

# Speed and Direction Control of DC-Motor Wirelessly using Radio Frequency

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**Abstract**— DC motor play a major role in many industries and factories. In paper mill, printing machine tools, cranes etc DC motors are used to move a product from one place to another. It is necessary to control the speed and direction of DC motors to move the product safely under limited speed and move the product in both direction. To change the direction H-Bridge circuit act as a motor drive when the drive receive the signal from the Microcontroller PIC16F77A.The speed of the motor is controlled by PWM technique which reduce the motor under required speed.

**Keywords:** PIC16F77A, RF Transreciever, H-Bridge Circuit, Step down Transformer, Voltage Regulator, Dc-Motor

## I. INTRODUCTION

To control the speed of the DC motor many speed control technique are used ,such as armature control, flux control etc.,but this method required a large hardware setup to overcome this difficulty the radio frequency method is employed to control the speed and direction of DC-motor. It is very easy and very economical compare to other techniques. Today the rise in the development of semi-conductor technology made the microprocessor and microcontroller in small size and it also increase the speed. The microcontroller is used to send a signal which control the width of the pulse. By controlling the pulse width, we can easily control the voltage send to the motor terminal, simultaneously the speed of the motor can be controlled. To control the width of the pulse, PWM (pulse width modulation) technique is used.

Pulse width modulation technique are employed in various industries for high performance, easy control more importantly for its low cost.

The vector movement of DC motor can be changed by using motor drive ,instead of changing direction by changing the terminal voltage because using motor drive is very safer then changing the input terminals. H-bridge circuit consist of 4 transistor switches. Hence, the microcontroller can send a signal to obtain steady potential supply and h bridge can control

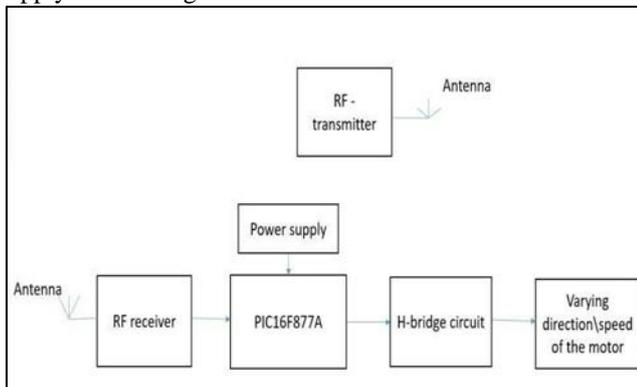


Fig. 1: Block diagram

## A. Microcontroller

PIC16F877A is used to control the speed and direction of the DC motor. PIC a few is referred to a Pheripheral Interface Controller Technology, derived from the PIC1650 originally developed by General Instruments Microelectronics Division. These devices signifies a 14- bit wide code memory and an improved 8-level deep call stack. The instruction set differs very little from the baselines devices, but the two additional opcode bits allow 128 registers and 2048 words of code to be directly addressed, there are a few additional miscellaneous instruction, and two additional 8-bit literal instruction, add and subtract.

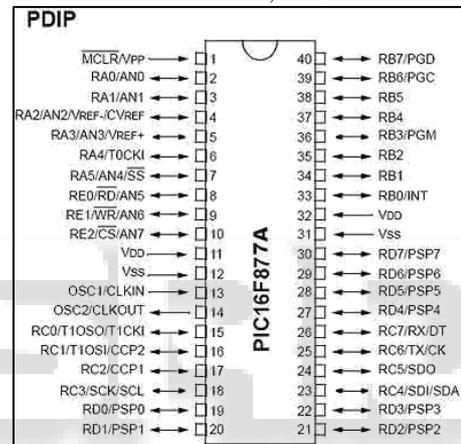


Fig. 2: Pin diagram

## B. RF-Transceiver

An RF module is a small electronics device used to transmit/receive radio signals between two devices. In an embedded system it is often desirable to communicate with another devices wirelessly.8 channel transceiver module range upto 200m.8 digit i/p.it is a secured protocol and ultra-low power range from 1.8V to 3.6V.

