Brushless DC Motor

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AIMS AND OBJECTIVES

To study the methods of controlling a brushless DC motor using a PIC microcontroller.

To demonstrate how real-time control of a power electronic converter can be applied in a small DC motor.

To control the motor in such a way that the direction and the speed can be varied.

INTRODUCTION

The present project illustrates the application of a power electronic converter in controlling a small brushless DC motor (BDCM). The motor is a 3 phase one (as seen in fig 1), comprising 8 number of poles with a rated voltage of 24v as well as a rated speed of 4000 rpm. However, three hall sensors (fig 2) are also embedded inside the motor to give the feedback positions of the motor as it is spinning.

The idea was to develop a code in c language in a PIC microcontroller, which would output the appropriate signals that would then connect to the motor through a gate drive (fig 4), these would then make the motor spin, change its direction along with its speed.

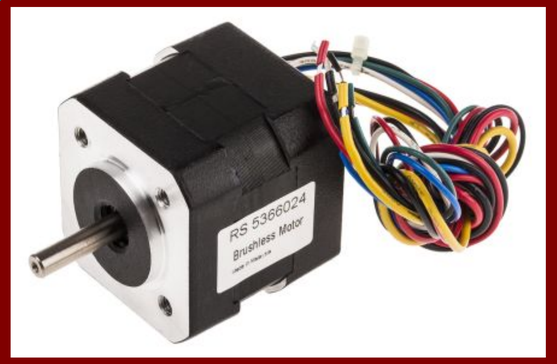

Figure 1. RS components. Brushless DC motor with hall effect sensors. Source: http://uk.rs-online.com/web/p/dc-motors/5366024/

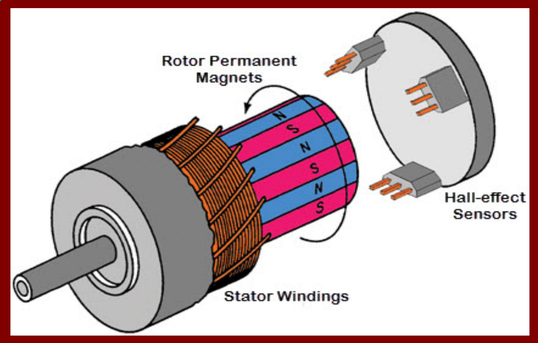

Figure 2. Electronic components. Hall effect sensors in a brushless DC motor. Source: https://www.efxkits.co.uk/speed-control-of-brushless-dc-motor/

RESULTS AND FINDINGS

The PIC microcontroller which is the main component used to control the motor was placed in a flexible board (similar to fig 4) along with the gate drive and three half bridge transistors.
Hence, the code was developed in a way that the analogue to digital ports from the PIC (fig 3) read the signal coming from the hall sensors inside the motor, these indicated the position of the rotor (as seen in fig 2). Based on these signals it was possible to determine in which position the rotor were and the next position that it should move. The signals processed by the PIC were in a PWM (pulse width modulation) form. Because the motor was a 3 phase motor, so three PWMs corresponding to the number of phases of the motor were connected to the motor through the half bridge transistors (fig 4).

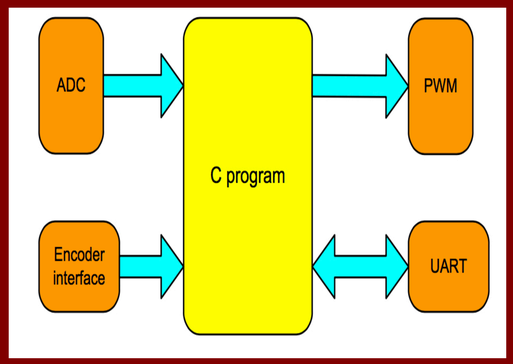

Figure 3. Relationship between peripheral hardware an d c Program. From Electrical drives lecture notes

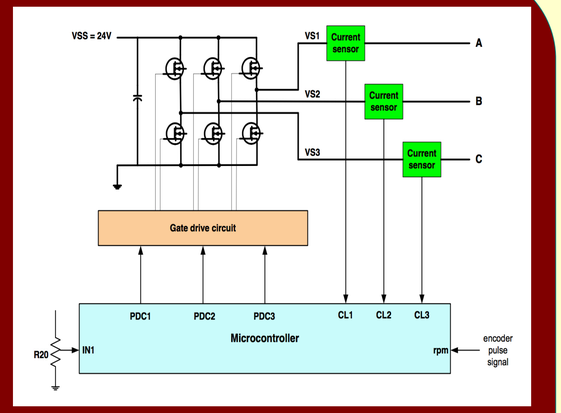

Figure 4. Microcontroller input and output signals in the flexible board. Source: Electrical drives lecture notes

DISCUSSION AND CONCLUSION

The code worked fairly in a way that it was expected, where the output and the input signals in the PIC were corresponding to each other. A minor issue however, was the fact that at some point when the program was running some input could not be recognized by the PIC, and in these situations the direction could not be changed. This issue could have been overcome, if more time was given, so for the future research it is one of the aspects that can be improved. All in all, the result obtained was very satisfactory.

ACKNOWLEDGEMENT

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