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Design and Implementation of Performance Monitoring of DC Motor Based on Microcontroller and Temperature Control of Heat Sink

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***Abstract*— The electric drive systems used in industrial applications are increasingly required to meet the higher performance and reliability requirements. The DC motor is an attractive piece of equipment in many industrial applications requiring variable speed, good speed regulation; frequent starting, braking and reversing. Microcontrollers provide a suitable means of meeting these needs. In this Project work, implementation of microcontroller, PIC16F877A for of speed control of DC motor fed by a DC chopper is carried out. The chopper is driven by a high frequency PWM signals. Controlling the PWM duty cycle is equivalent to controlling, the motor terminal voltage which in turn adjusts directly the motor speed. Microcontroller based closed loop control system for a DC motor which gives the output as speed at different conditions, system provides over current protection of DC Motor and temperature controlled system.**

Keywords— **DC motor drives, Microcontroller, Speed control, Temperature control**

I. INTRODUCTION

The use of power electronics for the control of electric machines offers not only better performance caused by precise control and fast response but also maintenance, and ease of implementation. In parallel with the advance in power electronic there have been great advances in microcontroller-based control systems due to the microcontroller flexibility and versatility [1].In this paper the microcomputer is used to control the speed of a dc motor. The control algorithm are stored and implemented by the microprocessor of the microcomputer. The system employs the use of thyristor, which is controlled using the software implemented on the microcomputer [2].In this paper , it consists of chopper driven by the PWM signal generated from the microcontroller. The motor voltage control is achieved by measuring the rectified mains voltage with the analog to digital converter present on the microcontroller and adjusting the PWM signal duty cycle accordingly [3].In this paper, the microprocessor computes the actual speed of the motor by sensing the terminal voltage and the current, it then compares the actual speed of the motor with the reference and generates a suitable control signal which is fed into the triggering unit. This unit drives H-bridge power MOSFET amplifier, which in turn supplies a PWM voltage to the dc motor .In this paper how the microcontroller can be used for speed control. The system can be summarized as the drive form a rectified voltage, it consists of chopper driven by the PWM signal generated from the microcontroller unit. The motor voltage control is achieved by measuring the rectified voltage mains with the analog to digital converter present on the microcontroller and adjusting the PWM signal duty cycle accordingly [4]. In this paper, the **use** of micro controller for speed control and protection of dc motor is presented. The peculiarity of this method is its adaptability to different ratings of motors [5].

The objective of this paper is to explore the approach of designing a microcontroller-based closed loop controller. The interface circuit and the software are all designed to achieve a better performance. The system is designed with a current flow monitor that can protect the dc motor from high currents due to overloading and temperature control for protection of DC motor. The microcontroller system is equipped with an LCD display and a keypad and software was return to monitor the registers on the LCD and commands from the keypad

II. HARDWARE DESIGN

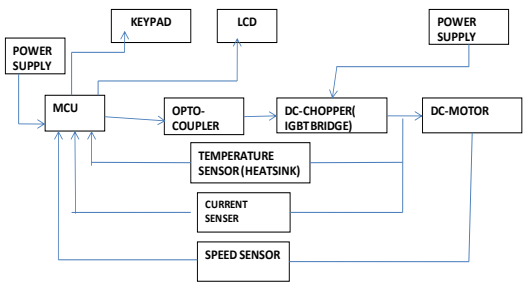

Fig.1.Block diagram of speed control system

The PIC16F877A microcontroller implements the control algorithm by conditioning the speed and current signals and performs the speed regulation according to reference fed through the keypad. The software includes a routine to read the motor current and sends emergency shutdown signal to protect the DC motor from over current, which causes a software interrupt and executes the emergency shutdown routine.