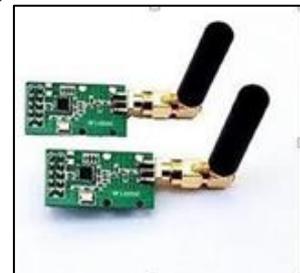


Fig. 3: RF Transreciever

## C. Pulse Width Modulation

The power in the load can be easily and effectively varied by using PWM method. PWM technique is a smooth and reliable technique. Microcontroller sends a pulse width signal to change the width of the pulse.it varies the voltage to the motor terminal, the speed of the motor can be controlled. The ratio of on time to off time is called as duty

cycle. The desired speed can be obtained by changing the duty cycle. The Pulse-Width-Modulation (PWM) in microcontroller is used to control duty cycle of DC motor drive. PWM is an entirely different approach to controlling the speed of a DC motor. Power is supplied to the motor in square wave of constant voltage but varying pulse-width or duty cycle. Duty cycle refers to the percentage of one cycle during which duty cycle of a continuous train of pulses. Since the frequency is held constant while the on-off time is varied, the duty cycle of PWM is determined by the pulse width. The diagram shown below determine the change of duty cycle of the PWM microcontroller. The microcontroller having a 25% duty cycle then it provide a  $\frac{1}{4}$  of power to the motor, when microcontroller having a 50% duty cycle then microcontroller provide a  $\frac{1}{2}$  of power to the motor, when microcontroller having a 75% duty cycle then microcontroller provide a  $\frac{3}{4}$  of power to the motor and finally the microcontroller provide a 100% duty cycle then microcontroller provide a full power to the motor

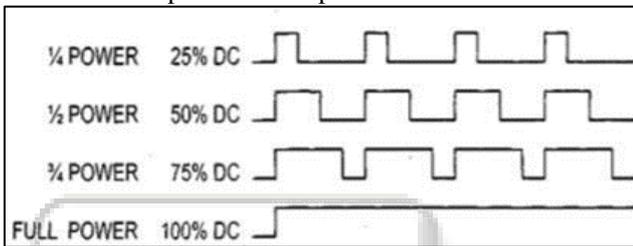


Fig. 4: Duty cycle and power output

D. H-bridge circuit

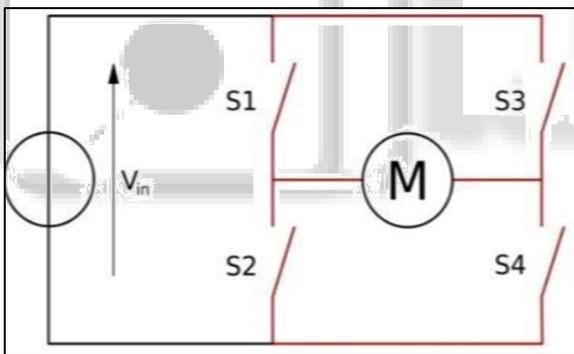


Fig. 5: H-bridge circuit

H-bridge is used to control the direction of the DC motor. It consists of four switches S1,S2,S3,S4. When S1 and S4 is turned on the motor rotate in clockwise direction. When S2 and S3 is turned on the motor rotate in anti-clockwise direction. when S1 and S3 turns on supply flow through the motor hence the motor will be break, when switches S2 and S4 is turned on the supply doesn't flow through the motor and it will break.

