use of extra hardware such as the use of timer, RAM and ROM can be avoided. This technology is very fast so controlling of multiple parameters is possible; also the parameters are field programmable by the user.

In this project we are controlling speed of DC motor. As we increase the speed of DC motor as a result an increase in the productivity of material. The application of this is used in domestic's purpose examples are hair dryer, mixer, zero machine, elevator and industrial purpose examples are traction and elevator. In this project we have control the actual speed of dc motor as per our requirement. This can be achieved through PIC microcontroller. The microcontroller computes the actual speed of the motor by sensing the terminal voltage and displayed on LCD.

The modeling and simulation of this project is done through MATLAB software. It then compares the actual speed of the motor with the reference speed and generates a suitable control signal which is fed into the triggering unit using MATLAB. Here we use PID Controller for error minimization purpose. This unit drives a Power MOSFET amplifier, which in turn supplies a PWM voltage to the dc motor. DC Motors can be used in various applications.

II. SCOPE OF THE PROJECT

In order to achieve the objective of the project, there is several scopes had been outlined. The scope of this project includes using MPLAB IDE to program microcontroller PIC 16F877A, build hardware for the system, and interface the hardware to computer by using RS232 serial port communication. Last but not least, a graph of speed versus time is obtained by using Visual Basic 6.0 at computer to observe the performance of the system.
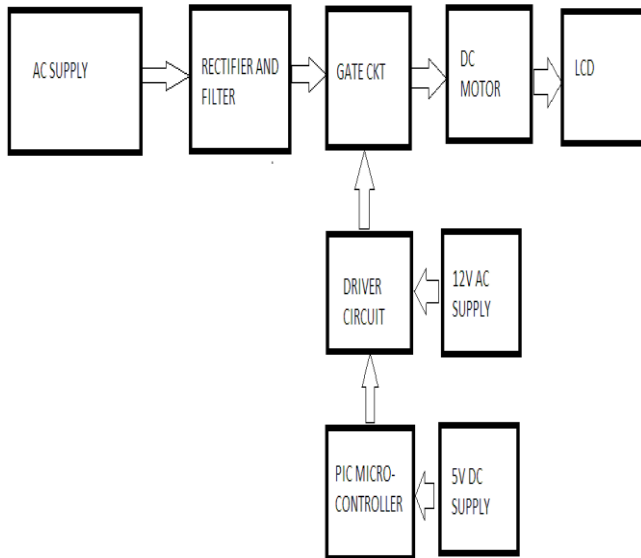
III. SCHEMATIC REPRESENTATION

fig.1 Schematic representation of DC motor control using PIC controller.

Block diagram is consisting of following parts:

1. Ac Supply
2. Rectifer And Filter
3. Gate Curcuit (Mosfet)
4. Driver Curcuit
5. Pic 16f877a Microcontroller
6. 5 Volt Dc Supply
7. Booster Curcuit
8. Dc Motor

A. Power Supply module

The AC voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired DC output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes.

B. PIC 16F877A Microcontroller

Peripheral Interface Controller (PIC) is introduced by Microchip technology. PIC 16F877A is a family of CMOS 8-bit Flash microcontroller.

Power consumption is very low. PIC16F877A is a 40/44-pin device which can operate at up to 20 MHz clock speed. It has 8K X 14 words flash program memory, 368X8 byte RAM data memory, 64bytes of EEPROM nonvolatile data memory, 8-bit timer with watchdog timer, Only 35 single-word instructions to learn, external and internal interrupt sources and large sink and source capability. The architecture is given by,
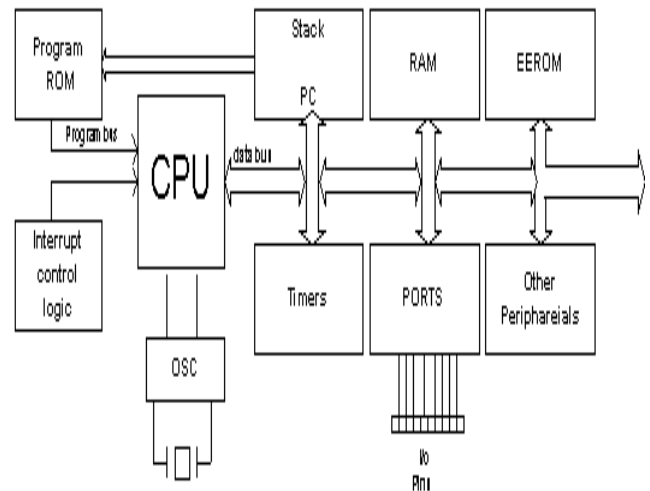

Fig.2 Architecture of 16F877A

C. Driver Circuit

The driver circuit is divided into following parts:

1. Buffer Circuit
2. Isolation Circuit
3. Phase Shifting (Transistor)
4. Darlington pair.

D. DC MOTORS

Direct current (DC) motors have variable characteristics and are used extensively in variable-speed drives. DC motor can provide a high starting torque and it is also possible to obtain speed control over wide range. Why do we need a speed motor controller? For example, if we have a DC motor in a robot, if we just apply a constant power to each motor on a robot, then the poor robot will never be able to maintain a steady speed. It will go slower over carpet, faster over smooth flooring, slower up hill, faster down hill, etc. So, it is important to make a controller to control the speed of DC motor in desired speed.
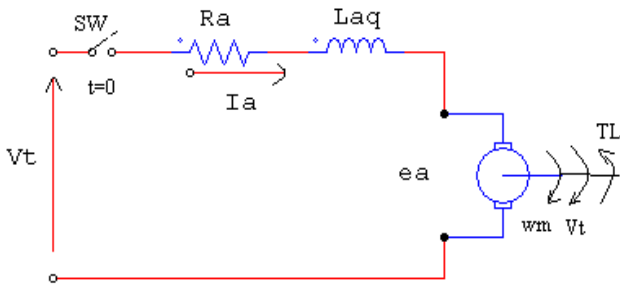

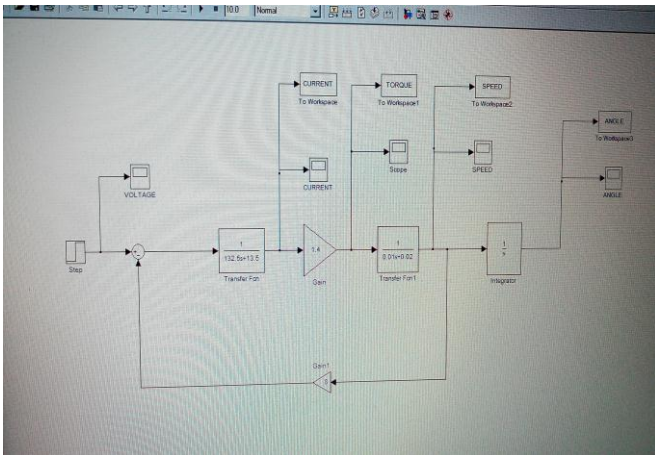**Fig.3 DC-Motor**

E. Matlab Simulink Block for PID control

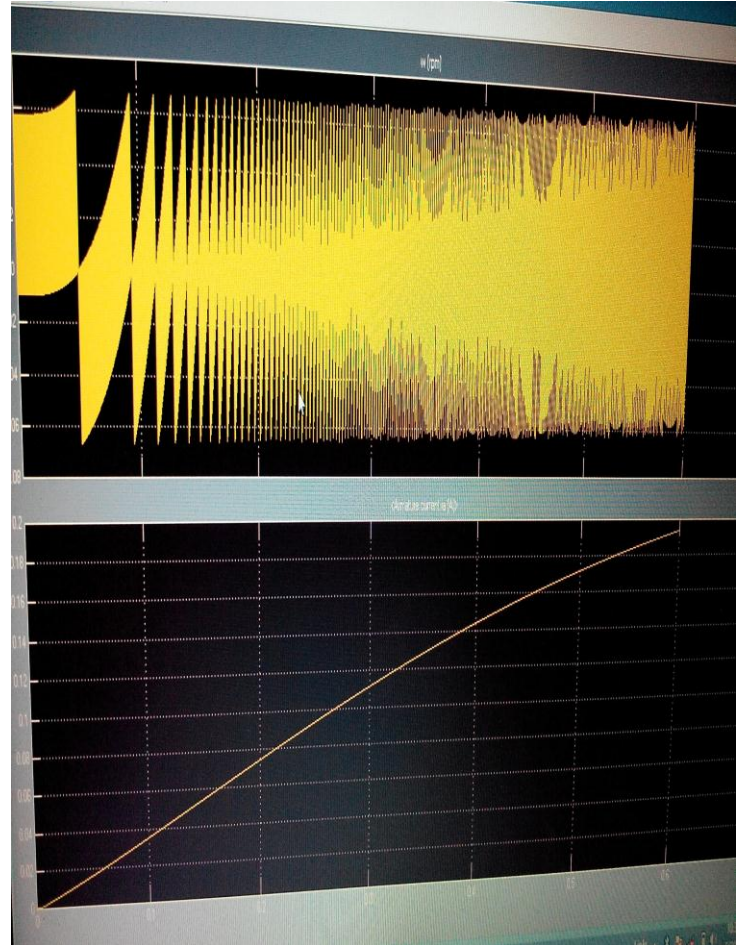**Fig.4 SIMULINK block for DC motor open loop control**

