# Design of a Servo DC motor speed controller using 8051 MCU

In this project, you will control the DC brushless axial flow fan (motor) using a built-in encoder (speed sensor) and a mikronBoard for 8051 40-pin microcontroller (here we call it MCU).

## Project Description:

In this project, an MCU is used to control the speed of the dc motor which is an axial flow fan. Also, the speed of the motor is shown using a 3-digit 7-segment.

The data sheet for the Servo DC motor has been attached here. As it is shown in the datasheet the motor has four wires, as two of them are for the power ($V^+$) and the ground. The other two outputs are for the encoder output and the PWM input of the servo motor. A motor encoder is a rotary encoder mounted to an electric motor that provides closed loop feedback signals by tracking the speed of the motor shaft. Beside you will be able to control the speed and the rotation of the motor by PWM output.

**Note:** The following steps should be considered to cover all the objectives above.

  I.  Read the reference speed from a DIP switch using a GPIO input in MCU. The combination of DIP switch sets the percentage of the maximum speed to be set in the output. For example, if three switches are used and 101 is set to the GPIO input, then the speed of the motor should be 70% of the maximum speed which is 2400x70%=1680rpm.
 II.  Read the encoder output to measure the motor speed. For this purpose, you can follow up the below steps:
   i.   As it can be seen in the datasheet (page 7) every two complete periods of the encoder signal shows one rotation in the motor. Measure the time between every two positive edges coming to the MCU to calculate the speed of the motor.
   ii.  Calculate the speed of the motor using the average of last three samples.
   iii. Send the output value for the speed to show on 7-segment. To show the speed of the motor you need 4-didigt 7-segments. Use only 3-digit 7-segment. For example, if the speed of the motor is 1576 rpm, you may show it as 157 on the 3 digits.
III.  Using a proportional controller create a PWM signal to control the speed of the motor.

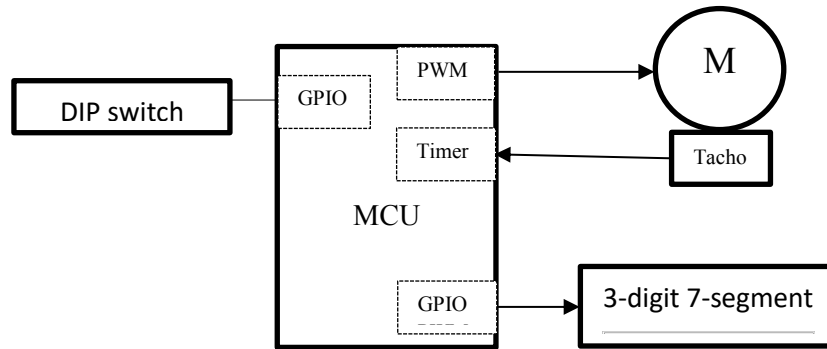The schematic of the controlling loop is demonstrated in Fig. 1.



Fig. 1. Schematic of the Servo motor control using a Microcontroller

## Materials Needed

- ✓ A servo DC motor
- ✓ mikronBoard for 8051 40-pin
- ✓ A DIP switch
- ✓ Three 7-segments (As the speed of the motor will be shown up which will be three digit)
- ✓ Resistors: 1K, 10k~1M, 20k ~2M
- ✓ MOSFET Transistor (N channel)

## Project deliverables

1.  A brief report including explanation of your design including program flow chart for the system, your C code of 8051, and circuit schematic.
2.  Project demonstration of your circuit. In your demonstration you should show three possible speeds that your motor runs with using the reference value setting.

## Grading

This project is worth 20% of the final course grade. Report Quality must include the following:

- Final Report, including: **6%**
  - Title Page with Student Names, Student Numbers, etc. format .docx) 1%
  - Introduction and description of the problem (Problem statement) 1%
  - Description of design objectives and design process 4%

- Embedded C code with proper comments and annotations (format .c or asm) **4%**

- Demonstration **10%**

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**20%**