The hardware control system includes the DC motor, power circuit, PIC16F877A microcontroller, speed sensor, current sensor and temperature sensor. An slotted coupler (MOC 7811) is used to measure the speed of the motor. The current sensing was accomplished by using Hall effect current sensor. It senses the current and feeds the current signal to microcontroller. The opto-couplers were used to isolate the high voltage circuits from the low voltage controlling signals. The temperature sensor(LM35) is used to measure the temperature. The drive is being mainly designed to run under predefined temperature range. Temperature range is set from a keypad provided on drive. A temperature sensor senses IGBT temperature, after reaching set temperature range triggering is stopped and trip is indicated. After each 60second of drive run time LCD will display the RPM and temperature also. The DC motor is the plant that will be controlled. The hardware of the microcontroller includes mainly the PIC16F877A system with LCD and keypad for user interface.

III. SOFTWARE DESIGN

The 16F877A microcontroller (MCU) can control speed of a DC motor accurately with minimum hardware at low cost. The flow chart shown in Fig.2 describes the main program. The program is written using assembly language. The software used is MP LAB. The initialization is the beginning of the software to initialize ports, LCD, ADC. Following steps describes the flowchart.

1. Ram is cleaned for avoiding false data reading/writing
2. Initialization Steps:
3. Ports are initialized to input/output.
    i. Port used for LCD is configured as output
    ii. Port pins used to interfaced keypad are configured as input & output
4. LCD is initialized for
    i. Clear LCD on Power on
    ii. 2 lines and 16 characters
    iii. 5x7 font size
    iv. Incremental cursor
5. ADC is initialized for
    i. Using particular channel
6. Tripping signal is checked
7. If any tripping signal comes
    i. Immediately stop PWM
8. If no tripping signal is active
    i. Break the loop
9. If interrupt occur
10. Go to Interrupt Service Routine
11. Increment counter of RPM pulse
12. Return from interrupt
13. Check keys
14. If key pressed
    i. Set flags corresponding to each keys.
15. Display on LCD
16. RPM
17. Input analog value in ADC
18. Display on LCD
    i. Temperature
19. Loop back to check tripping signal again (Step-6)

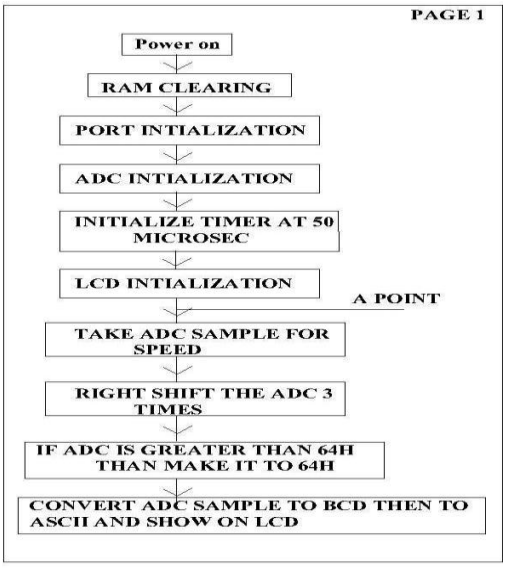

Fig.2.(i) Flow chart representation

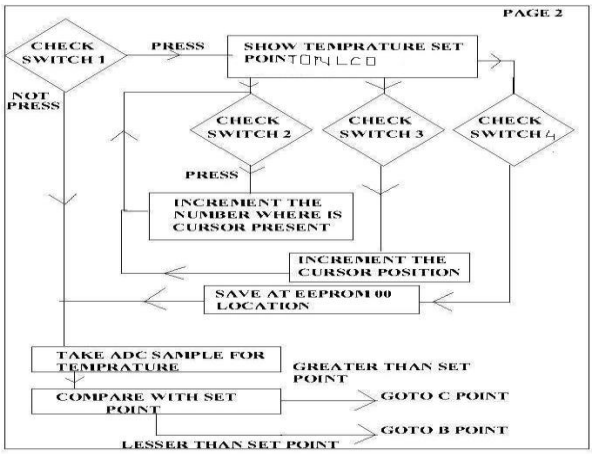

Fig.2. (ii)