Fig.5 simulation result for open loop control
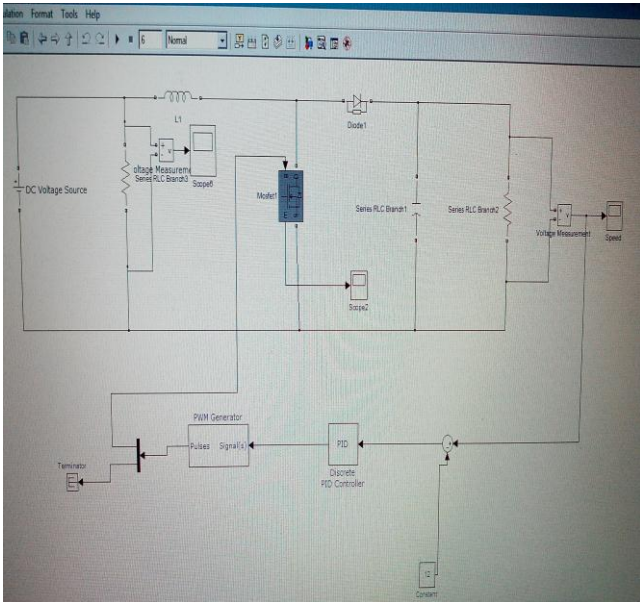
F. Simulink model for closed loop control

Fig.6 simulink model for closed loop control

Fig.7 simulation result using closed loop control
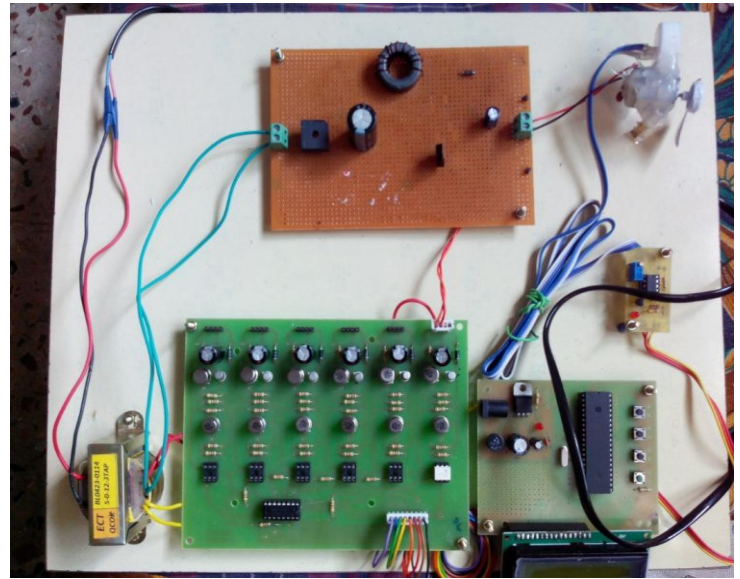
G. Overall Hardware scheme of the project
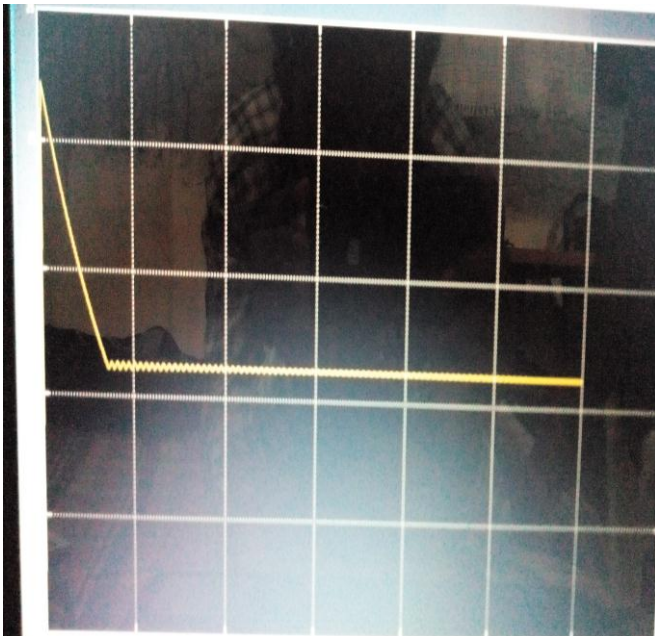

Fig.8 Hardware set-up for dc motor control

IV. CONCLUSION

Recent developments in science and technology provide a wide range scope of applications of high performance DC motor drives in area such as rolling mills, chemical process, electric trains, robotic manipulators and the home electric appliances require speed controllers to perform tasks. DC motors have speed control capabilities, which means that speed, torque and even direction of rotation can be changed at anytime to meet new condition.

The goal of this project is to design a DC motor speed control system by using microcontroller PIC16F877A.The controller will maintain the speed at desired speed when there is a variation of load.

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