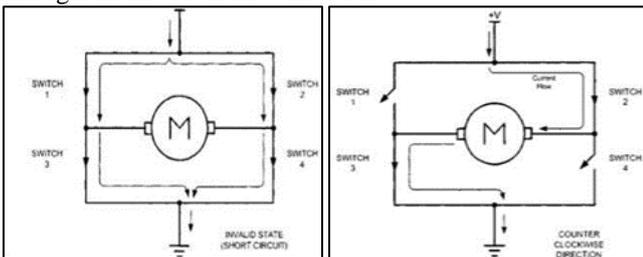


Fig. 6: Forward direction Fig. 7: Reverse direction

E. Truth Table

S1	S2	S3	S4	Operation of motor
1	0	0	1	Motor moves right
0	1	1	0	Motor moves left
1	0	1	0	Motor breaks
0	1	0	1	Motor breaks

Fig. 8: Truth table of H-bridge circuit

F. Circuit Diagram

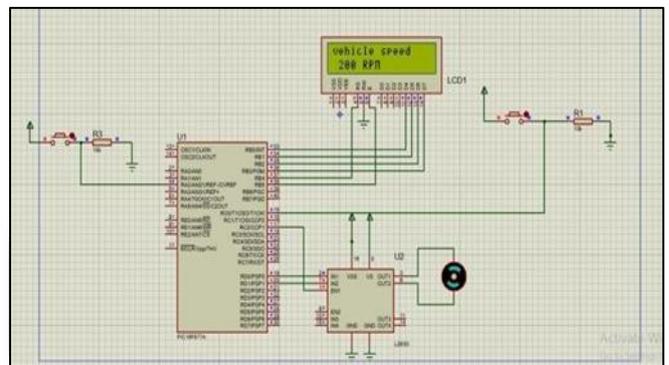


Fig. 9: Circuit and simulation diagram

It is the circuit diagram for the proposed system. It is simulated using proteus software. When the switch is clicked, the program dumped in the pic made the motor to rotate at desire direction and also it control the speed using h-bridge circuit

G. Hardware description

The power supply is taken from the supply. The supply voltage is about 220V. The pic microcontroller and DC motor operates at 5v and 12v, for this purpose step down transformer is used to reduce the voltage to 12v. The voltage regulator provided in the circuit regulate the voltage for devices in the PCB board. The motor drive, pic-microcontroller, RF receiver works at 5v. When the switch is on the RF transmitter send a signal to the receiver, then pic-microcontroller, generate the signal to change the width of the pulse, it varies the voltage to the motor terminal, which control the speed of the DC- Motor. When the switch is touched again the pic controller send the signal to motor drive to change the direction of the motor

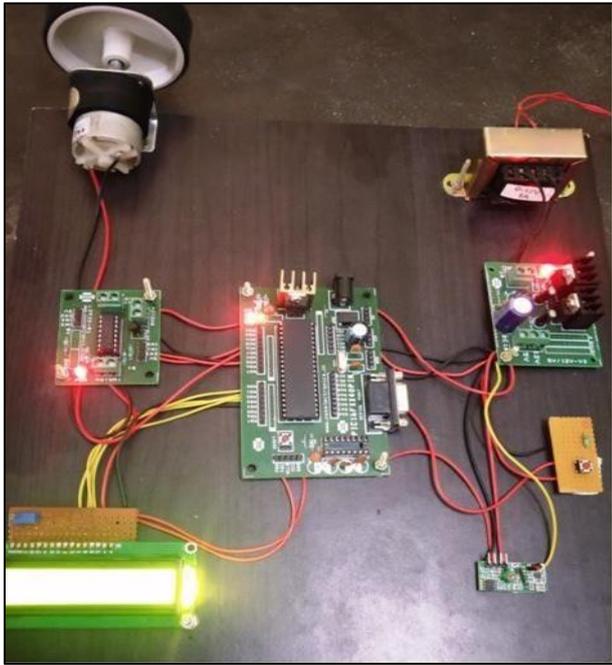


Fig. 10: Hardware setup

## II. CONCLUSION

The speed control and the vector control of the dc motor is obtained from the wireless and radio frequency technology with Pulse Width Modulation and H-Bridge. By using microcontroller programming speed control has been achieved with higher performance, reliable operation, easy control and better protection.

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