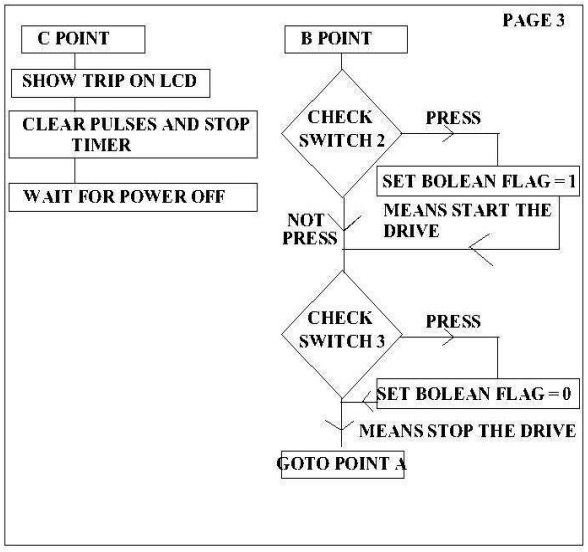

Fig.2. (iii)

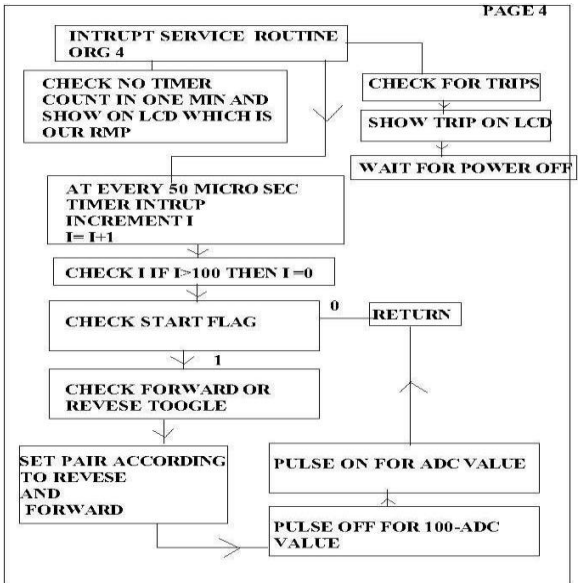

Fig.2.(iv)

IV RESULTS

Operating source voltage: 230V AC

DC supply voltage: 230*1.414V DC

Temperature (ambient temperature):35 °c

Speed: 1440rpm at potentiometer voltage: 2.5V

V CONCLUSION

The microcontroller based adjustable closed-loop DC Motor speed controller system has been developed. The results showed that the microcontroller is a reliable instrument to control the motor. Furthermore the protection and power cut-off system has yielded appreciable response and temperature control is good. Thus it can be concluded that the present system is a reliable adjustable drive system for DC motors.

VI REFRENCES

[1] T.Castabnet and J. Nicolai, "Digital Control for Brush DC Motor", "*IEEE Transaction on Industry Application*", Vol, 30, No 4, July/August 1998.

[2] Krishnan and Thadiappan, "Speed Control of DC Motor Using Thyristor Dual Converter," *IEEE Trans*, Vol, T-IECL, pp, 391-399, Nov. 1998.

[3] J. Nicolai and T.Castagnet," A Flexible Microcontroller Based Chopper driving a Permanent Magnet DC Motor," *The European Power Electronics Application*, 1999.

[4] Khoei and Hadidi, " MicroProcessor Based Closed –Loop Speed Control System for DC Motor using Power MOSFET," Umia University ICECS 1996, pp. 2003.

[5] Y. S. Ettomi, S. B. M. Noor, S. M.'Bashi and M. I<. Hassan," Micro Controller Based Adjustable Closed-Loop DC Motor Speed Controller" *Student Conference on Research and Development* (Scored), University Putra Malaysia 2003 .

[6] Peter Spasov, "Microcontroller Technology: The68HC11", Prentice-Hall, 2002.