

Speed and Direction Control of DC Motor using GSM and GPRS Technologies

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ABSTRACT

DC motors are best suited for many industrial applications such as turntables, conveyors, elevator and hoists, for propulsion of electric vehicles and in drives for steel rolling mills and others for which variable speed and constant or low speed-torque are required. They also work well in dynamic braking and reversing applications, which are common in many industrial machines. Their quick acceleration, stopping and reversing, along with their linear-speed torque curve, make the DC motor a popular choice in many new designs, particularly for fractional horsepower applications.

This paper deals with the control of speed and direction of a DC motor using hybrid techniques. In this, control of DC motor's speed and direction by GSM and GPRS technologies are discussed. The software implementations are done through "Dot Net" and "Keil C" languages. The speed control has been done at different ranges and the directions are varied as forward and reverse. The dot net frame has been developed to improve the user interface.

Keywords: DC Motor, GSM, GPRS, PWM, Microcontroller, H-Bridge

I. INTRODUCTION:

Conventional Rheostatic speed control methods, such as Armature & Field Control of DC Motor have many drawbacks. The demerits are double dependence of speed (Rheostat & Load), large amount of power wastage, reduction in maximum power developed and expensive. Hence to overcome these drawbacks and to provide a control system, which is user friendly and easily accessible, this hybrid system has been developed. In this system, the advanced technologies, ie, GSM (Global System for Mobile communication) and GPRS (General Packet Radio Services) have been used. The DC motor speed is varied by using PWM (Pulse Width Modulation) technique. The program has been written in Keil Embedded C and different values have been assigned for different speed ranges and directions.



Fig 1: GSM & GPRS controlled DC Motor

The existing system of GSM based control uses a separate modem, some special complex code to interface with the PC or Laptop. Hence to avoid such complexity, a cell phone with GSM facility has been utilized and the GPRS based control has been provided over the internet. The commands for GSM and GPRS applications have been written using VB.NET and ASP.NET. A separate website has been developed for the GPRS based applications.

II. BLOCK DIAGRAM:

The scheme developed can be explained using the following block diagram:

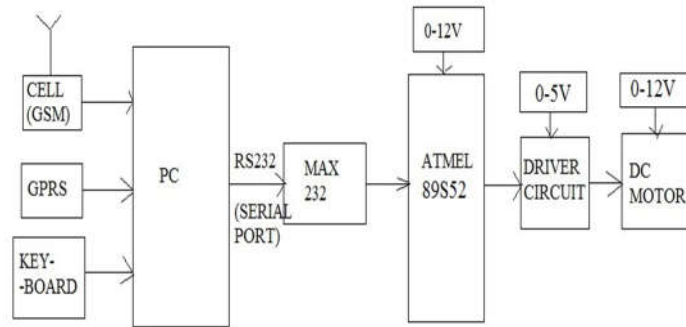


Fig 2: Block diagram of the proposed system

A mobile phone with Bluetooth will be connected to PC for GSM based applications. The internet connection has been given to the PC for GPRS based application and the manual control will be carried out through the Keyboard as an input device. For serial communications, the MAX-232 IC has been connected to the serial port, to convert signals from a TIA-232 (RS-232) serial port to signals suitable for use in TTL-compatible digital logic circuits.

The TTL logic level is given as the input to Microcontroller (Atmel 89S52), which accepts the command from PC and process to the driver circuit to control the motor.

The microcontroller will be loaded with Keil Embedded C program.

III. BASIC PRINCIPLE:

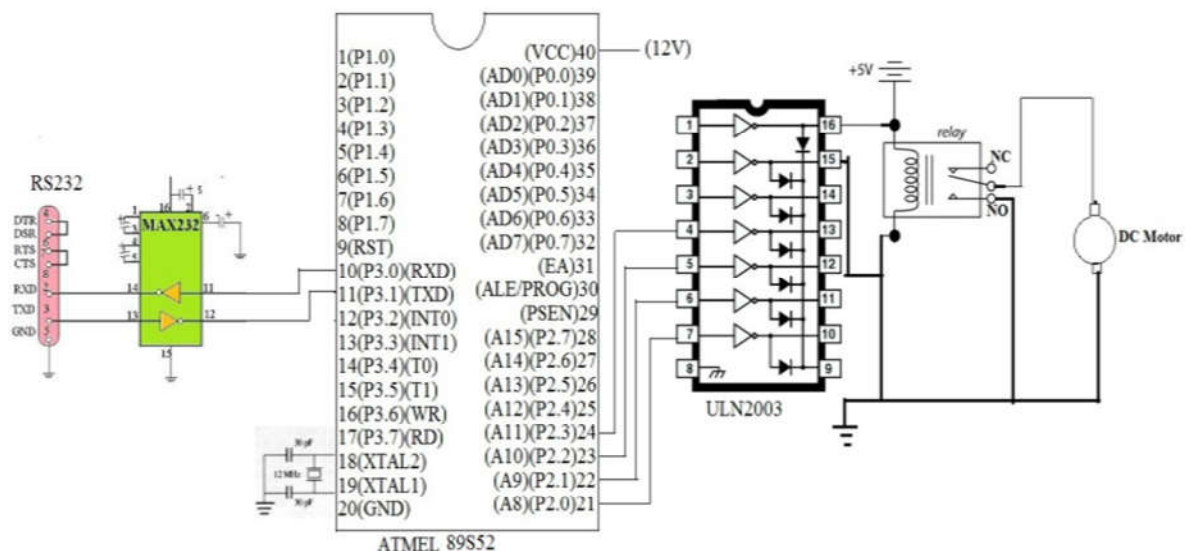


Fig 3: Pin Details of Atmel 89S52

The output from the MAX232 is connected to the TXD and RXD port of microcontroller. When the input is obtained in the form of TTL logic, the microcontrollers process it to the driver IC in the form of input. The driver circuit output is connected to the Relays, which provide an H-Bridge operation to the DC motor.

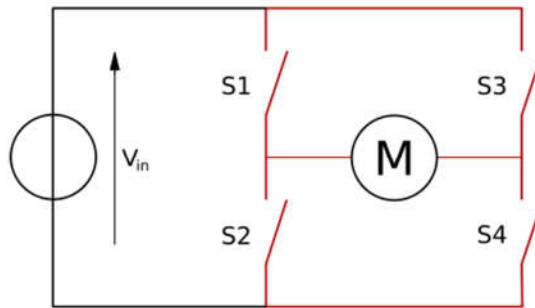


Fig 4: H-bridge circuit connection for direction control

When the motor is to be operated in forward direction, any two combinations of the switches get closed and during the reverse operation of motor, the other two combinations of the switches get closed. This circuit is implemented using two relays in H-Bridge configurations.

All type of control signals from the PC or Laptop is given through the DOT NET frame.

VALUE OF SIGNALS	OPERATION
0	MOTOR OFF
1	FULL SPEED
2	75% SPEED
3	50% SPEED
4	25% SPEED
F	FORWARD DIRECTION
R	REVERSE DIRECTION

Table 1: Response of DC Motor for different input values from the PC

IV. FRAME WORK:

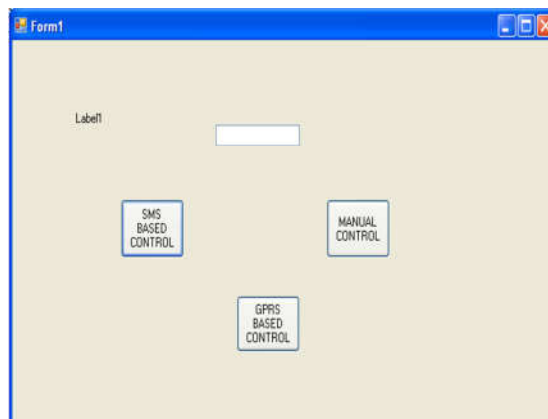


Fig 5: Main form to switch between the type of controls, such as GSM, GPRS and Manual control.

In the above form, the method of control should be selected first. For example, click the manual control button which will switch to another form as shown below:

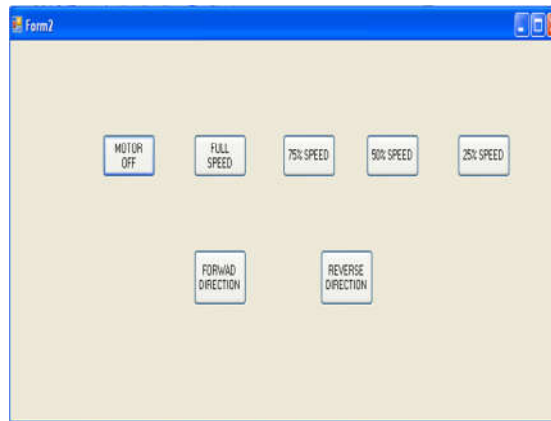


Fig 6: Form for manual control

The corresponding operation which is to be carried out has to be selected.

As such, SMS based control button has to be selected to activate the SMS via control of motor. The same values as shown in the table would be sending via SMS to the PC.

In the GPRS based control, the website will be opened through internet connection, the necessary control can be passed through it.



Fig 7: GPRS based Control window

V. ADVANTAGES

- Simple platform, which can be easily understandable by all, is used.
- Any range of speed can be controlled.
- Fully automatic, hence there is no possibility of switching losses.
- .NET can be used for console applications.
- Cheaper to implement.
- Remote operation.

VI. APPLICATIONS

- Automated industries,
- Textile industries,
- Robotics
- Winding machines
- Lift locomotives

VII. CONCLUSION & FUTURE WORK

This paper discussed about controlling only the speed and direction of the DC motor using a user friendly platform. It can be further extended as to monitor the motor functions, such as torque and to indicate the fault occurrence, such as overload, excessive voltage, etc. Higher rating switching device and higher rating heat sink for higher capacity of the drive can be used. Accuracy can be increased by using PID controllers. RPM of motor can be displayed on LCD. Temperature of motor can be measured. Alarm and tripping facility for protecting the devices may also be used. All these will enable the use of DC Motors for any range real time applications in future.

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